

1885 SMI UNIVERSITY

Sindh Madressatul Islam University

**DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY (SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI
LOT NO.4 FACULTY STAFF RESIDENCES, BACHELOR FACULTY MALE / FEMALE HOSTELS (REMAINING WORKS)**

**VOLUME-I
CONDITIONS OF CONTRACT**

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INVITATION FOR BIDS



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NO. SMIU/PC/MC/ Pack-3 (RW)/Tend/2024/36

Date: 21st March 2025

TENDER NOTICE

Sindh Madressatul Islam University, Karachi invites e-bids through E-Pak Acquisition & Disposal System (EPADS) on standard bidding documents from interested contractors/firms registered in the required PEC category and specialization as mentioned in column (7) below for the following works. The tender shall be based on the single stage – one envelope procedure under Rule No 46 (1) of SPPRA-Rules 2010 (Amended-up to date). Bidding documents can be viewed/downloaded from <https://portalsindh.eprocure.gov.pk/#/>: and also available and viewed from SMI, University's website: www.smiu.edu.pk

No.	Name of Work	Bid Security	Estimated Cost (Rs. In Millions)	Tender Fee (In Pak. Rs.)	Time for Completion (In Months)	PEC Category & Specialization required (Valid Registration)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Development of Sindh Madressatul Islam University (SMIU) Campus at Education City Malir, Karachi (Lot #4, Faculty & staff residences and Bachelor faculty Male & Female Hostels) Remaining Works.	2% of Bid Price	313.270	10,000/-	15	C-3 and above with specialization codes CE01, CE09, CE10 and EE04.

Electronic Bids should be submitted through EPAD only. Interested bidders are required to get registered themselves on EPAD system in the link <https://sindh.eprocure.gov.pk/#/supplier/registration> for submission of electronic bids.

1- The bids prepared in accordance with the instruction given in the bidding document must be submitted on EPADS only by Tuesday, 22nd April 2025 by 2.30 P.M. The original instrument of tender fee and bid security 2% of the bid price in shape of Call Deposit/Pay Order/Demand Draft/Bank Guarantee issued by any scheduled bank of Pakistan in favour of Sindh Madressatul Islam University Karachi. must reach the Procurement Agency in sealed envelop prior to the deadline for the opening of e-bids. The bids will be opened on the same day at 3.00 P.M before Procurement Committee, Representative of the Consultant and the bidders or their authorized representatives who wish to be present, in the conference room No. 2, SMIU, main city campus Aiwan-e- Tijarat Road behind Habib Bank Plaza, Karachi.

2- Eligibility Criteria:

- Valid registration with Pakistan Engineering Council (PEC) in prescribed category and the relevant field of specialization codes as per column-7 above.
- Registration with income tax department (NTN certificates) with activated status in Federal Board of Revenue.
- Registration certificate of Sindh Revenue Board Government of Sindh with valid Certificate.

d. Experience and past performance of each work:

Experience in similar nature of work(s) executed in the last 5 years:

- i. Atleast 1 Similar nature of work having minimum cost of 80% of estimated cost of this work: or
- ii. Atleast 2 similar nature of works with each having minimum cost of 50% of estimated cost of this work

e. Financial:

Average annual financial turnover not less than equivalent cost of the scheme/project during last five years.

- f. List of machinery and equipment available.
- g. An affidavit certificate that the firm at present is not been black listed by Government/ Semi Government / Autonomous / Private bodies and that the firm has not been involved in any litigation and arbitration with Government/ Semi Government / Autonomous / Private bodies.
- h. Audited financial statements for last three (3) years.
- i. In case of joint ventures, same conditions to be fulfilled by both the firms.
- j. Affidavit with effect that all the documents/ particulars information furnished are true correct.
- k. All documents from Sr.No. “a” to “j” mentioned in the eligibility Criteria of this NIT will be examined at the time of opening of tender.

3- Bid Validity Period is 90 days.

4- Conditional bid and bid **without earnest money** shall not be considered.

5- Procuring Agency reserves the right to reject all or any bids subject to the relevant provisions of SPPRA Rules-2010 (amended up to date).

6- In case any unforeseen situation resulting in closure of office on the date of opening or if Government declares holiday, the tender shall be submitted/opened on the next working day at the same time and venue.

**Project Coordinator
SMIU Malir Campus,
Karachi.**

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders along with Bidding Data will not be part of the Contract and will cease to have effect once the contract is signed.)

A. GENERAL

- | | | |
|-------------|-------------------------|---|
| IB.1 | Scope of Bid | <p>1.1 The Employer as defined in the Bidding Data hereinafter called “the Employer” wishes to receive bids for the construction and completion of works as described in these Bidding Documents, and summarized in the Bidding Data hereinafter referred to as the “Works”.</p> <p>1.2 The successful Bidder will be expected to complete the Works within the time specified in the Bidding Data.</p> |
| IB.2 | Source of Funds | <p>2.1 The Employer has applied for/received a funding from the source(s) in various currencies towards the cost of the project specified in the Bidding Data and it is intended that part of the proceeds of this funding will be applied to eligible payments under the Contract for which these Bidding Documents are issued.</p> |
| IB.3 | Eligible Bidders | <p>3.1 This Invitation for Bids is open to all Bidders meeting the following requirements at the time of submission of Bids and thereafter:</p> <p>(a) Duly prequalified for this bidding process;</p> <p>(b) Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works in the relevant field of specialization.</p> <p>However, a Foreign Constructor can submit provisional license with its Bid but the Foreign Constructor will be required to submit standard license after award of Contract and before start of work.</p> <p>Foreign Constructor shall not be eligible to participate in bidding individually. Foreign Constructor shall enter into joint venture with Pakistani Constructor registered with the Pakistan Engineering Council in equivalent/compatible category and submit the joint venture agreement to the Employer before participating in bidding in accordance with PEC Construction and Generation of Engineering Works Bye-laws, 1987;</p> <p>a. Must be on Active Taxpayer List of the Federal Board of Revenue and provincial revenue authority/ board where applicable; and</p> <p>b. All partners constituting the Bidder including proposed subcontractors do not appear in the list of debarred/ blacklisted firms and individuals on the websites of PEC and Federal & Provincial Procurement Regulatory Authorities and have not been declared debarred/ blacklisted by foreign country, international organizations or other foreign institutions.</p> |

Not Applicable

IB.4	Eligible Materials, Equipment and Services	4.1	All materials, equipment and services to be supplied under this Contract shall have their origin in eligible countries described under paragraph 4.4 hereunder.
		4.2	For purpose of this Clause, “origin” means the place where the Goods are mined, grown or produced or from where the ancillary services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.
		4.3	The origin of Goods and Services is distinct from the nationality of the Bidder.
		4.4	Eligible countries to participate in this bidding process are those which have been notified by Ministry of Interior, Government of Pakistan as Business-Friendly Countries (BVL); information can be accessed through following link: http://www.dgip.gov.pk/Files/Visa%20Categories.aspx#L
IB.5	One Bid per Bidder	5.1	Each Bidder shall submit only one Bid either by himself, or as a partner in a joint venture. A Bidder who submits or participates in more than one Bid (other than alternatives pursuant to Clause IB.17) will be disqualified.
IB.6	Site Visit	6.1	The Bidders are advised to visit and examine the Site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. All cost in this respect shall be at the Bidder’s own expense.
		6.2	The Bidders and any of their personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Bidders, their personnel and agents, will release and indemnify the Employer, his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of such inspection.

B. BIDDING DOCUMENTS

IB.7	Contents of Bidding Documents	7.1	The Bidding Documents, in addition to Invitation for Bids, are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9:
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1. Instructions to Bidders;
2. Bidding Data;
3. Evaluation Criteria and Qualification Updating Forms;
4. General Conditions (GC);
5. Particular Conditions (PC):Part
A - Contract Data;
Part B - Special Provisions;
6. Specifications (SP):
Part A - Specific Provisions; Part B
- Technical Provisions;
7. Letter of Bid;
8. Schedules to Bid;
9. Standard Forms:
(i) Form of Bid Security;
(ii) Letter of Acceptance;
(iii)(iii)Form of Contract Agreement;
(iv)Form of Performance Security;
(v) DAAB Agreement;
(vi)Form of Mobilization Advance Guarantee;
10. Drawings.

7.2 The Bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of Bid submission will be at the Bidder's own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

**IB.8 Clarification
of Bidding
Documents,
Pre-Bid
Meeting**

- 8.1 Any prospective Bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in the Invitation for Bids. The Employer will respond to any request for clarification which he receives earlier than the period specified in the **Bidding Data**, prior to the deadline for submission of bids.
- 8.2 Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.
- 8.3 The Employer may, on his own or at the request of any prospective Bidder(s), hold a pre-bid meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of pre-bid meeting, if convened, are as stipulated in the **Bidding Data**. All prospective Bidders or their authorized representatives shall be invited to attend such a pre-bid meeting.
- 8.4 The Bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than seven (7) days before the proposed pre-bid meeting.

	8.5	Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub-Clause IB.7.1 hereof which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.
	8.6	Absence at the pre-bid meeting will not be a cause for disqualification of a Bidder.
IB.9 Amendment of Bidding Documents	9.1	At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by issuing addendum.
	9.2	Any addendum thus issued shall be part of the Bidding Documents listed in Sub-Clause IB.7.1 hereof and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective Bidders shall acknowledge receipt of each addendum in writing to the Employer.
	9.3	Such addendum shall be issued not later than number of days prior to the deadline for submission of bids, specified in the Bidding Data . To afford prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend the deadline for submission of bids in accordance with Clause IB.20.
C. PREPARATION OF BIDS		
IB.10 Cost of Bidding	10.1	The Bidders shall bear all costs associated with the preparation and submission of their respective bids and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
IB.11 Language of Bid	11.1	The Bid and all correspondence and documents related to the Bid exchanged by a Bidder and the Employer shall be in the Bid language stipulated in the Bidding Data and Particular Conditions of Contract. Supporting documents and printed literature furnished by the Bidders may be in any other language provided the same are accompanied by duly certified translation of the relevant parts in the Bid language, in which case, for purposes of evaluation of the bid, the translation in Bid language shall prevail.
IB.12 Documents Comprising the Bid	12.1	Each Bidder shall: <ul style="list-style-type: none"> (a) submit duly filled in, signed and stamped Letter of Bid and completed Schedules to Bid as required, including priced Bill of Quantities, in accordance with Clause IB.18 hereof;

- (b) submit Bid Security in accordance with Clause IB.16 hereof;
- (c) submit alternative proposal, if permissible in accordance with Clause IB.17;
- (d) Submit a written power of attorney authorizing the signatory of the Bid to act for and on behalf of the Bidder. The name and position held by each person signing the authorization must be typed or printed below the signature;
- (e) submit the Qualification Updating Forms duly filled in, signed and stamped along with requisite attachments, to establish that the Bidder continues to meet the Eligibility and Qualification Criteria set out in the Pre- Qualification Documents and as provided in the Section “Evaluation Criteria and Qualification Updating Forms”;
- (f) furnish a technical proposal taking into account the various Schedules to Bid, especially the following:
Schedule-C to Bid, Proposed Construction Schedule; Schedule-D to Bid, Method of Performing the Work; Schedule-E to Bid, List of Major Equipment; Schedule-F to Bid, Organization Chart for Supervisory Staff; and other pertinent information, such as mobilization programme, etc.

12.2 Bids submitted by a joint venture of two (2) or more firms specified in **Bidding Data**, shall comply with the following requirements:

- (a) the bid, and in case of a successful bid, the Form of Contract Agreement shall be signed by all members so as to be legally binding on all partners;
- (b) one of the joint venture partners shall be nominated as being in-charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;
- (c) the partner-in-charge shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;
- (d) all partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the

Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub- Para(b) above as well as in the Letter of Bid and in the Form of Contract Agreement (in case of a successful bid); and

- (e) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation and corresponding duties & responsibilities of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments/ modifications whatsoever in the joint venture agreements shall be agreed to between the joint venture partners without prior written consent of the Employer.

- 12.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause IB.1.2 hereof.

IB.13 Bid Prices

- 13.1 The price and discount if any quoted by the Bidders in the Letter of Bid and in the Bill of Quantity shall conform to the requirement specified below:
- 13.2 The Bidder shall quote any discounts and the methodology for their application.
- 13.3 If bids are being invited for individual lots (contracts) or for any combination of lots, the Bidders can offer discounts for the individual lots (contracts) as well as for award of more than one Contract and shall specify in their bid.
- 13.4 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause IB.1.1 hereof, based on the unit rates and/or prices.
- 13.5 The Bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by a Bidder will not be paid for by the Employer when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities.
- 13.6 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to the deadline for submission of bids shall be included in the rates and prices and the total Bid Price submitted by a Bidder.

Additional/reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed/ deducted as per Sub Clause 13.6 [*Adjustment for Changes in Laws*] of the Conditions of Contract.

- 13.7 The rates and prices quoted by the Bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Sub-Clause 13.7 [*Adjustments for Changes in Cost*] of the General Conditions of Contract. The Bidders shall furnish the prescribed information for the price adjustment formulae in Schedule-A to Bid, and shall submit with their bids such other requisite supporting information if required under the said Schedule.

IB.14 Currencies of Bid and Payment

- 14.1 The unit rates and the prices shall be quoted by the Bidder entirely in Pak Rupee and shall be paid accordingly in same currency.

A Bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as the "Foreign Currency Requirements") shall indicate in Table III of Schedule-A to Bid the proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements; in such case the unit rates and the prices shall be quoted by the Bidder in Equivalent PKR.

- 14.2 The rates of exchange to be used by the Bidder for currency conversion shall be the TT Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date twenty-eight (28) days prior to the deadline for submission of bids. Such rates shall be notified by the Employer not later than fourteen (14) days prior to the deadline for submission of Bids.

For the purpose of payments, the exchange rates used in Bid preparation shall apply for the duration of the Contract.

IB.15 Bid Validity

- 15.1 Bids shall remain valid for the period stipulated in the **Bidding Data** after the date of Bid Opening specified in Clause IB.23.
- 15.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the Bidders extend the period of validity for a specified additional period which normally may not be more than the original bid validity period. The request and the responses thereto shall be made in writing. A Bidder may refuse this request of the Employer without his Bid Security being forfeited. A Bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.16 in all respects.

IB.16 Bid Security

- 16.1 Each Bidder shall furnish, as part of his bid, a Bid Security in original form in the amount stipulated in the **Bidding Data** in PKR.
- 16.2 The Bid Security shall be in the form of Call Deposit Receipt (CDR) / Pay Order issued by a Scheduled Bank in Pakistan in favor of the Employer valid for a period 14 days beyond the Bid Validity date.

Bid Price (In Eq. million PKR)	Minimum Rating of Insurance Companies
Up to 1000	A (+)
1001 to no limit	AA

- 16.3 Any Bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive.
- 16.4 The Bid Securities of the Bidders except the lowest three will be returned by the Employer within twenty-eight (28) days from the opening of Bids, provided a Bidder request for the return of its Bid Security, or upon the expiry of original validity of Bid Security or as extended, whichever is earlier.
- 16.5 The Bid Security of the lowest three Bidders including the successful Bidder will be returned when the successful Bidder has furnished the required Performance Security.
- 16.6 The Bid Security may be forfeited:
- if the Bidder withdraws his bid except as provided in Sub Clause IB.22.1;
 - if the Bidder does not accept the correction of his Bid Price pursuant to Sub Clause IB.28.2 hereof; or
 - in the case of successful Bidder, fails to furnish the required Performance Security.

IB.17 Alternative Proposals by Bidder

- 16.7 In case of annulment, all Bids submitted and specially, Bid securities, shall be returned to the Bidders within 14 days of annulment.
- 17.1 Unless otherwise specified in the **Bidding Data**, alternative proposal(s) shall not be considered.
- 17.2 Should any Bidder consider that he can offer any advantages to the Employer by a modification to the designs, specifications or other conditions, he may, in addition to his Bid to be submitted in strict compliance with the Bidding Documents, submit any alternative proposal(s) containing (a)

relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details/conditions, provided always that the total submitted on the Letter of Bid shall be that which represents complete compliance with the Bidding Documents.

- 17.3 Alternative proposal(s), if any, of the Bidder having submitted most advantageous Bid only may be considered by the Employer as the basis for the award of Contract to such Bidder.

IB.18 Format and Signing of Bid

- 18.1 Bidders are particularly directed that the amount entered on the Letter of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.
- 18.2 All Schedules to Bid are to be properly completed and signed.
- 18.3 No alteration is to be made in the Letter of Bid nor in the Schedules thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the Bid may be rejected.
- 18.4 Each Bidder shall prepare by filling in the forms completely and without alterations one (1) original and number of copies, specified in the **Bidding Data**, of the documents comprising the Bid as described in Clause IB.12 and clearly mark them “ORIGINAL” and ‘COPY” as appropriate. In the event of discrepancy between them, the original shall prevail.
- The Bidder shall also provide complete searchable PDF versions as well as Word, Excel, etc., versions of the Bid if so required in the **Bidding Data**.
- 18.5 The original of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder pursuant to Sub-Clause IB.12.1(d) hereof. All pages of the Bid shall be initialed and stamped by the person or persons signing the bid.
- 18.6 The Bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Employer, or as are necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the Bid.
- 18.7 Bidders shall indicate in the space provided in the Letter of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their bids and the Contract is to be sent.
- 18.8 Bidders should retain a copy of the Bidding Documents and the Bid as their file copy.
- 18.9 All documents executed outside Pakistan required to be submitted with the Bid must be certified by Pakistani Embassy in the respective country(ies).

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

- 19.1 Each Bidder shall submit his Bid as under:
- (a) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such.
 - (b) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed /identified as given in Sub Clause IB.19.2 hereof.
- 19.2 The inner and outer envelopes shall:
- (a) be addressed to the Employer at the address provided in the **Bidding Data**;
 - (b) bear the specific identification of this bidding process as specified in the **Bidding Data**; and
 - (c) Provide a warning not to open before the time and date for bid opening, as specified in the **Bidding Data**.
- 19.3 In addition to the identification required in Sub-Clause IB.19.2 hereof, the inner envelope shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared “late” pursuant to Clause IB.21.
- 19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

- 20.1
- (a) Bids must be received by the Employer at the address specified no later than the time and date stipulated in the **Bidding Data**.
 - (b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of Bids. No claims will be entertained for refund of such expenses.
 - (c) Where delivery of a Bid is by mail and the Bidder wishes to receive an acknowledgment of receipt of such Bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed Bid envelope.
 - (d) Upon request, acknowledgment of receipt of Bids will be provided to those making delivery in person or by messenger.
- 20.2 The Employer may, at his discretion, extend the deadline for submission of Bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations of the Employer and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Late Bids

- 21.1 (a) Any Bid received by the Employer after the deadline for submission of bids prescribed in Clause IB.20 shall be declared late, rejected and returned unopened to such Bidder.
- (b) Delays in the mail, delays of person in transit, or delivery of a Bid to the wrong office shall not be accepted as an excuse for failure to deliver a Bid at the proper place and time. It shall be the Bidder's responsibility to determine the manner in which timely delivery of his Bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

- 22.1 Any Bidder may modify, substitute or withdraw his Bid after Bid submission provided that the modification, substitution or written notice of withdrawal is received by the Employer prior to the deadline for submission of bids.
- 22.2 The modification, substitution, or notice for withdrawal of any Bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.
- 22.3 No Bid may be modified by a Bidder after the deadline for submission of Bids except in accordance with Sub Clauses IB.22.1 and 28.2.
- 22.4 Withdrawal of a Bid during the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified in the Letter of Bid may result in forfeiture of the Bid security in pursuance to Clause IB.16.

E. BID OPENING AND EVALUATION

IB.23 Bid Opening

- 23.1 The Employer will open the Bids including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of Bidders' representatives who choose to attend, at the time, date and location stipulated in the **Bidding Data**. The Bidders' representatives who are present shall sign a register evidencing their attendance.
- 23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened. Only bids that are opened and read out at Bid opening shall be considered further.
- 23.3 The Bidder's name, total Bid Price and price of any alternative proposal(s), any discounts, Bid modifications, substitution and withdrawals, the presence or absence of Bid security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening of Bids. Only discounts and alternative proposals

read out at Bid opening shall be considered for evaluation. The Letter of Bid and the Summary Bill of Quantities are to be initialed by representative(s) of the Employer attending Bid opening. The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with Sub-Clause IB 21.1).

- 23.4 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with the Sub-Clause IB.23.3.

IB.24 Process to be Confidential

- 24.1 Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of Contract shall not be disclosed to Bidders or any other person not officially concerned with such process before the announcement of the result of Bid evaluation in the form of final evaluation report giving justification for acceptance or rejection of Bids which shall be done at least fifteen (15) days prior to award of Contract. The announcement to all Bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the Bids evaluated. Any effort by a Bidder to influence the Employer's processing of Bids or Contract award decisions may result in the rejection of such Bidder's Bid. Whereas any Bidder feeling aggrieved may lodge a written complaint not later than five (5) days after the announcement of the final evaluation report.

IB.25 Clarification of Bids

- 25.1 To assist in the examination, evaluation and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates and lump sum prices. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The request for clarification and the response shall be in writing. No change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause IB.28.
- 25.2 The Employer may, at his discretion, ask any Bidder for confirmation/submission of missing information to clarify its Bid. However, the Employer does not have an obligation to request any additional information or clarification with respect to missing or deficient information in a Bid. The Employer may reject any Bid as non-responsive if found materially incomplete, obscure, irregular or omitting any material information required to be submitted in accordance with the Bidding Documents.
- 25.3 If a Bidder does not provide clarifications of its Bid by the date and time set reasonably (not less than seven (7) days) in the Employer's request for clarification, the Employer may proceed with the evaluation based on the information submitted in the Bid without waiting for the Bidder's response.

-
- IB.26 Examination of Bids and Determination of Responsiveness**
- 26.1 Prior to the comparison of Bids, the Employer will determine whether each Bid is substantially responsive to the requirements of the Bidding Documents.
- 26.2 The Employer's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in Sub- Clause IB.12.
- 26.3 A substantially responsive Bid is one which meets the requirements of the Bidding Documents, without material deviation, reservation or omission. A material deviation, reservation or omission is one that,
- (a) if accepted, would:
- (i) affect in any substantial way the scope, quality or performance of the Works; or
- (ii) limit in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the Bidder's obligations under the proposed Contract; or
- (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.
- 26.4 During the evaluation of Bids, the following definitions apply:
- (a) "Deviation" is a departure from the requirements specified in the Bidding Documents;
- (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Documents; and
- (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Documents.
- 26.5 The Employer shall examine the technical aspects of the Bid submitted in accordance with Sub-Clause IB.12.1(f), in particular, to confirm that all requirements stated in Specifications have been met without any material deviation, reservation or omission.
- 26.6 If a Bid is not substantially responsive to the requirements of the Bidding Documents, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation, reservation or omission.
-
- IB.27 Nonmaterial Nonconformities**
- 27.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid.
- 27.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or

		documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
	27.3	Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component, by adding the average price of the item or component quoted by other lowest two evaluated substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use a suitable CSR, adjusted to the date 28 days earlier to the Bid submission date or its best assessment.
IB.28 Correction of Arithmetic Errors	28.1	Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows: <ul style="list-style-type: none"> (a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern. (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected. (c) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.
	28.2	The amount stated in the Letter of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid security shall be forfeited in accordance with Sub Clause IB.16.6(b) hereof.
IB.29 Evaluation and Comparison of Bids	29.1	The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26. The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.
	29.2	In evaluating and comparing the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows: <ul style="list-style-type: none"> (a) making any correction for arithmetic errors pursuant to Clause IB.28;

- (b) price adjustment due to discounts offered in accordance with Sub-Clause IB.23.3;
- (c) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced daywork;
- (d) making an appropriate price adjustment for any quantifiable nonmaterial nonconformities in accordance with Sub-Clause IB.27.3; and
- (e) the additional evaluation factors are specified in Section Evaluation Criteria and Qualification Updating Forms.

29.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bids' comparison.

**IB.30 Abnormally
Low Bids**

30.1 If the Bid Price of the successful Bidder is more than 15% below the lower of the Employer's estimate of the cost of work to be performed under the Contract or average of other lowest two evaluated substantially responsive Bids, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require an additional Performance Security by 10% of the difference of the Bid Price as determined hereinabove up to issuance of Taking Over Certificate at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract. The Bids having Bid Price lower than 25% shall be liable to be rejected.

**IB.31 Unbalanced or
Front Loaded
Bids**

31.1 If the Bid of the successful Bidder is seriously unbalanced (Front Loaded) in relation to the average of other evaluated substantially responsive Bids, the Employer during execution of contract may pay against measured quantities of significantly higher quoted line item(s) rate(s) with respect to same line item(s) rate(s) determined from the average of other lowest two evaluated substantially responsive Bids as instructed by the Engineer. The balance line item(s) rate(s) may be paid against the same measured quantities at the time of issuance of Taking Over Certificate or as instructed by the Engineer.

F. AWARD OF CONTRACT

**IB.32 Award
Criteria**

32.1 Subject to Clauses IB.33 and IB.39, the Employer will award the Contract to the Bidder who's Bid has been determined as most advantageous Bid (substantially responsive to requirements of the Bidding Documents with the lowest evaluated Bid Price).

**IB.33 Employer's
Right to Annul
the Bidding
Process**

33.1 Notwithstanding Clause IB.32, the Employer reserves the right to annul the bidding process and reject all Bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidders or any obligation.

The Employer shall upon request communicate to any Bidder who submitted a Bid, the grounds for its rejection of all Bids but is not required to justify those grounds. Rejection of all Bids shall be notified to all Bidders promptly.

IB.34 Notification of Award

34.1 Prior to expiration of the period of Bid validity prescribed by the Employer, the Employer will notify the successful Bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Accepted Contract Amount").

The Letter of Acceptance will also state the remedies with respect to Sub-Clauses IB.30 & IB.31 if applicable.

34.2 No negotiation with the Bidder having submitted most advantageous Bid or any other Bidder shall be permitted, however, Employer may have clarification meetings before issuing Letter of Acceptance to get clarified any item in the Bid evaluation report.

34.3 The Letter of Acceptance/ notification of award and its acknowledgement/acceptance by the Bidder will constitute the formation of the Contract, binding the Employer and the Bidder till signing of the formal Contract Agreement.

34.4 Upon furnishing by the successful Bidder of a Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful and return their Bid securities in accordance with Sub-Clause IB.16.5.

**IB.35 Performance
Security**

35.1 The successful Bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Conditions of Contract and additional Performance Security if applicable under IB.30 as stated in the Letter of Acceptance, within a period of **14 days** after the receipt of Letter of Acceptance.

35.2 Failure of the successful Bidder to comply with the requirements of Sub Clause IB.35.1 or Clauses IB.36 or IB.37 shall constitute sufficient grounds for the annulment of the award, forfeiture of the Bid security and to award the Contract to the Bidder having submitted next advantageous Bid.

**IB.36 Signing of
Contract
Agreement**

36.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will notify the successful Bidder to depute its representative with appropriate Power of Attorney to sign the Contract Agreement in the form provided in the Bidding

Documents, incorporating all agreements between the parties.

- 36.2 The formal Agreement between the Employer and the successful Bidder shall be executed within 14 days of the receipt of the above stated notification by the successful Bidder from the Employer.
- IB.37 Integrity Pact** 37.1 The Bidder shall sign and stamp the Integrity Pact provided at Schedule-J to Bid in the Bidding Documents for all Federal Government procurement contracts exceeding PKR ten million. Failure to provide such Integrity Pact shall make the Bidder non-responsive.
- IB.38 Instructions not Part of Contract** 38.1 Bids shall be prepared and submitted in accordance with the Instructions to Bidders which are provided to assist the Bidders in preparing Bids but do not constitute part of the Contract.
- IB.39 Corrupt and Fraudulent Practices** 39.1 The Employer will reject a Bid if it determines that the Bidder recommended for award, or any of its personnel, or its agents, or its sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract under this bidding.
- 39.2 The Employer will blacklist and hence forthwith debar a Constructor or individual, at any time, in accordance with the prevailing Public Procurement Rules 2004.

BIDDING DATA

BIDDING DATA

The following specific data for the Works to be bided shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

IB Clause Reference	Bidding Data
1.1	Name and address of the Procuring Agency: Sindh Madressatul Islam University, Aiwan-e-Tijarat Road, Behind Habib Bank Plaza, Karachi
1.1	Name of the Project and Summary of the Works: Development of Sindh Madressatul Islam University (SMIU) Campus at Education City Malir, Karachi – Lot No.4 Faculty Staff Residences, Bachelor Faculty Male / Female Hostels (Remaining Works)
1.2	Time for Completion for the Works: 450 days (15 Months)
2.1	Name of the Borrower/Source of Financing/Funding Agency: Federal Government (HEC) PSDP funds.
3.1	Foreign Constructors are not allowed
8.1	Time limit for clarification: Seven (7) calendar days prior to the Date of Opening of Tender.
8.3	Venue, time and date of Pre-bidding meeting: Pre-bid meeting shall be held at Conference Room SMIU Malir Campus, Education City, Malir, Karachi on Monday, 14th April 2025 at 11.30 A.M
9.3	Number of Days: Five (05)
11.1	Bid Language: English
14.1	Bidders to quote entirely in Pak. Rupees
15.1	Period of Bid validity: Bid shall be valid for 90 days from the date of opening of bid.
16.1	Amount of Bid Security: Bid Security in form of Call Deposit / Pay Order/ Demand Draft/Bank Guarantee issued by a Scheduled Bank in Pakistan, of the amount at 2% of the Bid Price in favor of Sindh Madressatul Islam University which shall remain Valid for a period of 28 days beyond the validity period of bids mentioned in para 15.1 above. List of Insurance Companies: (Not Applicable)
17.1	Alternative Proposal(s) by the Bidder shall not be considered.

18.4	<p>Number of copies of the Bid to be completed and returned: Each bidder shall prepare their bid by filling in all the forms completely and without any alterations. The bid document properly and completely filled-in must be submitted only through-Pak Acquisition and Disposal System (EPADS) on or before the deadline stated in the Tender Notice.</p>
19.2 (a)	<p>Procuring Agency's address for the purpose of submission: Conference Room No. 2, First Floor, Main Building, Sindh Madressatul Islam University, Aiwan-i-Tijarat Road, Behind Habib Bank Plaza, Karachi.</p>
19.2 (b)	<p>Name of the Contract: Development of Sindh Madressatul Islam University (SMIU) Campus at Education City Malir, Karachi – Lot No.4 Faculty Staff Residences, Bachelor Faculty Male / Female Hostels (Remaining Works)</p>
19.2 (c)	<p>Time and date for Bid Opening: Bids shall be opened at 03:00 P.M on Tuesday 22nd April 2025 in the Conference Room No. 02, first floor Main building at Sindh Madressatul Islam University, Aiwan-e-Tijarat Road Behind Habib Bank Plaza, Karachi</p>
20.1 (A)	<p>Deadline for submission of Bids: On or before Tuesday, 22nd April 2025 at 02:30 P.M only through EPAD as stated in Tender Notice.</p>
23.1	<p>Venue, time, and date of opening:</p> <ul style="list-style-type: none"> • Venue: Conference Room No. 02, first floor Main building at Sindh Madressatul Islam University, Aiwan-e- Tijarat Road Behind Habib Bank Plaza, Karachi. • Bids opening time: 03:00 P.M. • Date of Bids opening: 22nd April 2025

EVALUATION CRITERIA AND QUALIFICATION UPDATING FORMS

EVALUATION CRITERIA AND QUALIFICATION UPDATING FORMS

1. General

This Section contains Eligibility and Qualification Criteria that the Employer shall use to evaluate Bids and qualify Bidders in accordance with Clauses IB.26 of Instructions to Bidders. The Bidder shall provide all the information requested in the relevant forms contained in Bidder's Qualification Updating Forms provided herein.

The information provided in the forms shall be substantiated with valid documentary evidences otherwise the requirement will not be considered as complied.

Wherever a Bidder is required to state a monetary amount, Bidders shall indicate the PKR equivalent using the rate of exchange determined as follows:

- For financial data - Exchange rate prevailing on the last day of the respective calendar year (in which the amounts for that year is to be converted) was originally established.

Exchange rates shall be taken from the publicly available source identified in the Sub-Clause IB.14.2. Any error in determining the exchange rates in the Bid may be corrected by the Employer.

2. Domestic Preference

A margin of preference of 7.5% (seven and a half percent) shall be granted to domestic Bidders (in case of JV, all partners are Pakistani Constructors), in accordance with and subject to the following provisions:

- a.** The Bidders applying for such preference shall provide, as part of the data for qualification, such information, including details of ownership, as shall be required to determine whether, according to the classification established by the Employer, a Bidder qualifies for a domestic preference.
- b.** After Bids have been received and reviewed by the Employer, responsive Bids shall be classified into the following groups:
 - Group A: Bids offered by domestic Bidders eligible for the preference.
 - Group B: Bids offered by other Bidders.

All evaluated Bids in each group shall, as a first evaluation step, be compared to determine the lowest Bid, and the lowest evaluated Bids in each group shall be further compared with each other. If, as a result of this comparison, a Bid from Group A is the lowest, it shall be selected for the award. If a Bid from Group B is the lowest, as a second evaluation step, all Bids from Group B shall then be further compared with the lowest evaluated Bid from Group A. For the purpose of this further comparison only, an amount equal to 7.5% (seven and a half percent) of the respective Bid Price corrected for arithmetical errors, including unconditional discounts and excluding Provisional Sums and the cost of dayworks, if any, shall be added to the evaluated price offered in each Bid from Group B. If the Bid from Group A is the lowest, it shall be selected for award. If not, the lowest evaluated Bid from Group B based on the first evaluation step shall be selected.

3. Evaluation Criteria

The following criteria shall apply:

- Valid registration with Pakistan Engineering Council (PEC) in prescribed category and the relevant field of specialization of work.
- Experience in similar nature of works executed in the last five years with atleast one similar project completed having project cost equal to 80% of the estimated cost of this project given in the tender notice or two similar projects completed with each having project costs equal to 50% of the estimated project cost.
- Registration with income tax department (NTN certificates) with activated status in Federal Board of Revenue.
- Registration certificate of Sindh Revenue Board Government of Sindh STN Certificate.
- List of machinery and equipment available.
- An affidavit certificate that the firm has never been black listed by Government/ Semi Government / Autonomous / Private bodies and that the firm has not been involved in any litigation and arbitration with Government/ Semi Government / Autonomous / Private bodies.
- Audited financial statements for last three (3) years.
- In case of joint ventures, same conditions to be fulfilled by both the firms.
- Affidavit with effect that all the documents/ particulars information furnished are true correct.

4. Assessment of adequacy of Technical Proposal with Requirements

a. Multiple Contracts, if permitted under Sub-Clause 1.1 of Bidding Data, will be evaluated as follows:

Award Criteria for Multiple Contracts

Bidders have the option to Bid for any one or more lots. Bids will be evaluated lot-wise, taking into account discounts offered, if any, for combined lots. The contract(s) will be awarded to the Bidder or Bidders offering the lowest evaluated cost to the Employer for combined lots, subject to the selected Bidder(s) meeting the required qualification criteria for lot or combination of lots as the case may be.

Qualification Criteria for Multiple Contracts

This Section describes criteria for qualification for each lot (contract). For multiple lots (contracts) the criteria for qualification is aggregate minimum requirement for respective lots.

b. Price Adjustments, if permitted under IB.29.2(d), will be evaluated as follows:

i. Price Adjustment for Completeness in Scope of Work

In case of omission in the scope of work of a quoted item, no price adjustment for the omitted item(s) shall be applied provided that the Bidder has mentioned in his Bid that the same is covered in any other item. Otherwise the adjustments will be applied for comparison purpose only, taking the average price quoted by other lowest two evaluated substantially responsive Bidders in their original Bids for corresponding item. In case of non-availability of price from other Bidders, the price will be estimated by the Employer from a suitable CSR, adjusted to the date 28 days earlier to the Bid submission date or the Employer shall use its best assessment.

The price adjustment shall not justify any additional payment by the Employer and the price(s) of omitted item(s) shall be deemed covered by other prices of the Bill of Quantities.

ii. Price Adjustment for Technical/ Commercial Non Compliance

The cost of making good any deficiency resulting from technical/commercial non-compliance will be added to the Corrected Total Bid Price for comparison purpose only.

The adjustments will be applied taking the average price quoted by other lowest two evaluated substantially responsive Bidders in their original Bids for corresponding item. In case of non-availability of price from other Bidders, the price will be estimated by the Employer in accordance with sub-para (a) hereof.

Bidders Qualification Updating Forms

To establish its qualifications to perform the contract in accordance with Section (EvaluationCriteria and Qualification Updating Forms) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI -1.1

Bidder Information Form

Date: _____
Bid Reference No. (if any) and title: _____

Page _____ of _____ pages

Bidder's name
In case of Joint Venture (JV), name of each member:
Bidder's country of registration: <i>[indicate country of Constitution]</i>
Bidder's year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents, in case of JV, JV agreement, in accordance with Sub-Clause IB 3.1.

Form ELI -1.2

Bidder's JV Information Form
(to be completed for each member of Bidder's JV)

Date: _____
Bid Reference No. (if any) and title: _____
Page _____ of _____ pages

Bidder's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____

Form CON – 1

Pending

Litigation

Bidder's Name: _____

Date: _____

JV Member's Name _____

Bid Reference No. (if any) and title: _____

Page _____ of _____ pages

Pending Litigation, in accordance with Eligibility and Qualification Criteria			
5 No pending litigation in accordance with Eligibility and Qualification Criteria, Sub-Factor 2.1.			
6 Pending litigation in accordance with Eligibility and Qualification Criteria, Sub-Factor 2.1 as indicated below.			
Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount (currency), Eq. PKR (exchange rate)
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	

Form FIN – 3.1:
**Financial Situation and
Performance**

Bidder's Name: _____

Date: _____

JV Member's Name _____

7 Financial data

Bid Reference No. (if any) and title: _____

Page _____ of _____ pages

Type of Financial information in (currency)	Historic information for last year, (amount in currency, currency, exchange rate*, Eq. PKR)
Statement of Financial Position (Information from Balance Sheet)	
Total Assets (TA)	
Total Liabilities (TL)	
Total Equity/Net Worth (NW)	
Current Assets (CA)	
Current Liabilities (CL)	
Working Capital (WC)	
Information from Income Statement	
Total Revenue (TR)	
Profits Before Taxes (PBT)	
Cash Flow Information	
Cash Flow from Operating Activities	

*Refer to IB 14.2 for the exchange rate

8 Financial documents:

The Bidder and its parties shall provide copies of financial statements for last year pursuant to Eligibility and Qualification Criteria, Sub-factor 3.1. The financial statements shall:

- 8.1 reflect the financial situation of the Bidder or in case of JV member, and not an affiliated entity (such as parent company or group member).
- 8.2 be independently audited or certified in accordance with local legislation.
- 8.3 be complete, including all notes to the financial statements.
- 8.4 correspond to accounting periods already completed and audited.

9. Attached are copies of financial statements¹ for the last year required above; and complying with the requirements

¹ If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, thereason for this should be justified.

Form FIN – 3.2:

Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Eligibility and Qualification Criteria.

No.	Source of financing	Amount (Eq. PKR)
1		
2		
3		

Form FIN – 3.3:

Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No.	Name of Contract	Employer's Contact Address, Tel, Fax	Value of Outstanding Work [Current Eq. PKR]	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months [Eq. PKR /month)]
1					
2					
3					
4					
5					

LETTER OF BID AND SCHEDULES TO BID

LETTER OF BID

Bid Reference No. _____
[Name of Contract/ Works]

To: _____

Gentleman,

- 9 Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Specifications, Schedules to Bid including Bill of Quantities, Drawings and Addenda Nos. _____ for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the said Bidding Documents and**

Addenda for the sum of Equivalent PKR _____ (Eq. Pak Rupees _____) or such other sum as may be ascertained in accordance with the said conditions.

10 We meet the eligibility requirements in accordance with IB.3.

- 11 We, including any Subcontractors for any part of the Contract, are not debarred/blacklisted by the Employer, any Government/Semi Government/Public Department in Pakistan or foreign country, international organizations or other foreign institutions.**

- 12 Our subcontractors or suppliers for any part of the Contract, if any, shall have nationalities from eligible countries, in accordance with IB.4.4.**

13 We understand that all the Schedules attached hereto form part of this Bid.

14 As security for due performance of the undertakings and obligations of this Bid, we submit
herewith a Bid Security in the amount of PKR _____ (Pak. Rupees. _____) drawn in your favour or made payable to you and valid for a period of _____ days beginning from the date Bids are opened.

- 15 We undertake, if our Bid is accepted, to commence the Works and to complete the whole of the Works comprised in the Contract within the time stated in Contract Data.**

- 16 We agree to abide by this Bid for the period of _____ days, inclusive of 14 days beyond Bid validity period (as mentioned at Sr. No. 6 above) and it shall remain binding upon us and may be accepted at any time before the expiration of that period.**

- 17 Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.**

- 18 We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other Bidder for the Works.**

- 19 We understand that you are not bound to accept the lowest or any Bid you may receive.**

- 20 We undertake that all the information and documents submitted with the Bid are genuine, and in case of incorrect information of fake documents we shall be liable for punitive action under the Applicable Law.**

Dated this _____ day of _____ 20____

Signature: _____

in the capacity of _____ duly authorized to sign Bids for and on behalf of

(Name of Bidder in Block Capitals)
(Seal)

Address: _____

Witness:

Signature: _____

Name: _____

Address. _____

Occupation _____

SCHEDULE OF ADJUSTMENT DATA

Schedule of Cost Indexation

[The Employer is to engage a professional with experience in construction costs and the inflationary effect on construction costs when preparing the contents of the Schedule of Cost Indexation. In the case of very large and/or complex works contracts, it may be necessary to specify several families of price adjustment formulae corresponding to the different works involved.]

[The formulae for price adjustment shall be of the following general type:]

$$P_n = a + b \frac{L_n}{L_o} + c \frac{E_n}{E_o} + d \frac{M_n}{M_o} + \dots$$

where:

“P_n” is the adjustment multiplier to be applied to the estimated Contract value in the relevant currency of the work carried out in period “n”, this period being a month;

“a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“b”, “c”, “d”, ... are coefficients representing the estimated proportion of each cost element related to the execution of the Works as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

“L_n”, “E_n”, “M_n”, are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“L_o”, “E_o”, “M_o”, are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

The weightings (coefficients) for each of the factors of cost stated in the following table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variation(s).

If the currency in which the Contract price is expressed is different from the currency of the country of origin of the indices, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall be: Z_0 / Z_1 , where,

Z_0 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price on the Base date, and

Z_1 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price on the Date of Adjustment.

SCHEDULE OF ADJUSTMENT DATA

Table I. Local Currency (LC) For Bill Nos. _____

[In the Table below, the Bidder shall (a) indicate amount of local currency payment, and the Employer shall (b) enter the Index description and source of indices for the different elements of cost, and (c) derive weightings for local currency payment including nonadjustable fixed portion. PEC Standard Procedure and Formula for Price Adjustment (Second Edition), May, 2022 as amended time to time shall be applied for preparation of the following Table.]

Cost Element	Description	Weightages	Applicable index
1	2	3	4
(i)	Fixed Portion	0.38	Government of Pakistan (GP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin of June 2024.
(ii)	Local Labour**	0.27	
(iii)	Cement – in bags	0.10	
(iv)	Reinforcing Steel	0.11	
(v)	High Speed Diesel (HSD)	0.05	
(vi)	Bajri	0.04	
(vii)	Tiles	0.05	
	Total	1.00	

BILL OF QUANTITIES

9 Preamble:

- 9.3 The Bill of Quantities shall be read in conjunction with the Conditions of Contract, Specifications and Drawings.**
- 9.4 The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices as given in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix as per the Contract.**
- 9.5 The rates and prices as given in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract include all costs of Contractor's plant, labour, supervision, materials, execution, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract. Furthermore, all duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.**
- 9.6 A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.**
- 9.7 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Works, or the same shall be determined by the Engineer in accordance with Clause 13, General Conditions.**
- 9.8 General directions and description of work and materials are not necessarily repeated nor summarised in the Bill of Quantities. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the Bill of Quantities.**
- 9.9 Provisional sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub- Clause 13.4 of General Conditions of Contract.**
- 9.10 The following abbreviations for units have been used in Bill of Quantities:**

Units		Abbreviations
Cubic Meter	=	cum
Square Meter	=	sqm
Kilogram	=	kg
Provisional Sum	=	PS
Lump-Sum	=	LS

C-1
Schedule-C to Bid

CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 8.3 of the General Conditions, the whole of the Works, and each Section (if any), shall be completed within the Time for Completion for the Works or Section (as the case may be) stated as hereunder and mentioned in Contract Data:

Description	Time for Completion (days)
a) Whole Works	
b) Section A	
c) Section B	
d) _____	
e) _____	

[The Bidder shall provide, the Construction Schedule in the bar chart (CPM, PERT or any other to be specified herein) showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed programme for completion of the whole of the Works and Sections of the Works may meet Employer's completion targets in days noted above and counted from the Commencement Date (Attach sheets as required for the specified form of Construction Schedule)]

METHOD OF PERFORMING THE WORK

[The Bidder is required to submit a narrative outlining the method of performing the Work. The narrative should indicate in detail and include but not be limited to:

(d) Organization Chart:

Shall indicate head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.

(e) Mobilization:

In Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.

(f) Part Method of executing the Works:

The procedures for installation of equipment and machinery and transportation of equipment and materials to the site.]

**E-1
Schedule-E to Bid**

LIST OF MAJOR EQUIPMENT

[The Bidder will provide on Sheet E-2 of this Schedule a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment.

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Sheet E-3.]

**LIST OF MAJOR EQUIPMENT
Owned, Purchased or Leased**

Owned Purchased or Leased	Description of Unit (Make, Model, Year)	Capacity HP Rating	Condition	Present Location or Source	Date of Delivery at Site	Period of Work on Project
1	2	3	4	5	6	7
a. Owned						
b. To be Purchased						
c. To be arranged on Lease						

LIST OF MAJOR EQUIPMENT
Equipment details

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	
The following information shall not be applicable for equipment owned by the Bidder		
Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

[This Table shall be used for each item of Equipment separately]

F-1
Schedule-F to Bid

**ORGANIZATION CHART FOR
THE
SUPERVISORY STAFF AND LABOUR**

G-1
Schedule-G to Bid

LIST OF SUBCONTRACTORS

I/ We intend to subcontract the following parts of the Work to subcontractors. In my/ our opinion, the subcontractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

Part of Works (Give Details)	Subcontractor (With Complete Address)
1	2

H-1
Schedule-H to Bid

ESTIMATED PROGRESS PAYMENTS

Bidder's estimate of the value of work which would be executed by him during each of the periods stated below, based on his Programme of the Works and the Rates in the Bill of Quantities, expressed in thousands of PKR:

Quarter	Amounts (1,000 PKR)
1	2
1 st	
2 nd	
3 rd	
4 th	
5 th	
6 th	
7 th	
8 th	
9 th	
Bid Price	

CONSTRUCTION CAMP AND HOUSING FACILITIES

[The Bidder in accordance with Clause 6 of the Conditions of Contract shall provide description of his construction camp's facilities and staff housing requirements.

The Bidder shall list or explain his plans for providing these facilities for the service of the Contract as follows:

- (g) Site Preparation (clearing, land preparation, etc.).**
- (h) Provision of Services.**
 - *Electrical power (expected power load, etc.).*
 - *Water (required amount and system proposed).*
 - *Sanitation (sewage disposal system, etc.)*
- (i) Construction of Facilities**
 - *Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).*
 - *Warehouses and Storage Areas (area required, type of construction and layout).*
 - *Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.).*
- (j) Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).**
- (k) Other Items Proposed (Security services, etc.)]**

Note:

The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp.

J-1
Schedule-J to Bid

INTEGRITY PACT
DECLARATION OF FEES, COMMISSION AND BROKERAGE, ETC.
PAYABLE BY THE BIDDERS/CONTRACTORS OF GOODS, SERVICES &
WORKS IN
CONTRACTS WORTH PAK. RS. 10.00 MILLION OR MORE

Contract No. _____

Dated _____

Contract Value: _____

Contract Title: _____

..... [Name of Bidder/Contractor] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan (GoP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoP through any corrupt business practice.

Without limiting the generality of the foregoing, [Name of Bidder/ Contractor] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP, except that which has been expressly declared pursuant hereto.

[Name of Bidder/Contractor] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[Name of Bidder/Contractor] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoP under any law, contract or other instrument, be voidable at the option of GoP.

Notwithstanding any rights and remedies exercised by GoP in this regard, [name of Bidder/Contractor] agrees to indemnify GoP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoP in an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Bidder/Contractor] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP.

Name of Employer:

Signature:

[Seal]

Name of Bidder/Contractor:

Signature:

[Seal]

STANDARD FORMS

FORM OF BID SECURITY

Security Executed on _____
(Date)

Expiry on _____
(Date)

Name of Surety with Address: _____

Name of Principal (Bidder) with Address _____

Penal Sum of Security PKR _____ (Pak Rupees _____)

Bid Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto _____ (hereinafter called the 'Employer') in the sum stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Bidder has submitted the accompanying Bid dated _____ for _____
(Particulars of Bid) to the said Employer; and

- 13 WHEREAS, the Employer has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum to the Employer, conditioned as under: that the Bid Security shall remain in force for a period fourteen (14) days beyond the Bid Validity date i.e., upto _____.**
- 14 that the Bid Securities of the Bidders except the lowest three will be returned by the Employer within twenty eight (28) days from the opening of Bids, provided a Bidder request for the return of its Bid Security, or on the expiry of original validity of Bid Security or as extended, whichever is earlier;**
- 15 that the Bid Security of the lowest three Bidders comprising the successful Bidder will be returned when the successful Bidder has furnished the required Performance Security; and**
- 16 that in the event of failure of the successful Bidder to furnish the required Performance Security, the entire said sum be paid immediately to the said Employer pursuant to IB.16 and IB.35 of the Instructions to Bidders for the successful Bidder's failure to perform.**

NOW THEREFORE, if the successful Bidder shall, within the period specified therefor, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer in accordance with his Bid as accepted and furnish within twenty eight (28) days of his being requested to do so, a Performance Security with good and sufficient surety, as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Surety shall forthwith pay the Employer the said sum upon first written demand of the Employer (without cavil or argument) and without requiring the Employer to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Employer by registered post duly addressed to the Surety at its address given above.

PROVIDED ALSO THAT the Employer shall decide, whether the Principal (Bidder) has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance Security within the time stated above, or has defaulted in fulfilling said requirements and the Surety shall pay without objection the said sum upon demand from the Employer forthwith and without any reference to the Principal (Bidder) or any other person.

IN WITNESS WHEREOF, the above bounden Surety has executed the instrument under its seal on the date indicated above, the name and seal of the Surety being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

SURETY
(Schedule Bank/Insurance Company)

WITNESS:

Signature _____

16.2 Name _____

Title _____

Corporate Secretary (Seal)

Corporate Guarantor (Seal)

2. _____

Name, Title & Address

FORM OF PERFORMANCE SECURITY

Guarantee No. _____

Executed on _____

Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor with address: _____

Name of Principal (Contractor) with address: _____

Penal Sum of Security (*express in words and figures*) _____

Letter of Acceptance No. _____ Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the

_____ (hereinafter called the Employer) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted the Employer's above said Letter of Acceptance for _____

_____ (*Name of Contract*) for the _____

_____ (*Name of Project*).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 11, Defects After Taking Over, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____ (the Guarantor), waiving all objections and defense under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments

and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to Employer's designated Bank & Account Number.

PROVIDED ALSO THAT the Employer shall decide, whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above-bounden Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Guarantor

(Schedule Bank/ Insurance Company)

WITNESS:

1. _____

Corporate Secretary (Seal)

2. _____

Name, Title & Address

Signature _____

Name _____

Title _____
Corporate Guarantor (Seal)

Letter of Acceptance

[Letterhead paper of the Employer]

NAME OF CONTRACT: _____

CONTRACT NUMBER: _____

TO : _____

Date: _____

Your Reference: _____

Our Reference: _____

We thank you for your Bid dated _____ for the execution and completion of the Works comprising the above-named Contract and remedying of defects therein, all in conformity with the terms and conditions contained in the Contract.

We have pleasure in accepting your Bid for the Accepted Contract Amount of:

[currency and amount in figures]

[currency and amount in words]

In consideration of you properly and truly performing the Contract, we agree to pay you the Accepted Contract Amount or such other sums to which you may become entitled under the terms of the Contract, at such times and as prescribed by the Contract.

We acknowledge that this Letter of Acceptance creates a binding Contract between us, and we undertake to fulfil all our obligations and duties in accordance with the terms of this Contract.

Signature: _____

Signed by: _____

For and on behalf of: _____

Date: _____

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day of _____ (month) 20____ between _____ (hereinafter called the "Employer") of the one part and _____ (hereinafter called the "Contractor") of the other part.

WHEREAS the Employer is desirous that certain Works, viz., _____ should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

NOW this Agreement witnessed as follows:

14 In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

15 The following documents, in the order of priority, after incorporating addenda, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Agreement:

- 15.1 This Contract Agreement;**
- 15.2 The Letter of Acceptance;**
- 15.3 The Letter of Bid;**
- 15.4 The Particular Conditions Part A - Contract Data;**
- 15.5 The Particular Conditions Part B - Special Provisions;**
- 15.6 The General Conditions;**
- 15.7 The Specifications Part A - Specific Provisions;**
- 15.8 The Specifications Part B - Technical Provisions;**
- 15.9 The Drawings;**
- 15.10 The Completed Schedules to Bid including Schedule of Prices;**
 - 15.11 the JV Undertaking (if the Contractor is a JV); and**
 - 15.12 *[Employer to insert any other documents forming part of the Contract]***

The addenda/corrigenda, if any, (Excluding part relating to Instructions to Bidders along with Bidding Data) shall be deemed to have been incorporated at the appropriate places in the "Documents forming the Contract".

- 16 In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.**
- 17 The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.**

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of Contactor

Signature of Employer

(Seal)

(Seal)

Signed, Sealed and Delivered in the presence of:

Witness

Witness

(Name, Title and Address)

(Name, Title and Address)

DAAB Agreement

DAAB-1

[All italicised text and any text within square brackets (except sub-clause headings) in this form of agreement is for use in preparing the form and should be deleted from the final product].

Name and details of the Contract _____

This Agreement made the _____ day of _____[*month*], _____[*year*], between

Name and contact details of the Employer _____ (name)
 _____ (address)
 _____ (telephone)
 _____ (email / other contact details);

Name and contact details of the Contractor _____ (name)
 _____ (address)
 _____ (telephone)
 _____ (email / other contact details);

Name and contact details of the DAAB Member _____ (name)

_____ (address)

_____ (telephone)

_____ (email / other contact details);

(“DAAB Agreement”)

Whereas:

- A.** the Employer and the Contractor have entered (or intend to enter) into the Contract;
- B.** under the Contract, the “DAAB” or “Dispute Avoidance/Adjudication Board” means the sole member or three members (as stated in the Contract Data of the Contract) so named in the Contract, or appointed under Sub-Clause 21.1 [*Constitution of the DAAB*] or Sub-Clause 21.2 [*Failure to Appoint DAAB Members*] of the Conditions of Contract;
- C.** the Employer and the Contractor desire jointly to appoint the above-named DAAB Member to act on the DAAB as:
- a. the sole member of the DAAB, and where this is the case, all references to the “Other Members” do not apply; or
- b. one of three members / chairman [*delete the one which is not applicable*] of the DAAB and, where this is the case, the other two persons are:

_____ (name)	_____ (name)
_____ (address)	_____ (address)
_____ (telephone)	_____ (telephone)
_____ (email/ other contact details)	_____ (email/ other contact details)

the “Other Members”; and

D. the DAAB Member accepts this appointment.

The Employer, Contractor and DAAB Member jointly agree as follows:

1. The conditions of this DAAB Agreement comprise:

- (a) Clause 21 [*Disputes and Arbitration*] of the Conditions of Contract, and any other provisions of the Contract that are applicable to the DAAB’s Activities; and**
- (b) the “General Conditions of Dispute Avoidance/Adjudication Agreement”, which is appended to the General Conditions of the “Conditions of Contract for Construction” Second Edition 2017 published by FIDIC (“GCs”), as amended and/or added to by the following provisions.**

2. [Details of amendments to the GCs, if any. For example:

In the procedural rules annexed to the GCs, Rule _ is deleted and replaced by: “ ... “]

3. The DAAB Member shall be paid in accordance with Clause 9 of the GCs.

The currency of payment shall be _.

In respect of Sub-Clauses 9.1 and 9.2 of the GCs, the amounts of the DAAB Member’s monthly fee and daily fee shall be:

monthly fee _____ per month, and

daily fee of _____ per day

(or as otherwise set under Sub-Clause 9.3 of the GCs).

- 4. In consideration of the above fees, and other payments to be made to the DAAB Member in accordance with the GCs, the DAAB Member undertakes to act as DAAB Member in accordance with the terms of this DAAB Agreement.**
- 5. The Employer and the Contractor shall be jointly and severally liable for the DAAB Member’s fees and other payments to be made to the DAAB Member in accordance with the GCs.**
- 6. This DAAB Agreement shall be governed by the law of _____ (if not stated, the law that governs the Contract under Sub-Clause 1.4 of the Conditions of Contract).**

DAAB-3

SIGNED by: _____	SIGNED by: _____	SIGNED by: _____
Print name: _____	Print name: _____	DAAB Member
Title: _____	Title: _____	Title: _____
for and on behalf of the Employer	for and on behalf of the Contractor	
in the presence of	in the presence of	in the presence of
Witness: _____	Witness: _____	Witness: _____
Name: _____	Name: _____	Name: _____
Address: _____	Address: _____	Address: _____
_____	_____	_____
Date: _____	Date: _____	Date: _____

FORM OF MOBILIZATION ADVANCE GUARANTEE/ BOND
(NOT ALLOWED)

Guarantee No. _____ Date _____

WHEREAS _____ (hereinafter called the 'Employer')

has entered into a Contract for _____
(Particulars of Contract)

with _____ (hereinafter called the "Contractor").

AND WHEREAS, the Employer has agreed to advance to the Contractor, at the Contractor's request, an amount of Pak Rupees _____ (PKR _____) which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS, the Employer has asked the Contractor to furnish Guarantee to secure the mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____

(hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the Employer agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW, THEREFORE, the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above mentioned Contract and if he fails and commits default in fulfilment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Employer for payment not exceeding the aforementioned amount.

Notice in writing of any default, on the part of the Contractor, of which the Employer at his discretion of making decision, shall be given by the Employer to the Guarantor, and on such first written demand, payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall remain in force until the advance is fully adjusted against payments from the Interim Payment Certificates of the Contractor or until _____ whichever is earlier.
(Date)

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of
 PKR _____ (Pak Rupees _____).
 _____).

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor

agrees that the aforesaid period of validity shall be deemed to be extended if on the abovementioned date the advance payment is not fully adjusted.

Guarantor
(*Scheduled Bank/ Insurance Company*)

WITNESS:

Signature _____

1. _____

Corporate Secretary (Seal)

Name _____
Title _____
Corporate Guarantor (Seal)

2. _____

Name, Title & Address

CONDITIONS OF CONTRACT

CONDITIONS OF CONTRACT

The Conditions of Contract comprise two parts:

18 General Conditions

19 Particular Conditions

General Conditions

These Conditions are the “General Conditions” which form part of the “FIDIC Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer Second Edition (2017 Red book, Reprinted 2022 with amendments)” published by:

International Federation of Consulting Engineers
(Fédération Internationale des Ingénieurs – Conseils) – (FIDIC)
World Trade Center II - Geneva Airport
P. O. Box 311
CH-1215 Geneva 15
Switzerland
Email: fidic@fidic.org, fidic.pub@fidic.org
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The successful Bidder after award of Works shall have to provide two (02) copies of above said “General Conditions” for incorporation in the Contract.

Particular Conditions

*(Mandatory Provisions not to be amended/substituted
except as instructed/permited by PEC in writing)*

The Particular Conditions (PC) complement the General Conditions (GC) to specify dates, contractual requirements, and special circumstances related to the Works. The PC consists of two parts, Part A - Contract Data and Part B - Special Provisions. The provisions to be found in the Special Provisions (Particular Conditions - Part B) take precedence over the equivalent provisions found under the same Sub-Clause number(s) in the General Conditions, and the provisions of the Contract Data (Particular Conditions - Part A) take precedence over the Special Provisions (Particular Conditions - Part B).

Part A - Contract Data

Sub-Clause	Data to be Given	Data
1.1.27	Defects Notification Period (DNP):	<u>365</u> days
1.1.31	Employer's name and address:	Sindh Madressatul Islam University, Aiwan-e-Tijarat Road, Behind Habib Bank Plaza, Karachi
1.1.35	Engineer's name and address:	<i>EA Consulting Pvt Ltd.</i> AL-9, 15th Lane Khayaban-e-Hilal, D.H.A. Phase 7 Defence Housing Authority, Karachi, Sindh 75500
1.1.73	Sections:	<i>[If Sections are used, insert "Refer to Table: Summary of Sections of the Works given below" otherwise insert "None" and delete the Table]</i>
1.1.84	Time for Completion:	<u>450</u> days for whole of the Works
1.3(a)(ii)	Agreed methods of electronic transmission:	<i>[insert systems of electronic transmission, if any, at the time of signing of the Contract]</i>
1.3(d)	Address of Employer for communications:	Sindh Madressatul Islam University, Aiwan-e-Tijarat Road, Behind Habib Bank Plaza, Karachi
	Address of Engineer for communications:	<i>EA Consulting Pvt Ltd.</i> AL-9, 15th Lane Khayaban-e-Hilal, D.H.A. Phase 7 Defence Housing Authority, Karachi, Sindh 75500

Sub-Clause	Data to be Given	Data
1.8	number of additional paper copies of Contractor's Documents:	_ Only via EPADS
2.1	after receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within:	Immediately after issuance of Notice to Commencement
2.4	Employer's financial arrangements	Federal Government (HEC) PSDP funds.
3.2 (e)(ii)	Engineer's Duties and Authority	Variation resulting in an increase of the Accepted Contract Amount in excess of one percent (1%) subject to accumulative Variations not exceeding five percent (5%) of the Accepted Contract Amount
4.2	Performance Security (as percentage of the Accepted Contract Amount in Currencies) percent: currency :	Five percent (5%) denominated in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer
4.2.1	List of Insurance Companies	1. _____ 2. _____ 3. _____ [Not Applicable]
4.7.2	Period for notification of errors in the items of reference	Twenty Eight (28) days
4.19	Period of payment for temporary utilities	each month
4.20	Number of additional paper copies of progress reports	02 Nos. Copies
5.1(a)	Maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	NOT APPLICABLE

Sub-Clause	Data to be Given	Data
5.1(b)	parts of the Works for which subcontracting is not permitted	NOT APPLICABLE
6.5	Normal working hours on the Site	<i>08 hours and 6 working days in a week</i>
8.3	number of additional paper copies of programmes	<i>03 Copies</i>
8.8 & 14.15(b)	Delay Damages payable for each day of delay	0.075% Of the Contract Value for each day of delay in completion of the works upto a maximum of 10% of the Contract Price stated in the Letter of Acceptance.
8.8	maximum amount of Delay Damages	Ten percent (10%) of the Accepted Contract Amount
8.14	Applicability of Incentives for Early Completion	No
12.3	Percentage profit	Ten percent (10%)
13.4.(b)(ii)	percentage rate to be applied to Provisional Sums for overhead charges and profit	Twenty Five percent (25%)
14.2	total Advance Payment	Not Applicable
14.2.1	List of Insurance Companies	1. _____ 2. _____ 3. _____ <i>Not Applicable</i>

Sub-Clause	Data to be Given	Data
14.2.3	percentage deductions for the repayment of the Advance Payment	Deduction shall be made at the amortization rate of 17.5 % of the value of the Works executed of each IPC as provided in paragraph (i) of Sub-Clause GCC 14.3, starting from 2 nd IPC provided that the advance payment shall be completely repaid prior to the time when 90% of the Accepted Contract Amount less Provisional Sums has been certified for payment. It may be more than 17.5% in the last installment to ensure full repayment.
14.3	period of Interim payment	Monthly Basis
14.3(b)	number of additional paper copies of Statements	<i>Original plus one hard copy, plus one electronic</i>
14.3 (iii)	percentage of retention	Five percent (5%) on each IPC
14.3 (iii)	limit of Retention Money (as a percentage of the Contract Price)	Five percent (5%)
14.5(b)(i)	Plant and Materials for payment when shipped	Not Applicable
14.5(c)(i)	Plant and Materials for payment when delivered to the Site	Not Applicable
14.6.2	minimum amount of Interim Payment Certificate (IPC)	<i>As per monthly work done</i>
14.7(a)	period of payment of Advance Payment to the Contractor	Not Applicable
14.7b(i)	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.6 [Interim Payment]	<u>28 days</u>

Sub-Clause	Data to be Given	Data
14.7b(ii)	period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 (Final Payment)	28 days
14.7(c)	period for the Employer to make final payment to the Contractor	56 days
14.8	financing charges for delayed payment	Not Applicable
14.11.1(b)	number of additional paper copies of draft Final Statements	3 Copies
14.15	currencies of payment of Contract Price	Pak Rupees
14.15(a)(i)	Proportions or amounts of Local and Foreign currencies	Not Applicable
14.15(c)	currencies and proportions for payment of Delay Damages	Not Applicable
14.15(f)	rates of exchange	Not Applicable
17.2(d)	forces of nature, the risks of which are allocated to the Contractor	Nil
19.1	permitted deductible limits: 19 insurance required for the Works 20 insurance required for Goods 21 insurance required for liability for breach of professional duty 22 insurance required against liability for fitness for purpose (if any is required) 23 insurance required for injury to persons and damage to property 24 insurance required for injury to employees 25 other insurances required by Laws and by local practice	Ten percent (10%) of loss amount on each & every loss Nil Nil Nil Nil Nil Nil

Sub-Clause	Data to be Given	Data
19.1	Periods for submission of insurance: 23 evidence of insurance 24 relevant policies	Not later than the Commencement Date Within twenty eight (28) day from the Commencement Date
19.2.1(b)	additional amount to be insured (as a percentage of the replacement value)	15% of the replacement value (Accepted Contract Amount)
19.2.2	extent of insurance required for Goods amount of insurance required for Goods	from Ex-Works (i.e., works, factory, warehouse, etc) to delivery at the Site Full replacement value
19.2.3(a)	amount of insurance required for liability for breach of professional duty	Full replacement value of the Works to be designed by the Contractor
19.2.3(b)	insurance required against liability for fitness for purpose	Yes
19.2.3	period of insurance required for liability for breach of professional duty	Until the date of issuance of Performance Certificate
19.2.4	amount of insurance required for injury to persons and damage to property	Injury to person and Fatal case: in accordance with Workmen Compensation Act Damage to Property: _____ [Employer to insert amount(s) as per his assessment of the adjoining property(ies) other than the Works] without limit to the number of incidents
19.2.6	other insurances required by Laws and by local practice	All insurances as applicable, to the extent of execution of the project, under Federal and Provincial laws of Islamic Republic of Pakistan
21.1	time for appointment of the DAAB	Within 28 days from the Commencement Date. In case the Accepted Contract Amount is lesser than PKR one (01) billion, appointment of the DAAB shall be made when Dispute arises between the Parties.

Sub-Clause	Data to be Given	Data
21.1	the DAAB shall comprise	<p>_____</p> <p><i>[insert either “a sole Member” or “Three Members”]</i></p> <p><i>[For a Contract estimated to cost above PKR 2.5 billion, the DAAB shall comprise of three members. For a Contract estimated to cost between PKR 1 billion and PKR 2.5 billion, the DAAB may comprise of three members or a sole member. For a Contract estimated to cost less than PKR 1 billion, a sole member is recommended.]</i></p>
21.1	<p>List of proposed members of DAAB</p> <p>24 proposed by Employer</p> <p>25 proposed by Contractor</p>	<p><i>[to be inserted at the time of signing of the Contract]</i></p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p>
21.2	Appointing entity (official) for DAAB members	Chairman Pakistan Engineering Council (PEC) from the list of PEC approved arbitrators published at its website
21.6	Rules of Arbitration	<p>PEC Rules of Conciliation and Arbitration or Pakistan Arbitration Act of 1940, if the former is inactive.</p> <p>The place of Arbitration shall be in the Employer’s _____ country:</p> <p>_____</p> <p><i>[Insert name of city]</i></p>

Summary of Sections of the Works

Section Name/Description of parts of the Works that shall be designated a Section for the purposes of the Contract (Sub-Clause 1.1.73)	Value: Percentage* of Accepted Contract Amount (Sub-Clause 14.9)	Time for Completion (Sub-Clause 1.1.84)	Delay Damages (Sub-Clause 8.8)
A			
B			
C			

* These percentages shall also be applied to each half of the Retention Money under Sub-Clause 14.9.

Section Name/Description (Sub-Clause 1.1.73)	Time for Completion (Sub-Clause 1.1.84)	Incentives for Early Completion (Sub-Clause 8.14)
A		
B		
C		

Particular Conditions

Part B - Special Provisions

- 1.1 Definitions** 1.1.76 “Specification”
Following is added at the end:
“and consists of two parts i.e.,
i) “Part A - Specific Provisions”; and
ii) “Part B - Technical Provisions”.”
- 1.2 Interpretation** “and” is deleted from the end of sub-paragraph (i) and added at the end of sub-paragraph (j).
Sub-paragraph (k) is added:
“(k) The word “tender” is synonymous with “bid” the word tenderer with “bidder”, the words “tender documents” with “bidding documents” and “Schedule of Prices” with “Bill of Quantities”, as applicable.”
- 1.5 Priority of Documents** The documents listed at (a) through (k) of this Sub-Clause are deleted and substituted with the following:
(a) the Contract Agreement;
(b) the Letter of Acceptance;
(c) the Letter of Bid;
(d) the Particular Conditions Part A - Contract Data;
(e) the Particular Conditions Part B - Special Provisions;
(f) the General Conditions;
(g) the Specification Part A - Specific Provisions;
(h) the Specification Part B - Technical Provisions;
(i) the Drawings;
(j) the completed Schedules to Bid including Bill of Quantities;
(k) the JV Undertaking (if the Contractor is a JV); and
(l) any other documents forming part of the Contract.
The addenda/corrigenda, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.
- 1.6 Contract Agreement** In the last line of the 1st paragraph the text “shall be borne by the Employer” is substituted by “shall be reimbursed by the Employer to the Contractor”.
- 3.1 The Engineer** In sub-paragraph (a) the text “as defined in the Pakistan Engineering Council Act, 1975 (Act No. V of 1976)” are added after the words “professional engineer”.
- 3.2 Engineer’s Duties and Authority** The Engineer shall obtain the consent in writing of the Employer before taking action under the following Sub-Clauses of these Conditions:
(a) Consenting to the subcontracting of any part of the Works

- under Sub-Clause 5.1 [Subcontractors]
- (b) Any action under Sub-Clauses 8.9 [Employer's Suspension] and 8.12 [Prolonged Suspension]
 - (c) Issuance of "Taking Over Certificate" under Sub-Clause 10.1 [Taking Over the Works and Sections].
 - (d) Issuing the "Performance Certificate" under Sub-Clause 11.9 [Performance Certificate].
 - (e) Sub-Clause 13.1 [Right to Vary]: instructing a Variation, except;
 - (i) in an emergency situation as determined by the Engineer, or
 - (ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data.
 - (f) Sub-Clause 13.3 [Variation Procedure]: approving a proposal for Variation submitted by the Contractor in accordance with Sub-Clause 13.3.2 [Variation by Request for Proposal] or 13.2 [Value Engineering].
 - (g) Certifying release of second half of the Retention Money under Sub-Clause 14.9 [Release of Retention Money].
 - (h) Issuing Final Payment Certificate under Sub-Clause 14.13 [Issue of FPC].
 - (i) Sub-Clause _____ *
 - (j) Sub-Clause _____ *

*[insert Sub-Clause number (not Sub-Clause 3.7 [Agreement or Determination])]

Any such requirement shall not be applied to any action by the Engineer under Sub-Clause 3.7 [Agreement or Determination], as stated in Sub-Clause 3.2 [Engineer's Duties and Authority] of the General Conditions.

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Employer.

Following is added after the words "the Employer's consent is required" in 4th paragraph:

"stating that the Employer's consent has been obtained for that specified authority"

4.2 Performance Security

4.2.1 Contractor's Obligations

The entity issuing the Performance Security and its form shall be as under:

The Performance Security shall be, at the option of the Contractor, issued in the prescribed form included in the Bidding Documents, by (a) a Scheduled Bank in Pakistan or (b) a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan or (c) an Insurance Company listed in the Contract Data and rated by PACRA/VIS of rating as provided in Table below:

Accepted Contract Amount (In Eq. PKR million)	Minimum Rating of Insurance Companies
Up to 1000	A (+)
1001 to no limit	AA

In case of Joint Venture, the Performance Security shall be in the name of the Joint Venture or in the name of Lead/either firm of the JV or in ratio of shares of the individual JV partners.

Following paragraph is added at the end of this Sub-Clause:

“The amount of Performance Security shall be reduced to 50% following issuance of the Taking Over Certificate for the whole of the Works under Clause 10 of Conditions of Contract.”

4.3 Contractor's Representative

In second paragraph the text “professional engineer as defined in the Pakistan Engineering Council Act, 1975 (Act No. V of 1976) (having temporary licence in case of foreign engineer under Section 12 of the Pakistan Engineering Council Act, 1975 (Act No. V of 1976))” are added after the words “qualified, experienced”.

In the 3rd paragraph the words “28 days” are substituted by “14 days”. In 2nd line of 4th paragraph the text “or appoint a replacement” is substituted by “except appointment of a suitable temporary replacement is deployed at the Site”

4.4.2 As-Built Records

4.4 Contractor's Documents

First paragraph is deleted and the text in the last paragraph is substituted with the following:

“The Contractor shall furnish to the Engineer 6 copies, one reproducible and one electronic copy (provided the Engineer has made available to the Contractor editable form of the Drawings) of all Drawings amended to conform to the Works as built. In case the Engineer does not make available to the Contractor editable form of the Drawings, the Contractor shall furnish to the Engineer as-built data for incorporation in the Drawings. Upon receipt of PDF versions of the as-built drawings prepared by the Engineer, the Contractor shall furnish to the Engineer 6 copies and one reproducible of these Drawings.

The price of such Drawings shall be deemed to be included in the Contract Price.”

Following Sub-Clause is added:

4.4.4 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copies of all shop and erection drawings applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

4.8 Health and Safety Obligations

Review and approval by the Engineer shall not exceed 21 days and be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and the Engineer’s review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

The following text is added at the end of this Sub-Clause:

In the event of work being carried out outside the normal working hours and in the event of work being carried out at night, the Contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site and the Works where the night work is being carried out shall be sufficiently lighted. All arrangement adopted for such lighting shall be to the satisfaction of the Engineer.

4.20 Progress Reports

At the end of sub-paragraph (g) the word “and” is deleted and at the end of sub-paragraph (h) the full stop (.) is replaced with“;”, and the following new sub-paragraphs are added as:

- (i) planned programme for the execution of the Works for next 56 days to enable the Engineer to determine its programme of inspection and testing;
- (j) monthly summary of daily job record indicating weather conditions, deployment of Contractor’s Equipment, labour employment, local material procurement and material import, if any; and
- (k) salient contractual and project information.

5.1 Subcontractors

Add the following text at the end of paragraph (ii):

“under Schedule to Bid”

The following is added at the end of the last paragraph of Sub-Clause 5.1:

“All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under sub-paragraph (a) of Sub- Clause 15.2.3 [After Termination].

The Contractor shall give reasonable opportunity to contractors from Islamic Republic of Pakistan for subcontracts for the Works, and endeavour to employ such contractors as Subcontractors.”

5.2 Nominated Subcontractors

5.2.2 Objection to Nomination

In sub-paragraph (c), “and” is deleted from the end of (i);“.”

at the end of (ii) is replaced with: “, and”.

The following is then added as (iii):

“(iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.2.3 [Payment to nominated Subcontractors].”

6.1 Engagement of Staff and Labour

The following paragraph is added at the end of the Sub-Clause:

“The Contractor shall, to the extent practicable and reasonable, employ staff (not less than 50%) and labour (not less than 85%) with appropriate qualifications and experience from sources within the Islamic Republic of Pakistan.”

6.7 Health and Safety of Personnel

The existing text is substituted with the following:

“In order to provide for the safety, health and welfare of persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the Safety Requirements of the Government of Pakistan with such modifications thereto as the Engineer may authorize or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose. The Contractor shall also provide all other medical services and appoint a health and safety officer at Site if stated in the Specifications. In case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.”

6.8 Contractor’s Superintendence

Insert at the end of sub-paragraph (a) of this Sub-Clause:

"or, if not, the Contractor shall make competent interpreters available during all working hours, in a number sufficient for those persons to properly perform their superintendence duties"

The following text is added at the end of this Sub-Clause:

“The Contractor’s authorized representative and his other engineers working at site shall possess valid registration with the Pakistan Engineering Council.

The Contractor’s authorized representative at Site shall be authorized to exercise adequate administrative and financial powers on behalf of the Contractor so as to achieve completion of the Works as per the Contract.”

6.12 Key Personnel

The following is inserted at the end of the last paragraph:

“If any of the Key Personnel are not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.”

The following Sub-Clauses 6.13 to 6.26 are added at the end of Sub-Clause 6.12:

6.13 Foreign Personnel

The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required

residence visas and work permits. The Employer will, if requested by the Contractor, use all reasonable endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

- 6.14 Supply of Foodstuffs** The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.
- 6.15 Supply of Water** The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.
- 6.16 Measures against Insect and Pest Nuisance** The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.
- 6.17 Alcoholic Liquor or Drugs** The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereto by Contractor's Personnel.
- 6.18 Arms and Ammunition** The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.
- 6.19 Festivals and Religious Customs** The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.
- 6.20 Funeral Arrangements** The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of its local employees who may die while engaged upon the Works.
- 6.21 Forced Labour** The Contractor, including its Subcontractors, shall not employ or engage forced labour which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.
- 6.22 Child Labour** The Contractor, including its Subcontractors, shall not employ or engage child labour in accordance with relevant law(s) in force .

6.23 Employment Records of Workers The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Contractor's Records].

6.24 Workers' Organizations The Contractor shall comply with the relevant labour laws of Pakistan which recognize workers' rights to form and to join workers' organizations/Trade Union of their choosing and to bargain collectively without interference.

6.25 Non-Discrimination and Equal Opportunity The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices.

Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure nondiscrimination and equal opportunity, including for specific groups such as women, persons with disabilities, migrant workers and children (of working age in accordance with Sub-Clause 6.22).

6.26 Epidemics In the event of any out-break of illness of epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government or the local medical or sanitary authorities for the purpose of overcoming the same.

7.7 Ownership of Plant and Materials The following is added before the first paragraph:
"Except as otherwise provided in the Contract,"

The following is added at the end of the Sub-Clause:
"No Plant and/or Materials that is the property of the Employer shall be removed from the Site. If it becomes necessary to:

(i) remove any item of such Plant from the Site for the purposes of repair, the Contractor shall give a Notice, with reasons, to the Engineer requesting consent to remove the defective or damaged item off the Site. This Notice shall clearly identify the item of defective or damaged Plant, and shall give details of: the defect or damage to be repaired; the place to which defective or damaged item of Plant is to be taken for repair; the transportation to be used (and insurance cover for such transportation); the proposed

inspections and testing off the Site; and the planned duration required before the repaired item of Plant shall be returned to the Site. The Contractor shall also provide any further details that the Employer may reasonably require; or

- (ii) replace any item(s) of such Plant and/or Materials, the Contractor shall give a Notice, with reasons, to the Engineer clearly identifying the item(s) of Plant and/or Materials to be replaced, and giving details of the due date of delivery to the Site of the replacement item(s).

Where any item of Plant and/or Materials has become the property of the Employer under this Sub-Clause before it has been delivered to the Site, the Contractor shall ensure that such an item is not moved except for its delivery to the Site.

The Contractor shall indemnify and hold the Employer harmless against and from the consequences of any defect in title or encumbrance or charge (except any reasonable restriction arising from the intellectual property rights of the manufacturer or producer) on any item of Plant and/or Materials that has become the property of the Employer under this Sub-Clause."

The following Sub-Clause 7.9 is added after Sub Clause 7.8:

- | | |
|--|--|
| 7.9 Use of Pakistani Materials and Services | The Contractor shall, so far as may be consistent with the Contract, make the maximum use of materials, supplies, plant and equipment indigenous to or produced or fabricated in Pakistan and services available in Pakistan provided such materials, supplies, plant, equipment and services shall be of required standard. |
| 8.1 Commencement of Works | The following is added before the first paragraph:
"After signing of the Contract Agreement by both Parties," and thereafter the word "The" is replaced with the word "the". |
| 8.5 Extension of Time for Completion | The following is added after paragraph (c):
"for last five years". |

The following Sub-Clause 8.14 is added after Sub-Clause 8.13:

- | | |
|---|--|
| 8.14 Incentives For Early Completion | If Contract Data does not state applicability of incentives for early completion, this Sub-Clause shall not apply.

The Contractor shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to bonus payment if the Works and/or each Section is completed earlier than the Time for Completion for the Works or Section (as the case may be). The amount of bonus for early completion of the |
|---|--|

Works and/or each Section shall be upto a limit and at a rate to 50% of the relevant limit and rate of delay damages prescribed in Contract Data and shall be paid for every day which shall elapse between the relevant Date of Completion of the Works or Section and therelevant Time for Completion.

For the purposes of calculating any bonus payment, the applicable Time for Completion stated in the Contract Data is fixed and no adjustments of this time by reason of granting an

EOT will be allowed.

The following Sub-Clause 11.12 is added after Sub-Clause 11.11:

11.12 Supervisory Assistance During DNP

If provided under the Schedule of Prices, the Contractor shall provide supervisory assistance to the Employer during the DNP for the Works. Such supervisory assistance shall be as described in the Specification for the purpose of supporting the Employer's operation and maintenance of the Plant for the period specified in the Schedule of Prices after the Date of Completion.

12.2 Method of Measurement

The following paragraph is added at the end of the Sub-Clause:

“Summary of measured quantity for payment shall be delineated item-wise under four heads namely; “Schedule of Prices Quantity”, “Quantity Executed To-date”, “Quantity Certified Previously” and “Net Quantity Executed under this Certificate”.

12.3 Valuation of the Works

The following text is added at the end of fifth paragraph of the Sub-Clause:

“Sum of overhead charges and profit for sub-paragraph (a) shall be Twenty Five percent (25%)”.

13.4 Provisional Sums

The following paragraph is inserted as the penultimate paragraph:

“The Provisional Sum shall be used to cover the Employer’s share of the DAAB members’ fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB. The Contractor shall submit the DAAB members’ invoices and the satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Sub-Clause 14.3.

13.6 Adjustments for Changes in Laws

The following paragraphs are added at the end of the Sub- Clause:

“Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the Table of Adjustment Data in accordance with the provisions of Sub-Clause 13.7 [Adjustments for Changes in Cost].”

14.1 The Contract Price The following is added at the end of the Sub-Clause:

“Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts, imported by the Contractor for the sole purpose of executing the Contract shall be temporarily exempt from the payment of import duties and taxes upon initial importation, provided the Contractor shall post with the customs authorities at the port of entry an approved re-export bond or bank guarantee, valid until the Time for Completion plus six months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment and spare parts, and callable in the event the Contractor's Equipment is not re-exported from the Country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer upon the importation of individual items of Contractor's Equipment and spare parts. Upon re-export of individual items of Contractor's Equipment or spare parts, or upon the completion of the Contract, the Contractor shall prepare, for approval by the customs authorities, an assessment of the residual value of the Contractor's Equipment and spare part to be re-exported, based on the depreciation scale(s) and other criteria used by the customs authorities for such purposes under the provisions of the applicable Laws. Import duties and taxes shall be due and payable to the customs authorities by the Contractor on (a) the difference between the initial imported value and the residual value of the Contractor's Equipment and spare parts to re-exported; and (b) on the initial imported value of the Contractor's Equipment and spare parts remaining in the Country after completion of the Contract. Upon payment of such dues within 28 days of being invoiced, the bond or bank guarantee shall be reduced or released accordingly; otherwisethe security shall be called in the full amount remaining.”

[The Employer may change or delete this Sub-Clause as per Project requirements]

14.2 Advance Payment

14.2.1 Advance Payment Guarantee

The entity issuing the Advance Payment Guarantee and its form shall be as under:

The Advance Payment Guarantee shall be in the form of Guarantee issued by (a) a Scheduled Bank in Pakistan or (b) a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan or (c) an Insurance Company listed in the Contract Data

and rated by PACRA/VIS of rating as provided in Table below:

Accepted Contract Amount (In Eq. million PKR)	Minimum Rating of Insurance Companies
Up to 1000	A (+)
1000 No limit	AA

In case of Joint Venture, the Advance Payment Guarantee(s) shall be in the name of the Joint Venture or in the name of Lead/either firm of the JV or in ratio of shares of the individual JV partners.

14.6 Issue of IPC

14.6.1 The IPC

In the first line of the 1st paragraph the words “28 days” are substituted by “14 days”.

14.7 Payment

The words “or through crossed cheque in favour of The Contractor or JV partners. The Payment to JV partners shall be made at the request of the Joint Ventures in the ratio of their shares specified by them” are added at the end of the Sub-Clause.

14.8 Delayed Payment

In the first paragraph, third line, the words “compounded monthly” are deleted.

The text of 2nd paragraph is deleted and substituted with the following:

“The Employer shall pay to the Contractor compensation at therate stated in the Contract Data.”

- 15.2 Termination for Contractor's Default**
- 15.2.1 Notice
- Following text is added at the end of sub-paragraph (h) of this Sub-Clause:
- “For the purposes of this Contract, corrupt and fraudulent practices have been defined in Public Procurement Rules 2004.”
- 15.2.3 After Termination
- The word “and” at the end of sub-paragraph (ii) of paragraph (b) is deleted the following paragraph is added after sub-paragraph (iii):
- “(iv) all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 [*Employer-Supplied Materials and Employer's Equipment*], and”
- 15.4 Payment after Termination**
- The following text is added at the end of this Sub-Clause:
- “The Employer shall be entitled to sell any of the Contractor's Equipment, Temporary Works and unused materials and apply the proceeds of sale towards payment of any debt due from the Contractor to the Employer under this Clause including any outstanding payments to the Subcontractors.
- 16.2 Termination by Contractor**
- 16.2.1 Notice
- The sub-paragraph (j) is deleted in its entirety.
- At the end of sub-paragraph (i) “; or” is replaced with “.” and at the end of sub-paragraph (h) “;” is replaced with “; or”.
- In sub-paragraph (f) “84 days” are replaced with “180 days” and text “for reasons not attributable to the Contractor” is added at the end.
- 16.3 Contractor's Obligations After Termination**
- Sub-paragraph (c) is deleted and replaced with:
- “(c) deliver to the Engineer all Employer-Supplied Materials and/or Employer's Equipment made available to the Contractor in accordance with Sub-Clause 2.6 [*Employer-Supplied Materials and Employer's Equipment*]; and
- (d) remove all other Goods from the Site, except as necessary for safety, and leave the Site.”
- 17.1 Responsibility for Care of the Works**
- After the two instances of “Goods” in the last paragraph, the words “Employer-Supplied Materials and/or Employer's Equipment” are added.

- 17.7 Use of Employer's Accommodation/Facilities** The Contractor shall take full responsibility for the care of the items of the Employer's facilities and/or accommodation, if any, as detailed in the Specification, from the date of use and/or occupation by the Contractor until the date on which such use and/or occupation is re-vested in the Employer.
- If any loss or damage happens to any of the above items during a time while the Contractor is responsible for its care, arising from any cause other than a cause for which the Employer is responsible or liable, the Contractor shall promptly rectify the loss or damage at the Contractor's risk and cost.
- 18.1 Exceptional Events** The words "or disorder" are replaced with "disorder or sabotage" in sub-paragraph (c) of the Clause.
- 18.4 Consequences of an Exceptional Event** The following is added at the end of sub-paragraph (b) after deleting the "":
- " , including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Exceptional Events, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 19.2 [Insurance to be provided by the Contractor]."
- 18.5 Optional Termination** In sub-paragraph (c), the words "and necessarily" are added after the words "was reasonably".
- 19.1 General Requirements** Following text is added at the end of first paragraph:
- "The Contractor shall immediately after the date of the Letter of Acceptance submit the draft of insurance policies for the Employer's consent."
- Following text is added at the end of third paragraph:
- "The Contractor shall, within the respective periods stated in the Contract Data submit to the Engineer and the Employer a) evidence that the insurances described in this Clause have been effected, and b) copies of policies of the insurances described in Sub-Clauses 19.2.1, 19.2.4 and 19.2.5."
- 19.2 Insurance to be provided by the Contractor**
- 19.2.5 Injury to employees
- The words "sickness, disease" are deleted in the third line of first paragraph.
- The following Sub-Clause is added after Sub-Clause 19.2.6:
- 19.2.7 Insurance Company

Accepted Contract Amount (In Eq. million PKR)	Minimum Rating of Insurance Companies
Up to 1000	A (+)
1001 to no limit	AA

The Contractor shall be obliged to place all insurances described in this clause this clause with the insurers listed in the Contract Data and rated by PACRA/VIS of rating as provided in Table above.

21.6 Arbitration The word “international” is deleted in the sixth line of first paragraph. The text of sub-paragraph (a) is substituted with the following:

“the Dispute shall be finally settled under the Rules of Arbitration, specified in the Contract Data;”

The following Clauses are added after Clause 21

22 Custom Duty [Employer may incorporate provisions where applicable. However, in order to make the bid more balanced, the payment of Customs Duties should be the responsibility of the Employer.]

23 Taxes The Contractor, Subcontractors and their employees shall be liable to pay income tax, withholding tax, super tax and other taxes on income arising out of the Contract. The rates and prices as stated in the contract shall be deemed to cover all such taxes.

24 Integrity Part If it is found and established at any stage that the Contractor or any of his Subcontractors, agents or servants have violated or involved in violation of the Integrity Pact signed by the Contractor then the Employer shall be entitled to :

- (a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder’s fee or kickback given by the Contractor or any of his Subcontractors, agent or servants;
- (b) terminate the Contract; and
- (c) recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, agent or servants.

The termination under sub-paragraph (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clause 15.1 to 15.4 and the payment under Sub-Clause 15.4 shall be made after having deducted the amounts due to the Employer under sub-paragraph (a) and (c) of this Sub-Clause.



**Sindh Madressatul Islam
University**

**DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY
(SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI LOT
NO.4 FACULTY STAFF RESIDENCES, BACHELOR FACULTY
MALE / FEMALE HOSTELS (REMAINING WORKS)**



**VOLUME-II
TECHNICAL SPECIFICATIONS**



EA Consulting Pvt Ltd

**ARCHITECTURE | ENGINEERING | PROJECT MANAGEMENT
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1 GENERAL

- 1.01 This General Specification is to be taken as applying to all the works in this Contract. Figured dimensions on the working drawings shall be followed in preference to the scale.
- 1.02 Until and unless specified otherwise, all goods and materials are to be Pakistan manufactured and to be of the best quality, and where not otherwise specified shall be according to latest engineering practice and conforming to Pakistan Standards (P.S) or British Standard Specifications (B.S.S) or Standard of American Society of Testing Materials (ASTM). The Engineer or the Consultants may also supplement such specifications during the progress of work.
- 1.03 All materials and goods used for such and other items shall be subjected to standard testing and if found below the specified standard such as PS or BSS or ASTM or their equivalent shall be removed from the site immediately at Contractor's own expense. All testing of materials finished and unfinished, shall be carried out by the Contractor at his cost, in the presence of Engineer or Engineer or his Representative for which the Contractor shall maintain a reasonably well equipped laboratory of his own, close to the site of work or make any other additional arrangement to the satisfaction and convenience of the Engineer. The Contractor shall include testing charges in his quotations and shall not be entitled to any reimbursement on this account for routine testing.
- 1.04 The Contractor must give early attention to the submission of samples of materials for approval of the Engineer, indicating the names of the manufacturing firms where applicable especially of cement, sand, aggregates, steel, water, tiles, hard-core and all fittings. Whenever practicable, samples shall be submitted at least three weeks before it is proposed to use the materials. Until and unless specified otherwise and whenever materials are ordered to be forwarded to a testing laboratory other than site laboratory for check/ testing, the Contractor will be reimbursed the cost of fees for such tests if proved satisfactory, by the Employer. The Contractor, however, will be required to bear the cost of the fees for tests, which proved unsatisfactory.
- 1.05 The Contractor must take all steps necessary to prevent damage or interference with all supply lines such as water, electric power, fuel, telephones, drains, buried cables and any construction designed for the use of the public, government or semi government authorities or the Employer. The Contractor shall be responsible for any damage caused to such services or constructions and settle all claims in respect of such damage.
- 1.06 The Contractor shall protect from injury by covering all work, internally and externally needing protection including new concrete, Formwork, surface renderings, floors, etc., to the satisfaction of the Engineer, including the work of his sub-contractors at his own cost.
- 1.07 The whole work shall be carried out in the best manner in accordance with the instructions contained in these documents and those given by the Engineer
-

from time to time during the progress of the work. The work shall be carried out in conformity with the best of the standard construction practices preferably the British Codes of Practices.

- 1.08 The Contractor shall submit to the Engineer for his approval before beginning the work, a complete plan of the proposed sequence and methods of operations for the execution of the works. Detailed drawings showing the location and construction of dumping and working platforms, cranes, building and all other structures in connection with the Contractor's plant and material storage sheds shall also be submitted to the Engineer for his approval before construction.
- 1.09 Orders and directions may be given orally by the Engineer or his Representative, and shall be received and promptly obeyed by the Contractor or his Representative or any superintendent or foreman or any supervisor of the Contractor whosoever may have charge of the particular part or section of work in relation to which the orders or directions are given, and a confirmation in writing of such order or directions will be given to the Contractor by the Engineer, if so requested. The Contractor shall provide and maintain at his own expense during the performance of the work an office in the vicinity of work. Orders or directions, written or oral, from the Engineer or his Representative delivered at such office shall be considered as delivered to the Contractor. The Contractor's office shall be fitted with a telephone connected to the local Telephone Exchange.
- 1.10 The Contractor shall not use the site for any other purpose than that of carrying out this Contract work. The operations of the Contractor shall be confined to the area immediately adjoining the buildings and the works included in this Contract but site clearance shall be kept to the satisfaction of the Engineer to permit carrying out of other works by other Contractors. The Contractor shall not affix advertisements; neither shall he permit advertisements to be displayed without the written consent of the Engineer.
- 1.11 The contract drawings are the working drawings to guide the Contractor generally about the shape and size of all the structures and fittings. Before proceeding to make preparations, fabrication, execution, erection of any such fittings and other details of any temporary works, scaffolds, railings, shuttering, details of doors, windows, partitions, iron mongers work, etc.; the Contractor shall be under obligation to prepare and submit all detailed shop drawings to the satisfaction and the approval of the Engineer, before doing any or all of that described above or as directed. Approval of the contractor's drawings shall not relieve the Contractor for any part of his obligation to meet all the requirements of the specifications or correctness of his drawings. On site Mock-up and sample must be prepared and informed to engineer and client two weeks prior for visit.
- 1.12 No cement work shall be permitted during extreme cold weather when unless otherwise authorized by the engineer.

1.13 **PAYMENT**

Contractor shall not be entitled to any separate or additional payment on account of all these general requirements and any other arrangement or action Contractor has to undertake under the direction of the Engineer for a proper carrying out of the works and meeting all obligations of the Contract.

END OF SECTION

2 METAL

2.1 METAL FABRICATION

PART 1 - GENERAL

2.1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

2.1.2. SUMMARY

- A. This Section covers items fabricated from steel, stainless steel or aluminum and are not covered under other Specification Sections, including, but not limited to, the following:
 - 1. Miscellaneous framing and supports.
 - a. Concealed applications where framing and supports are required.
 - b. Countertop support.
 - c. Vanity supports
 - d. Steel framing and supports for mechanical and electrical equipment.
 - e. Steel framing and supports for Architectural applications.
 - 2. Elevator machine beams, hoist beams, and divider beams.
 - 3. Support angles for elevator door sills.
 - 4. Shelf angles.
 - 5. Loose bearing and leveling plates.
 - 6. Steel welded plates and angles for casting into concrete not specified in other Sections.
 - 7. Miscellaneous steel trim including steel angle corner guards, steel edgings and loading-dock edge angles.

This Section includes the following metal fabrications:

- 8. Ladders.
- 9. Floor plate and supports.
- 10. Cast nosings, treads, and thresholds.
- 11. Pipe guards.
- 12. Pipe bollards.
- 13. Column protection guard.

Products furnished, but not installed, under this Section include the following:

- 14. Loose steel lintels.
- 15. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

Related Sections include the following:

16. 3.0 Section "Cast-In-Situ Concrete" for corner guards to be placed in forms of reinforced concrete columns and for concrete footings required for metal fabrications.
17. 4.0 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
18. 9.0 Section "Painting" for field applied paint finishes.

2.1.3. DESIGN REQUIREMENTS

- A. Design Requirements: Design, engineer, fabricate, and install work in compliance with specified standards, performance requirements, material selections, and requirements of this Section and related sections.
 1. Provide work to withstand thermal movement, wind pressure, gravity loads, seismic loads and movement of building structure without failure. Work to remain free from defects.
 - a. **Seismic Load:** Uniform Building Code, 1997 Edition, zone 2A.
 - b. **Wind Loads:** Provide exterior metal fabrications that withstand design wind pressure calculated according to Uniform Building Code (UBC), 1997 Edition, Exposure C, Basic Wind Speed 130 Km/hr.
 - c. **Thermal Movements:** Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1) Temperature Change (Range): 35 deg C, ambient; 65 deg C, material surfaces.
- B. The design shall ensure that all components including anchors and connections shall comply with the allowable stresses as per relevant ASTM Standards. Load combinations shall be chosen to ensure that no element shall exceed the allowable stresses under any case of loading.

2.1.4. SUBMITTALS

- a. **Product Data:** for non-slip aggregates and non-slip aggregate surface finishes, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
- b. **Shop Drawings:** Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - i. Provide templates for anchors and bolts specified for installation under other Sections.
- c. Samples representative of materials and finished products as may be requested by Engineer.

- d. **Mill Certificates:** Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- e. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- f. **Qualification Data:** For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

2.1.5. QUALITY ASSURANCE

- a. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.
- b. **Fabricator Qualifications:** A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units, without delaying the work.
- c. **Engineering Responsibility:** Engage a fabricator who utilizes a qualified and experienced structural engineer to prepare design calculations, shop drawings, and other structural data.
- d. **Welding:** Qualify procedures and personnel according to the following:
 - i. AWS D1.1, "Structural Welding Code--Steel."
 - ii. AWS D1.2, "Structural Welding Code--Aluminum."
 - iii. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - iv. AWS D1.6, "Structural Welding Code--Stainless Steel."
 - v. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 - vi. Qualification tests according to the Structural Steel Code of Practice Prevailing in the country or other international Code or standard may also be accepted by the Engineer.

2.1.6. PROJECT CONDITIONS

- a. **Field Measurements:** Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - i. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

2.1.7. COORDINATION

- a. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including

sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

2.3 CUSTOM STEEL DOOR AND FRAMES - GENERAL

2.3.1 RELATED DOCUMENTS

- A. Drawing and provision of the contract, including general and supplementary Conditions.

2.3.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
 - 3. Fire-rated door and frame assemblies.
 - 4. Fire-rated window assemblies.
 - 5. Louvers in doors. Steel louvered door.
- B. Related Sections include the following:
 - 1. Section "Unit Block Masonry Assemblies" for building anchors into and grouting frames in masonry construction.
 - 2. 8.0 Section "Door Hardware" for door hardware and weather stripping.
 - 3. 8.0 Section "Glazing" for glass in doors.

2.3.3 PERFORMANCE REQUIREMENTS

- A. **Fire-Rated Door Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to the Consultant, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 3. Temperature-Rise Rating: If indicated, provide doors that have a temperature-rise rating of 250 deg C maximum in 30 minutes of fire exposure.
- B. **Fire Resisting Door Components:** All components of fire resisting doors and assemblies, including but not limited to: door leaves, frames, ironmongery, hardware and glazing, shall carry identifying labels of an approved independent testing and inspection agency or laboratory, confirming their individual fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.
- C. **Fire Resisting Door Closers:** All fire resisting doors shall be fitted with door closers that automatically close and positively latch the door. In case of double-leaf doors, the closing system shall ensure that the inactive door leaf (door leaf with strike) closes first prior to active door leaf (door leaf with lock).

- D. Fire rated door assemblies that are tested and certified according to British Standard Specifications (BS) shall also be accepted.
- E. Weather Stripping: provide weather seals to all external doors.
- F. Smoke-Control Door Assemblies: Comply with NFPA 105.

2.3.4 SUBMITTALS

- A. **Product Data:** Include construction details, material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.
- B. **Shop Drawings:** Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.
- C. **Door Schedule:** Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
 - 1. Coordinate glazing frames and stops with glass and glazing requirements.
- D. **Samples for Initial Selection:** Manufacturer's color charts showing the full range of finishes or colors available for units with factory-applied color finishes.
- E. **Samples for Verification:** For each type of exposed finish required, prepared on Samples not less than 75 by 125 mm (3" x 5") and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- F. **Construction Samples:** Approximately 300 by 300 mm, (12" x 12") representing the required construction of doors and frames for Project.
 - 1. Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include louver section and glazing stops if applicable.
 - 2. Frames: Show profile, welded corner joint, welded hinge reinforcement, dust-cover boxes, floor and wall anchors, stops, and silencers. Include panel and louver sections and glazing stops if applicable.
- G. **Product Certificates:** Signed by manufacturers of doors certifying that products furnished comply with or exceed the acceptance criteria of ANSI A250.4 for Level A doors.
- H. **Oversize Construction Certification:** For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

2.3.5 QUALITY ASSURANCE

- A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Mockups:** Before installing custom steel doors and frames, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location indicated or, if not indicated, as directed by Consultant.
 - 2. Build mockups for each custom steel doors and frames, and anchorage system components.
 - 3. Notify Consultant seven days in advance of dates and times when mockups will be constructed.
 - 4. Obtain Consultant's approval of mockups before fabricating custom steel doors and frames.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

2.3.6 WARRANTY

- A. **Door Manufacturer's Warranty:** Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that do not fulfill quality and performance requirements or do not comply with tolerances in referenced quality standard such as, but not limited to:
 - 1. Structural failures.
 - 2. Faulty operation of movable parts and hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 1. Warranty Period: Three years from date of Substantial Completion.

2.3.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
- B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Consultant; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames under cover at building site. Place units on minimum 100-mm- high wood blocking. Avoid using nonvented plastic

or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 6-mm spaces between stacked doors to permit air circulation.

PRODUCTS

2.3.8 MATERIALS

- A. **Metallic-Coated Steel Sheets:** ASTM A 653/A 653M, CS (commercial steel), Type B; with Z180 zinc (galvanized) or ZF180 zinc-iron-alloy (galvannealed) coating.
- B. **Inserts, Bolts, and Fasteners:** Manufacturer's standard units. Where items are to be built into exterior walls, zinc coat according to ASTM A 153/A 153M, Class C or D as applicable.

2.3.9 DOORS

- A. **General:** Provide flush-design doors, minimum 44 mm thick, (1¾") of seamless construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
 - 1. Visible joints or seams around glazed or louvered panel inserts are permitted.
 - 2. For single-acting swing doors, bevel both vertical edges 3 mm (2/16") in 50 mm (2").
 - 3. For double-acting swing doors, round vertical edges with 54-mm (2¼") radius.
- B. **Metallic Core Construction:** Provide the following core construction welded to both door faces:
 - 1. Steel-Stiffened Core: Galvanized steel vertical stiffeners extending full-door height, spaced not more than 150 mm apart and spot welded to face sheets a maximum of 150 mm (16") o.c. Fill spaces between stiffeners with rockwool insulation of minimum 96.00 kg/cu. m (2.72 kg/cft) density applied to inside surfaces of face sheets.
 - 2. Use for all doors internal and external.
 - 3. Thickness of vertical stiffeners shall be equal to or more than thickness of door skins
- C. **Fire Door Cores:** As required to provide fire-protection and temperature-rise ratings indicated.
- D. **Astragals:** As required by NFPA 80 to provide fire ratings indicated. Comply with requirements specified in 8.0 section "Hardware"
- E. **Top and Bottom Channels:** Spot weld metal channel not less than thickness of face sheet to face sheets not more than 150 mm o.c.(6")
 - 1. Reinforce tops and bottoms of doors with inverted horizontal channels of same material as face sheet so flanges of channels are even with bottom and top edges of face sheets.
 - 2. For exterior doors, close bottom edge with metallic-coated steel closing channel and top edge with filler channel of same material, so webs of channels are flush with bottom and top door edges.

- F. **Hardware Reinforcement:** Fabricate reinforcing plates from the same material as door to comply with the following:
 - 1. Hinges and Pivots: 4.2 mm (1'8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
 - 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 2.3 mm (1/16") thick.
 - 3. All Other Surface-Mounted Hardware: 1.3 mm (1/16") thick.
- G. **Interior Doors:** Fabricate face sheets of doors from two 1.30-mm- (2/32") thick metallic-coated, cold-rolled, stretcher-leveled steel sheets and other metal components from hot- or cold-rolled steel sheets.
- H. Thickness of face sheets for fire rated interior doors shall be as recommended by manufacturer to obtain fire rating indicated, but not less than 1.30 mm (2/32").
- I. Thickness of face sheets for interior steel doors to receive armor plates shall be 1.60 mm.
- J. **Exterior Steel Doors:** Fabricate face sheets of doors from two 1.6-mm- (3/32") thick, stretcher-leveled, metallic-coated steel sheets. Provide weep-hole openings in bottom of doors to permit entrapped moisture to escape. Seal joints in top edges of doors against water penetration.

2.3.10 FRAMES

- A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knockdown frames are not acceptable.
 - 1. For exterior use, form frames from 2.00-mm- (4'-0") thick, metallic-coated cold-rolled steel sheets.
 - 2. For interior use, form frames from metallic-coated cold-rolled steel sheet of the following thicknesses:
 - a) Openings up to and including 1200 mm (48") Wide: 1.60 mm (3/32").
 - b) Openings More Than 1200 mm (48") Wide: 1.7 mm (3/32").
- B. **Hardware Reinforcement:** Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for the following hardware:
 - 1. Hinges and Pivots: 4.2 mm (1/8") thick by 38 mm (1.5") wide by 150 mm (6") longer than hinge, secured by not less than 6 spot welds.
 - 2. Strikes, Flush Bolts, and Closers: 2.3 mm (2/8").
 - 3. Surface-Mounted Hold-Open Arms and Panic Devices: 2.3 mm (2/8").
- C. **Mullions and Transom Bars:** Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
 - 1. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.
- D. **Head Reinforcement:** Where installed in masonry, leave vertical mullions in frames open at top for grouting.

- E. **Jamb Anchors:** Weld jamb anchors to frames near hinges and directly opposite on strike jamb as required to secure frames to adjacent construction.
 - 1. In-Place Concrete or Masonry: Anchor frame jambs with minimum 9-mm- (6/16") diameter concealed bolts into expansion shields or inserts 150 mm from top and bottom and 650 mm (26") o.c., unless otherwise indicated. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts, unless otherwise indicated.
- F. **Floor Anchors:** Provide floor anchors for each jamb and mullion that extends to floor, formed of same material as frame, 1.7 mm (3/32") thick, as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.
 - 2. Cement-Based Screeds: Adjustable type with extension clips, allowing not less than 50-mm height adjustment. Terminate bottom of frames at finish floor surface.
- G. **Head Anchors:** Provide 2 head anchors for frames more than 1066 mm (43") wide and mounted in steel-stud walls.
- H. **Head Strut Supports:** Provide 9-by-50-mm (6/16" x 12") vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
- I. **Structural Reinforcing Members:** Provide as part of frame assembly, where indicated at mullions, transoms, or other locations to be built into frame.
- J. **Head Reinforcement:** For frames more than 1200 mm (48") wide in masonry wall openings, provide continuous steel channel or angle stiffener, 2.3 mm (2/8") thick for full width of opening, welded to back of frame at head.
- K. **Spreader Bars:** Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- L. **Rubber Door Silencers:** Except on weather-stripped doors, drill stop in strike jamb to receive three silencers on single-door frames and drill head jamb stop to receive two silencers on double-door frames. Install plastic plugs to keep holes clear during construction. Silencers shall be neoprene, UL-rated for fire doors.
- M. **Plaster Guards:** Provide 0.4-mm- thick plaster guards or dust-cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation.
- N. External frames shall have continuous grooves along perimeter to **house weather stripping.**

2.3.11 LOUVERS

- A. **Door Louvers:** Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support as recommended by louver manufacturer. Prime paint steel louvers after fabrication.

1. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of same material as door.
 - a) Steel: 1.00 mm (2/32") thick.
- B. **Fire-Rated Automatic Louvers:** Sight proof louver inserts fabricated from 1.3-mm- thick (2/32") steel, spring operated, and released by 57 deg C fusible links listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.

2.3.12 STOPS AND MOLDINGS

- A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.
- B. Form fixed stops and moldings integral with frame, unless otherwise indicated.
- C. Provide removable stops and moldings where indicated or required, formed of 0.8-mm- thick steel sheets matching steel frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 300 mm (12") o.c. Form corners with butted hairline joints.
- D. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

2.3.13 FABRICATION

- A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
 1. Fabricate doors to comply with acceptance criteria of ANSI A250.4 for a Level A door.
- B. For doors with metallic core construction, weld cores to both door face sheets.
- C. For doors with nonmetallic core construction, laminate core material to both door face sheets with waterproof adhesive.
- D. **Exposed Fasteners:** Provide countersunk flat or oval heads for exposed screws and bolts, unless otherwise indicated.
- E. **Thermal-Rated (Insulating) Assemblies:** At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C 236 or ASTM C 976.
 1. Provide thermal-rated assemblies with U-factor matching that of the assembly involving door.
- F. **Hardware Preparation:** Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series specifications for door and frame preparation for hardware.

1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
 2. Locate hardware as indicated or, if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
- G. **Electrical Closets Doors:** Are to comply with the following requirements:
1. Doors are to be proprietary, labeled as one (1) hour fire resistance rated and complying with requirements specified in this Section.
 2. Frames are to be integral with sill to be anchored to underlying sill construction.

3 WOOD, PLASTIC AND COMPOSITE

3.1- WOODEN DOORS

GENERAL SECTION

3.1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the contract, including general and supplementary Conditions.

3.1.2 SUMMARY

- A. This Section includes the following:
 - 1. Non-fire-rated flush wood doors of semi-solid core.
 - 2. Shop priming flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 - 4. Louvers for flush wood doors.
- B. Related Sections include the following:
 - 1.0 Section "Steel Doors and Frames" for steel frames to receive flush wood doors.
 - 1. Section "Door Hardware" hardware for flush wood doors.
 - 2. 8.0 Section "Glazing" for glass view panels in flush wood doors.
 - 3. 9.0 Section "Painting".

3.1.3 SUBMITTALS

Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.

- 1. Include factory-finishing specifications.
- A. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate doors to be factory finished and finish requirements.
- B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of factory-finished doors with opaque finish. Show the full range of colors available.
- C. Samples for Verification: As follows:
 - 1. Corner sections of doors approximately 200 by 250 mm (8" x 10") with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
 - 2. Louver blade and frame sections, 150 mm (6") long, for each material and finish specified.
 - 3. Frames for light openings, 150 mm (6") long, for each material, type, and finish required.

3.1.4 **QUALITY ASSURANCE**

Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

3.1.5 **DELIVERY, STORAGE, AND HANDLING**

Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

- 1. Individually package doors in plastic bags or cardboard cartons.
- 2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.
- A. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

3.1.6 **PROJECT CONDITIONS**

Environmental Limitations: Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

3.1.7 **WARRANTY**

Door Manufacturer's Warranty: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 6.5 mm (4/16") in a 1100-by-2100-mm (44" x 84") section or that show telegraphing of core construction in face veneers exceeding 0.25 mm in a 75-mm (3") span, or do not comply with tolerances in referenced quality standard.

- 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- 2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:
 - a) Semi-solid-core Interior Doors: Two years.

PRODUCTS

3.1.8 **WOODS, GENERAL**

- A. Woods shall be marked-on as Class-1 stocks which shall be properly treated, adequately seasoned and free from rot or insect attack, splits, shakes or checks, warping, twisting, chipping, loose knots and waming. Provide woods

of wane-free edges. Woods shall conform to the requirements of BS EN No. 942; plywood to BS EN No. 636.

- B. Preservative Treatment:** All woods and plywood used shall be preservative treated. Application is to be carried out after cutting and machining, but before assembly, by a processor licensed by the treatment solution manufacturer. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability. Moisture content of wood at time of treatment is to be as specified for use in the work. After treatment, allow wood to dry before use. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

C. Softwoods

1. Douglas Fir: Yellowish Brown wood of average intensity not less than 570 kg/m³ (16.5 kg/cft) at 12% moisture content.
2. Whitewood: White/pale Yellowish Brown wood of average intensity of 470 kg/m³ (13.32 kg/cft).
3. Or as directed by the Architect.

D. Hardwoods

1. White Oak Wood: Yellowish Brown, fine-grained wood of strong, compact, homogenous fibers and uniform texture. Average intensity shall not be less than 720 kg/m³ (20.40 kg/cft) at 12% moisture content. Or as directed by the Architect.

E. Plywood

1. General: Shall be highest grade to BS EN 636, designated as veneer, with minimal imperfections as peeled. Moisture content shall not exceed 12%. Thickness shall be as specified. Employ plywood glued with INT glues to BS 1203.
2. Softwood Plywood: All layers shall be of softwood.
3. Hardwood Plywood: White Oak plywood; White-Oak veneer 0.90 mm thick minimum shall be factory hot-applied at exposed face of door, cut and match of veneer shall be selected by the Consultant.

3.1.9 ACCESSORY MATERIALS

Preservative treatment: Type listed in BS 1282 (except coal tar creosote) obtained from approved manufacturer to provide protection against termites and other destroying organisms.

- A. Adhesives:** Close contact type to BS EN 301 or BS EN 302, suitable for the purpose and compatible with preservative treatment.

3.1.10 NON-FIRE RATED SEMI-SOLID-CORE FLUSH WOOD DOORS

General: Non-fire-rated flush wood doors shall be swinging-type side-hinged to jambs of frames with hand of doors as indicated on Drawings, fabricated to the general tolerances of BS No. 4787 and shall consist of a frame (door leaf frame) consisting of stiles and rails constructed of Douglas fir and a core constructed of a lower-density softwood (Whitewood). Core strips shall cover, at least, 67% of door leaf area (Semi-solid core).

- A. **Door Leaf Frame:** Stiles and rails shall be of dimensions as indicated on Drawings but in no case shall the width be less than 140 mm (5.50") for mortise stile or less than 100 mm for other stile and rails, before lipping. Door-leaf-frame components shall be continuously lipped at outer edges with 20 mm (3/4") thick lipping constructed of White Oak wood. Oak lipping shall be fixed to stiles and rails in continuous glued tongue-and-groove joints. Stiles, rails and lipping of door leaf frame shall be constructed in one piece, no jointing or splicing shall be permissible. Joints between stiles and rails shall be glued mortise-and-tenon.
- B. **Semi-Solid Cores:** Shall be horizontal rails of White wood, of uniform width. Ratio of solid to vacant shall be 2:1. Horizontal core rails shall be in one piece. Throughout door leaf height, at least, two horizontal core rails shall be mortise-and-tenon jointed and glued to stiles.
- C. **Facing:** Facing material shall be 6 mm (1/4") thick plywood glued with waterproof glue under pressure to both sides of core. Facing material shall extend flush and uniform, in both directions, between inner edges of lipping. Extend facing in one piece; no jointing or splicing shall be permissible. Type of facing material shall be as follows:
 - 1. Doors of Opaque Finish: Softwood plywood
- D. **Thickness of Doors:** Unless otherwise indicated on Drawings, finish thickness of flush non-fire-rated wood doors shall be 45 mm; (1 3/4") thickness of stiles, rails and core strips shall be 33 mm (1.5") and 45 mm (1 3/4") wood lipping.

3.1.11 LOUVERS AND LIGHT FRAMES

Metal Louvers: As follows:

- 1. Blade Type: Vision proof, inverted V.
- 2. Metal and Finish: Extruded aluminum with clear anodic finish, 25micron thick minimum.

3.1.12 HARDWARE

Hardware shall be as indicated in Hardware Sets and Door Schedule and as specified in 8.0, Section "Door Hardware".

3.1.13 FABRICATION, GENERALLY

Flush wood doors shall be fabricated in accordance with details shown on Drawings, requirements of this Section, general tolerances of BS No. 4787 and other in-contradicting requirements of BS No. 1186: Part 2.

- A. Carefully plan and layout the work to erect wood doors and to accommodate the work of other trades.
- B. Finish wood shall be smoothly dressed and sanded prior to assembly of door inner frames and shall be free from open joints, hammer and machine marks and other defects or surface blemishes.
- C. Re-treat all treated wood which is sawn along the length, ploughed, thickness, planed or otherwise extensively processed. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.
- D. Finish and cut wood at exact dimensions as required. Stile and rails shall be connected only in glued mortise-and tenon joints with horizontal core strips assembled and jointed at their locations between rails, along stiles. The resulting frame shall be robust, firm and square.

- E. Facing material shall be glued to core and frame. No nail-fixing exposed or concealed, for facing material shall be permissible. The assembly shall be glued under pressure with waterproof casein glue and be thoroughly dried and seasoned.
- F. Join lipping at outer perimeter of frame in continuous tongue-and-groove joints with glue.
- G. Factory machine doors for hardware that is not surface applied. Locate hardware as indicated on approved shop drawings. Comply with final hardware schedules, door frame shop drawings, and hardware templates.
 - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- H. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Louvers: Factory install louvers in prepared openings.

3.1.14 **SHOP PRIMING**

Doors for Opaque Finish: Shop seal faces and edge of doors including cutouts with one coat of wood primer specified in 9.0 Section "Painting."

PART 2 - EXECUTION

3.1.15 **EXAMINATION**

- A. Examine installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors/ frames with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.1.16 **INSTALLATION**

Hardware: For installation, see 8.0 Section "Door Hardware."

- A. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
- B. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 3.2 mm (4/32") at heads, jambs, and between pairs of doors. Provide 3.2 mm (4/32") from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 6.4 mm (4/16") from bottom of door to top of threshold.
 - 2. Bevel non-fire-rated doors 3-1/2 degrees at lock and hinge edges.
- C. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. 9.0 Section "Painting."

3.1.17 **ADJUSTING AND PROTECTING**

Operation: Re-hang or replace doors that do not swing or operate freely.

- A. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion by the Employer.

3.2- ACCESS DOORS AND FRAMES

GENERAL

3.2.1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contracts, including general and supplementary Condition.

3.3.1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wall access doors and frames.
 - 2. Recessed panels for ceramic tiles.
 - 3. Access panels for suspended gypsum board ceilings.
 - 4. Wood shaft access doors.
- B. Related Sections include the following:
 - 1. 4.0 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.
 - 2. 6.0 Section "Rough Carpentry" for materials and workmanship requirements for wooden shaft access doors.
 - 3. 9.0 Section "Gypsum Board Assemblies" for access panels to be installed in suspended gypsum board ceilings.
 - 4. 9.0 Section "Ceramic Tiles" for ceramic tiles and adhesives.
 - 5. 9.0 Section "Painting".

SUBMITTALS

- A. **Product Data:** For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. **Shop Drawings:** Show fabrication and installation details of doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- C. **Samples:** For each door face material, at least 75 by 125 mm (3" x 5") in size, in specified finish.

QUALITY ASSUARANCE

- A. **Source Limitations:** Obtain each type of doors and frames through one source from a single manufacturer.
- B. **Fire-Rated Access Doors and Frames:** Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors.
- C. **Size Variations:** Obtain Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

COORDINATION

- A. **Verification:** Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PRODUCTS

3.3.1.6 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with ZF180 zinc-iron-alloy (galvannealed) coating or Z180 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- C. **Plaster Bead:** Casing bead formed from 0.75-mm (1/32") zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

3.3.1.7 PAINT

- A. **Shop Primers:** Provide primers that comply with 9.0 Section "Painting."
- B. **Shop Primer for Metallic-Coated Steel:** Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
- C. **Galvanizing Repair Paint:** High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- D. **Epoxy paint:** Provide primers that comply with 9.0 Section "Painting."

3.3.1.8 ACCESS DOORS AND FRAMES

- A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: wall surfaces.
 - 2. Fire-Resistance Rating: As indicated on Drawings.
 - 3. Temperature Rise Rating: 139 deg C at the end of 30 minutes.
 - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 1.5 mm (2/32").
 - 5. Frame: Minimum 1.5-mm (2/32") thick sheet metal with plaster bead.
 - 6. Hinges: Concealed pin type.
 - 7. Lock: Key-operated cylinder lock, specified in 8.0 Section "Door Hardware".
- B. **Recessed Panels for Ceramic tiles:** Units consisting of frame with expansion casing bead, door, hardware and complying with the following requirements:
 - 1. Frame: Zinc-coated steel sections and shapes.
 - 2. Plaster casing Bead: 0.76 mm (1/32") zinc coated steel casing bead with flange formed out of expanded metal lath.
 - 3. Panel: 2 mm (2/32") zinc coated steel sheet.
 - 4. Finish: Ceramic wall tiles matching adjacent walls adhered with water cleanable epoxy-based adhesive.
 - 5. Hardware: Nickel-plated steel hinges, exposed type and self-latching bolt operated with knurled knob.
- C. **Heavy Duty Gypsum Board Ceiling Panels:** Heavy duty ceiling flush access panel with fully concealed steel frame and gypsum board inlay fastened to door.

1. **Material:** Removable spring-loaded door, integrated safety catches, patented concealed nylon hinge mechanism, rounded or square corners as directed, formed galvanized frames, stainless steel springs, zinc-plated fasteners, self-adhesive rubber gasket and accessories. Frame shall be two-part type fixed to opening edges and recessed door gypsum board inlay.
2. **Latch:** Tamper-resistant cam latch.

Sizes: As indicated on Drawings.

3.3.1.9 **SHAFT ACCESS DOOR**

- A. **Doors:** Solid core from approved softwood. 3 mm (2/16") thick plywood facing and hardwood lipping.
- B. **Frame:** Fabricate from preservative treated hardwood. Joints between stile and rail shall be single dove tail joints. Protect frame surfaces in contact with masonry with approved bitumen-based cold-applied protection coating.
- C. **Anchors:** Type suitable for fixing into concrete or hollow concrete masonry with metal components fabricated from corrosion-resistant material. Use minimum two anchors per each frame jamb or sill.
- D. **General:** Comply with requirements of Sections "Rough Carpentry" and "Flush Wood Doors" for preservative treatment and general workmanship requirements
- E. **Finishing:** Field-applied approved paint type of color selected by Engineer.

3.3.1.10 **FABRICATION**

- A. **General:** Provide access door assemblies manufactured as integral units ready for installation.
- B. **Metal Surfaces:** For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. **Steel Doors and Frames:** Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
- D. **Latching Mechanisms:** Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

3.3.1.11 **FINISHES, GENERAL**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

3.3.1.12 **METALLIC-COATED STEEL FINISHES**

- A. **Galvanizing of Steel Shapes and Plates:** Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. **Surface Preparation:** Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
1. **Galvanizing Repair Paint:** High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.
- C. **Factory Priming for Field-Painted Finish:** Apply shop primer immediately after cleaning and pre-treating.

EXECUTION

3.3.1.13 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.3.1.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install access doors with trim less frames flush with adjacent finish surfaces or recessed to receive finish material.
- D. Installation of fire-rated access doors and panels shall maintain same applicable requirements of Standards referenced for installation of fire-rated steel frames in 8.0 Section "Custom Steel Doors and Frames".

3.3.1.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.3- RIOUGH CARPENTRY

GENERAL - RELATED WORK

1. Architectural Wood Work
2. Gypsum Board System

3.3.1.1 THIS SECTION INCLUDES

This Section specifies incidental rough carpentry required for support or attachment of other construction and not specified in other sections and includes, but is not limited to, the following items:

- a. Wood grounds, blockings, nailers.
- b. Temporary and permanent grounds, blockings and supports required by other trades.

3.3.1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.
 1. Wood grounds, nailers, and blocking.
 2. Wood furring.
 3. Wood sub-frames.

3.3.1.3 PRESERVATIVE TREATMENT

- a. Application is to be carried out after cutting and machining, but before assembly, by processor licensed by the treatment solution manufacturer.
- b. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability.
- c. Moisture content of wood at time of treatment is to be as specified for use in the work.
- d. After treatment, allow wood to dry before use.
- e. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.
- f. Re-treat all treated wood which is sawn along the length, ploughed, thickened, planed or otherwise extensively processed.
- g. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.

3.3.1.4 SUBMITTALS

- a. Samples of all materials used in the work of this Section.
- b. Shop drawings for furring including details, sizes of wood sections, panel, spacings and method of attachment.

3.3.1.5 **QUALITY ASSURANCE**

- A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

3.3.1.6 **DELIVERY, STORAGE AND HANDLING**

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

PRODUCTS

TIMBER

- a. Timber shall be well seasoned and free from decay, insect attack except pinhole borers,
and knots wider than half of the width of the section.
- b. Timber shall be kiln dried to a maximum moisture content of 12% by weight.
- c. Timber required to be treated with preservatives or fire retardant shall be seasoned and kiln dried before treatment, and re-dried after treatment.
- d. Softwood shall be free from decay and insect attack, except pinhole borers, with
no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood species to be used in external locations are to be recommended for the purpose.
- e. Hardwood shall comply with BS EN 942. Hard wood to be used in internal locations are to be recommended for the purpose.
 1. Wood used for exterior applications or for interior applications in wet areas shall be factory treated to prevent moisture absorption.

SOFTWOOD

To be either:

- a. Douglas Fir (Standard Grade)
- b. European Redwood
- c. Or as suggested by the Architect.

HARDWOOD

- a. Teakwood
- b. White American Oakwood
- c. Or as suggested by the Architect.

RIGID SHEETS

3.3.1.7 MDF (Fire Resistance)

- a. Medium density fiberboard's for fabric panels, 8-10mm thick.
- b. Strips of MDF around fabric panels edging.
- c. All MDF components to be fire resistant.

3.3.1.8 PLYWOOD

- a. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.
- b. Marine Quality Plywood: to BS 1088 and BS 4079, excluding plywood made from gaboos.

3.3.1.9 CORK BOARD

Are to be pre-formed sheets that have been formed from clean granulated cork particles securely bound together by a synthetic resin of an insoluble nature. Minimum thickness of sheets is to be 25 mm (1"), width and length are to be as indicated on Drawings.

3.3.1.10 FASTNERS

- a. Nails: to BS 1202, Part 1, 2 or 3 generally, but non-ferrous types to Parts 2 or 3 for external use.
- b. Wood Screws: to BS 1210 generally, but non-ferrous types for external use.
- c. Self-Tapping Screws: to BS 4174.
- d. Dowels: mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
- e. Cramps: mild steel, 25 x 3 x 250 mm (1" x 2/16" x 10") girth, turned up at one end and twice drilled for 3 mm (2/16") screws, fish-tailed at other end for building in and galvanized to BS 729 after fabrication.
- f. Plugs: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fibre or plastics plugs, or other approved type.

3.3.1.11 TREATMENTS, ADHESIVE AND FINISHES

- a. Preservative Treatment: shall be type listed in BS 1282 (except coal tar creosote), obtained from an approved manufacturer, to give suitable protection against termites and other wood destroying organisms.
- b. Adhesive for Joinery: shall be close contact type to BS EN 301 or BS EN 302 suitable for the purpose. Obtain manufacturer's confirmation that adhesive is compatible with preservative treatment.

EXECUTION

3.3.1.12 INSTALLATION, GENERAL

- a. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- b. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

- c. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- d. Apply field treatment to cut surfaces of preservative-treated lumber and plywood.
- e. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- f. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- g. Use hot-dip galvanized nails.
- h. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.3.1.13 **WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS**

- a. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- b. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- c. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-38 mm wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3.1.14 **WOOD FURRING**

- a. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- b. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.
- c. Furring to Receive Wood or Plastic Sheets or Boards: Install 19-by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.
- d. Furring to Receive Gypsum Board: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.
- e. Furring to Receive Plaster Lath: Install 19 (3/4")-by-38-mm (1½") actual-size furring at 400 mm (16") o.c., vertically.

3.4- INTERIOR ARCHITECTURAL WOODWORK

GENERAL

3.4.1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

3.4.1.2 SUMMARY

- A. This Section includes the following:
 - 1. Pantry cupboard.
 - 2. Laboratory bench.
 - 3. Vanities constructed from solid surfacing.
 - 4. Wood base.
- B. Related Sections include the following:
 - 1. 6.0 Section "Rough Carpentry".
 - 2. 9.0 Section "Painting" for field finishing of interior architectural wood works components that need finishing.

3.4.1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated, including finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. **Shop Drawings:** Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
- C. **Samples for Initial Selection:** Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
 - 1. Shop-applied transparent finishes.
 - 2. Solid-surfacing materials.
- D. **Samples for Verification:** For the following:
 - 1. Solid-surfacing materials, 150 mm (6") square.
 - 2. Pantry hardware.
 - 3. Plastic-laminate-clad panel products, 200 by 250 mm, (8" x 10") for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
- E. **Product Certificates:** Signed by suppliers of used woods and rigid sheets certifying that products comply with requirements specified.

3.4.1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Fabricator Qualifications:** A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Source Limitations:** Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

3.4.1.5 PROJECT CONDITIONS

- A. **Field Measurements:** Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

3.4.1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PRODUCTS

3.4.1.7 WOOD

- A. Softwood shall be free from decay and insect attack, except pinhole borers, with no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood species to be used in external locations are to be recommended for the purpose.
- B. Hardwood shall comply with BS EN 942. Hardwood to be used in the works are to be recommended for the purpose.
- C. Wood shall be treated to prevent absorption of moisture.
- D. Plastic Laminate: to BS EN 438, color and pattern as follows:
 - 1. Color and Pattern: Shall be selected by Engineer from manufacturer's full range of colors and patterns.
 - 2. Minimum Thickness: 1.20 mm (1/16").
 - 3. Where indicated, select plastic laminate type suitable for post forming application.

3.4.1.8 RIGID SHEETS

- A. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.

3.4.1.9 FASTENERS

- A. **Nails:** to BS 1202, Part 1, galvanized steel.
- B. **Wood Screws:** to BS 1210 generally, galvanized steel.
- C. **Self-Tapping Screws:** to BS 4174.
- D. **Dowels:** mild steel, 10 mm (1/2") diameter, 100 mm (4") long, galvanized to BS EN ISO 1461 after fabrication.
- E. **Cramps:** mild steel, 25 x 3 x 250 mm (1" x 1/32" x 10") girth, turned up at one end and twice drilled for 3 mm (1/32") screws, fish-tailed at other end for building in and galvanized to BS EN ISO 1461 after fabrication.
- F. **Plugs:** either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fiber or plastics plugs, or other approved type.

3.4.1.10 FIRE-RETARDANT-TREATED MATERIALS

- A. **General:** Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to Engineer to produce products with fire-test-response characteristics specified.
 - 1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. **Fire-Retardant-Treated Lumber and Plywood by Pressure Process:** Comply with BS 5589. Use the following treatment type:
 - 1. Type: Organic-resin-based formulation thermally set in wood by kiln-drying.
 - 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - 3. Kiln-dry material before and after treatment to levels required for untreated material.
- C. All lumber, wood, fir, plywood or boards used in the works of this Section are to be preservative and fire-retardant treated.

3.4.1.11 SOLID SURFACE MATERIAL

- A. **Solid-Surfacing Material for Counter Top:** Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a pre-coated finish.

3.4.1.12 INSTALLATION MATERIALS, GENERAL

- A. **Furring, Blocking, Shims, and Hanging Strips:** Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

3.4.1.13 FABRICATION, GENERAL

- A. **General:** Comply with requirements of BS 1186-2.
- B. **Wood Moisture Content:** Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Engineer seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- G. Fabricated; cabinets and similar items are to be of robust firm neat construction with:
 - 1. Shutters, sashes, drawers and other opening or moving parts working smooth without bound conditions.
 - 2. Clearance between sashes and between jambs and sashes uniform.
 - 3. Level horizontal surfaces and plumb vertical surfaces when installed.

3.4.1.14 SHOP PRIMING

- A. **General:** Priming of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork and for priming materials to be used.
- B. **Preparations for Priming:** Comply with 9.0 Section "Painting" for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for priming woodwork, as applicable to each unit of work.
 - a. **Back-priming:** Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to end-grain surfaces.

3.4.1.15 PANTRY CUPBOARD AND BENCHES

- A. Base counters and upper cabinets units shall be pre-fabricated units constructed to dimensions and details indicated on Drawings.
- B. Construct units from the following materials so as to have all exposed or semi-exposed surfaces of plastic laminate finish:
 - 1. 19 mm (3/4") thick plywood with post-formed plastic laminate finish at both faces for front doors, bottoms and top of upper cabinet and shelves.
 - 2. 19 mm (3/4") thick solid surfacing material with integral factory formed back splash top of base counter with integral back splash.
 - 3. 6 mm (2/8") thick plywood of plastic laminate finish at one face for units backs and drawer base.

- 4. 19 mm (3/4") thick plywood with post-formed plastic laminate finish for drawers front, sides and back
- C. Plastic laminate sheet veneers shall be as specified in Clause 2.1 of this Section, color and pattern to the selection of the Engineer. Units are to be assembled in manufacturer's standard system to provide neat and robust construction.
- D. Construct sole of base counter, consisting of perimeter sides and intermediate struts, from hardwood solid blocks and finish exposed fronts to match finish of surrounding floors.
- E. Provide metal pre-slotted shelf holders of baked enamel finish complete with removable brackets for shelf supporting. Color is to be to the selection of the Engineer.
- F. Provide manufacturer's standard hardware including hinges, drawer slides, latches and knobs of finish to the selection of the Engineer. All hardware shall be manufactured from stainless steel, alloy 304, of satin finish.
- G. Blocking wood shall be from approved hardwood type.
- H. Construct top of base cabinet units integral with coved back splash from solid surfacing material as specified. Color or colors shall be selected by the Engineer from manufacturer's full range. To the maximum possible extent provide seamless construction. Where seams are unavoidable, align adjacent solid surfacing-material units and factory form seams. Joints are to be dressed smooth with surface scratches removed and entire surface cleaned.

3.4.1.16 WOOD BASES

- A. Are to be constructed from White Oak hardwood.
- B. Fabricate to dimensions and details indicated.
- C. Furnish in length as long as practice.
- D. Corners are to be mitered at 45 degrees.
- E. Finish of bases shall be transparent stained varnish as specified in section "Painting".

3.4.1.17 VANITIES

- A. Furnish vanities pre-fabricated in the workshop from solid surfacing material. Color(s) shall be selected by the Engineer.
- B. Fabricate vanities to dimensions indicated on Drawings and details indicated on approved shop drawings. Comply with the following sheet thickness:
 - Vanity: 20.0 mm (3/4")
 - Aprons and backsplash: 13.0 mm (1/2").
- C. Provide seamless vanity construction with pre-opened holes for assembly of lavatories. Use approved samples of lavatories for fixing size of holes. Comply with manufacturer's printed instructions for fabrication of vanities.

EXECUTION

3.4.1.18 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.4.1.19 **INSTALLATION**

- A. **Quality Standard:** Install woodwork to comply with BS 1186-2 and details indicated on Drawings and approved shop drawings.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Fix wood bases with pre-drilled, expansion-type wall plugs fabricated from hard nylon and galvanized-steel wood screws of suitable length and diameter at maximum intervals of 750 mm (30"). Counter sink heads of screws in wood and overfill with approved wood filler of matching color as adjacent finished stained wood.
- G. Refer to 9.0 Section "Painting" for final finishing of installed architectural woodwork components that need finishing.

3.4.1.20 **ADJUSTING AND CLEANING**

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semi exposed surfaces.

END OF SECTION

3.4.1.21 GLASS AND GLAZING

GENERAL

3.4.1.21 DESCRIPTION

A. Furnish labor, materials and equipment to supply and install glass in different types of windows and doors.

3.4.1.22 SUBMITTALS

A. Samples:

1. 300 x 300 mm (12 x 12 IN), of each specified type, class and thickness.
2. Sample of translucent ceramic fit pattern.

B. Project close-out information

1. Guarantee

3.4.1.23 JOB CONDITIONS

Do not proceed with installation under adverse weather conditions, or when temperature are below or above manufacturer's recommended limitations.

3.4.1.24 STORAGE AND HANDLING:

A. Store glazing in cases within building in a dry, well-ventilated area to avoid cyclic wetting and drying and damage from moisture.

B. Store glazing out of case vertically with interweaving or pacing between the individual lights

C. Protect glazing from welding operation, wind-blown objects, and run-off over alkaline materials.

D. Handle glazing carefully to prevent edge damage.

3.4.1.25 GUARANTEE

Written 5 year guarantee signed by installer to cover weather tightness of installation including air and water integrity. Guarantee structural adequacy of units and hardware, sealants and caulking within and around perimeter of installation.

PRODUCTS

3.4.1.26 MATERIALS

A. Glass materials.

1. Comply with specified standards
2. Manufacturer or fabricator is responsible for determining if any of these materials should be heat strengthened or fully tempered and provide accordingly.

B. Tinted glass for aluminum windows & doors

1. Tinted tempered float glass 6 or 8, 10 or 12 mm thick as produced by Pilkington or similar.

2. The following performance:

a- Visible light transmittance 71%

- b- Outdoor reflectance (%) 7%
- c- Total solar energy transmittance 33%
- d- Shading Coefficient 0.58%

C. Clear glass for windows and doors

- 1. Clear tempered float glass, 6 mm, 8 mm or 10 mm thick ASTM C1048.

D. Glazing compounds:

- 1. Non-sag, non-stain type.
- 2. Pigmented to match frame units not requiring painting.
- 3. Compatible with adjacent surfaces.
- 4. For use in setting glass: One part polyurethane or silicone sealant, F.S. TTS-00230C (2), Type II, class A or two-part polyurethane sealant, F.S. TT-S- 00227E, Type II, class A.
- 5. Sealant tape: Performed butyl 1 rubber sealant tape or ribbon having a continuous neoprene rubber shim.
- 6. Gaskets: Polyvinyl chloride or neoprene, extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.

A. Setting blocks and spacers: Neoprene, compatible with sealants used.

- 1. Setting blocks: 70 - 90 urometer
- 2. Spacers: 40-50 urometer
- 3. Compressible filler stock: closed-cell jacketed rod stock of synthetic rubber or plastic foam.

B. Shims clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

EXECUTION

3.4.1.27 INSPECTION

Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be performed.

3.4.1.28 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with combined recommendation of material manufacturers, except where more stringent requirements are shown or specified.
- D. Install sealants as recommended by sealant manufacturer.
 - A. E. Install setting blocks in adhesive.
- F. Provide spacers inside and out, of proper size and spacing, for all glass sizes larger than 1270 united mm, expect where gaskets are used for glazing. Provide 3.175 mm minimum bite of spacers on glass. Use thickness equal to sealant width. Use preshimmed tape, if tape is used.
- G. Miter cut and bond gasket ends together at corner. Do not stretch gaskets.
- H. Immediately after installation, attach crossed streamers to framing held away from glass. Do not apply anything to surfaces to glass.
- I. Remove, and replace damaged glass and provide new acceptable materials.

3.4.1.29 CLEANING AND PROTECTION

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish, glass on both faces not more than 7 days prior to Engineers acceptance of work in each area. Comply with glass manufacturer's recommendation.

END OF SECTION

3.5- TERMITE CONTROL

PART 1 – GENERAL

- A. General provisions of the Contract, including Conditions of Contract apply to this Section.

3.5.1. SUMMARY

- A. This Section includes the following for termite control:
 - 1. Termite prevention
 - 2. Soil treatment
 - 3. Wood protection

3.5.2. TERMITE PREVENTION

- A. Avoid creation of conditions that invite termites wherever possible. Take the following measures:
 - 1. Remove stumps, roots, wood, and other cellulose materials from the building site before commencing construction.
 - 2. Remove cellulose materials from around the foundation before final backfill.
 - 3. Promptly remove form boards and grade stakes used in construction from site.
 - 4. Allow no contact between building woodwork and soil or fill material.
 - a) Locate exterior woodwork a minimum of 15 cm above ground and beams in crawl spaces at least 45 cm above ground to provide ample space to make future inspections.
 - b) Make foundation areas accessible for inspection if possible.
 - c) If wood that contacts the soil, such as fence posts and foundation elements, use pressure treated wood.
 - 5. Design ventilation openings in foundations to prevent dead air pockets and to help keep the ground dry.
 - 6. Direct water away from the structure through proper grading.
 - 7. Assure that the roof drainage system directs all water away from the foundation.
 - 8. Avoid plantings near the foundation. Any tree that has the potential to grow to a height of 12 meters or taller shall not be planted within 15 meters of the foundation.

3.5.3. DEFINITIONS

- A. EPA: United States Environmental Protection Agency.
- B. PMP: Pest Management Professional

3.5.4. SUBMITTALS

- A. Product Data: For termiticide and borate.
 - 1. Include the EPA-Registered Label for termiticide and borate products.
- B. Product Certificates: For termite control products, signed by product manufacturer.

- C. Qualification Data: For Installer of termite control products.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.
- E. Wood Treatment Application Report: After application of borate is completed, submit report for Owner's record information, including the following:
 - 1. Date and time of application.
 - 2. Brand name and manufacturer of borate.
 - 3. Quantity of undiluted borate used.
 - 4. Dilutions, methods, volumes, and rates of application used.
 - 5. Areas of application.
- F. Warranty: Special warranty specified in this Section.

3.5.5. **QUALITY ASSURANCE**

- A. Applicator Qualifications: A PMP who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.
- B. Regulatory Requirements: Formulate and apply termiticide, and label with a US EPA registration number, to comply with EPA regulations and authorities having jurisdiction.
- C. Document any applicable local codes or authorities and ensure that all relevant work is in compliance.
- D. Implement applicable provisions of the Quality Control program as established in:
 - Section 01401, "Contractor Quality Control."

3.5.6. **PROJECT CONDITIONS**

TERMITE CONTROL SECTION 02361 - 3

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

3.5.7. **COORDINATION**

- A. Coordinate soil treatment application with excavating, filling, and grading and

concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

3.5.8. **WARRANTY**

- A. Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

3.5.9. **TERMITICIDES**

- A. Soil Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or amusable, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by the COR.
 - 1. The Department of State currently authorizes Termidor and Premise as soil termiticide.
 - 2. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
- B. Wood Protection Termiticide:
 - 1. Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation for review and acceptance by COR.
 - 2. The Department of State currently authorizes Timber and Bora Care for preventive wood treatment.
 - 3. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA Registered Label.
 - 4. Protect vegetation from contact with Timber and Bora Care.

END OF SECTION

SECTION – E - 1 GENERAL SPECIFICATIONS

FOREWORD

This document is to describe the minimum requirements for the equipment and installations and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

1. SCOPE OF WORK

The works related to the electrical system which are included in the scope of this Contract are shown on the Drawings, stated in the Particular Specifications, Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- a. Low Voltage Switch Board /Distribution Boards (Section - E - 2)
- b. Low Voltage Cable and Wires (Section – E- 3)
- c. Conduits and Pipes (Section – E- 4)
- d. Wiring Accessories (Section – E - 5)
- e. Lighting Fixtures (Section – E - 6)
- f. Voice & Data Communication Systems (Section – E - 7)
- g. Earthing System (Section – E - 8)
- h. Cable Tray, Ladder and Trunking (Section – E - 9)
- i. Public Address System (Section – E – 10)
- j. CCTV System (Section – E – 11)
- k. Fire Alarm System (Section – E – 12)
- l. Access Control System (Section – E – 13)
- m. UPS (Section – E – 14)
- n. Self-Contained Emergency Lights (Section – E – 15)
- p. Lightning Protection System (Section – E – 16)

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standards of Engineering design, workmanship, performance and function as here in specified and fully meet the quality level and rugged requirements of the specifications.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these documents but which is necessary for proper operation of the works / system, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and / or approved by the Owner or his representative, to achieve proper coordination with various equipment offered in the bid and

also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

2. RULES AND REGULATIONS

The entire electrical installation / work shall be carried out by licensed contractor, authorized to undertake such work under the provisions of Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the Electric Company shall be complied with.

3. STANDARDS

All works, equipment and materials shall conform to:

On the one hand:

The specification recommended practices, official standards and codes the non - restrictive list of which is given below.

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

Local Regulations

In the event of conflict between standards, the most stringent shall prevail.

Whenever the electrical equipment to be installed, does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets these standards.

In addition, even if no mention is stipulated in this specification, it is implied that the equipment be tropicalized, if required, by the conditions of the site of installation.

In any case, the standards and codes to be taken into consideration are those in force at the date of delivery.

4. INSTALLATION AND SERVICE CONDITIONS

4.1 Site Conditions

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material / equipment:

- a. Maximum outdoor ambient temperature : 45 degree C
- b. Minimum Indoor ambient temperature : 0 degree C
- c. Maximum relative humidity : 90 %
- d. Minimum relative humidity : 26 %

4.2 Service Conditions

Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

5. MAIN ELECTRICAL CHARACTERISTICS**5.1 Power Supply System**

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- Voltage 400 \pm 10%
- Phase 3, 4 wire system
- Frequency 50 Hz. \pm 2 Hz.

5.2 Degree of Protection of Enclosures

For indoors, IP42 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529. For outdoor, IP 55 minimum degree of ingress protection of the enclosures shall be provided.

6. GUARANTEE

The Contractor shall furnish written grantee which should clearly state that the works he will carry out as well as the materials he will supply, meet with this specification and that compliance thereto constitutes an official clause, added by implication to the general conditions of his offer when signing the Contract.

Guarantee shall also be for replacement and repair of part or whole of the equipment which may be found defective in material or workmanship. The grantee shall cover the duration of Maintenance Period as defined in the conditions of the Contract. This guarantee shall not relieve the Contractor of his obligations and he will fully be responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/ or replacements.

The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project under the Contract, to be carried out by the Contractor.

7. EXCEPTIONS TO SPECIFICATION

Any exception or deviation from this specification or the codes and standards shall be listed separately in the Contractor's "List of Deviations". Any exception, which shall not be listed, shall not be considered later.

8. AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE

The Contractor shall assume at his own cost the permanent availability of this specification and drawings on site where applicable.

9. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

10. MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are the estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at the site.

11. INSTALLATIONS DETAILS

The locations, routings, installation heights, detail etc. for electrical equipment are indicated on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or his representative.

12. DRAWINGS AND DATA

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

13. PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's representative before commencing any portion of the works. All such working drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

a. **Cable entry ducts into buildings:**

Working drawings shall be submitted within two weeks of handing over the site.

- b. All other working drawings shall be submitted to the Engineer against signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant working drawings at least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the working drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the working drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval within eight weeks after signing of the Contract. No extension of time shall be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

14. MATERIAL ORIGIN AND QUALITY

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to demand, at any time, the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

15. IDENTIFICATION OF EQUIPMENT

For each piece of equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of trifoliate and fixed with screws.

16. MARKINGS

The contractor shall provide "Danger Boards "and" Shock Charts "wherever required to comply with the requirements of local Electricity Rules and according to normal practice.

17. FACTORY TESTS

All equipment supplied by and installed as part of the Contract such as distribution boards and like shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of test of each equipment at least two weeks in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees referred to in Clause 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been included in the tender bid.

18. STORAGE

The Contractor shall store the equipment in such conditions that it cannot be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer when requested to do so.

19. LABOR AND STAFF OF CONTRACTOR

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

20. SMALL INSTALLATION MATERIAL

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

21. INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly position the equipment on specified foundation / location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

22. ASSOCIATED CIVIL WORKS

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for

their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.
- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and laying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or pipe suspensions.
- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be cut must be directed without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

23. TESTING - GENERAL

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. The Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization (whether official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

23.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

23.2 Earth Resistance Test

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

23.3 Switchgear

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses, disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

23.4 Special Systems Tests

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

23.5 Complete Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

24. ELECTRICAL CONNECTION

Electrical connection for each building shall be supplied by other but necessary arrangement coordination to be done by this Contractor.

25. AS BUILT DRAWINGS AND SERVICE MANUALS

A record shall be kept as the work proceeds of any work not in accordance with the working drawings, and upon completion of the work, the Contractor shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.
- b. Duplicate prints of as built drawings of lighting, power, telephone, fire alarm, as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

26. WORK COMPLETION

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

27. PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E - 2

LOW VOLTAGE SWITCHBOARDS / DISTRIBUTION BOARDS

1. GENERAL

1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard.

1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete switchboard as specified herein and/ or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

1.3 Standards

Switchboards shall comply with Section - E - 1, Clause 3.
Particular reference shall be made to:

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push bottoms
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switch gear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

1.4 Installation and Service Conditions

For general site conditions refer to Section - E- 1, Clause 4.

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency as stated in Section - E-1, Clause 5.1.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

2.0 MAIN ELECTRICAL CHARACTERISTICS

2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 415 V \pm 10%
- Phase 3 ϕ , 4 Wire.
- Frequency 50 Hz. \pm 2 Hz.
- Neutral system Solidly grounded.
- Peak asymmetrical SCC To be specified by the bidders.
- RMS symmetrical SCC To be specified by the bidders.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

2.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours. Per day, without exceeding the permitted temperature.

The current ratings of all equipment must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

Pins of auxiliary circuits shall be sized for a rated circuit of 10 Amp Minimum.

3. GENERAL REQUIREMENTS

3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor mounting type/wall mounted, totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.
- be designed for flush mounting of all instruments on the front side.
- have all incoming or outgoing connections from the top or

bottom as required. Have the components mounted so as to facilitate ease of maintenance from the front. Have common lamp test facility for all lamps.

- have wiring diagram on the inside of door of the switchboard. Be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.

3.2 Accessibility

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

3.3 Heaters

Space heaters shall be provided for prevention of moisture in each cubicle. Heaters shall be wired together and shall be automatically controlled to avoid over heating the equipment. Heater shall be suitable for operation on 230 VAC supply from an external source (to be provide in main Distribution Board)

3.4 Name plates

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white back ground, to be made from traffolite and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

4.0 MECHANICAL DESIGN

4.1 General Construction

The switchboard shall be fabricated, welded; grinded, finished with angle iron framework and clad with 14 SWG MS sheet, to form a rigid, free standing, flush mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to be accessible during normal maintenance operations, shall be adequately protected and / or barred to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and interchangeability of common parts. Removable gland plates shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for unarmoured and armoured cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.2 Bus Bars

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with their respective colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Neutral Bus bar should be of same ampere rating as phase bar.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

4.3 Earthing

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow colour. Earthing mass continuity between withdrawable parts and fixed frame shall be correctly ensured whatever the withdrawable part position.

Provision shall be made adjacent to cable termination for earthing cable armour to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions :

- impossibility of closing the earth switch if the switching device is closed.
- visual check of earthing switch positions to be possible.
- possibility of locking the earthing switch operating handle in open and closed position.
- the earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

5.0 DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel recess mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door of Distribution Board.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at both the top and / or bottom, as required.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6.0 COMPONENTS

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and of the electrical system. Typical specifications are given here under :

6.1 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

6.2 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 100 Amps. shall be conforming to

BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalized.

The MCBs shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF/TRIP positions.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

6.3 Earth Leakage Circuit Breakers (ELCB)

ELCBs shall be four pole, current operated type with tripping current of 0.3A and tripping time not more than 0.1 seconds.

6.4 Load Break Switch and Contactor

Load Break Switches and contactors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminium plate shall be provided for cable entry to ACBs / MCCBs cubicles of 630A and above rating.

7 POWER FACTOR IMPROVEMENT PLANT

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic-cum-manual.

The power factor improvement plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12 stages, 6 stages and 4 stages. Each capacitor bank unit shall be 25 and 50 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

- 1 No. Multi stage power factor correction relay for automatic/manual control.
- 1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.
- 1 No. Auto-off-Manual selector switch
- 1 No. Current transformer with 5 amps secondary current, having suitable output burden and accuracy.

3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 250 KVAR capacitor bank:

1 No. 630 amps, triple pole 415 volts air break contactor with auxiliary contacts (2 N.O+2 NC) Contractor shall be suitable for AC 3 duty.

1 Set of 2 Nos 630 Amps H RC back-up fuses with base and carrier.

1 Set of ON and OFF push buttons.

1 No. Red lamp for "On" indication of the contractor.

7.1 Requirement of Capacitor Banks

According to IEC-83 1 -1 and 831-2.

Fully insulated, terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminium coating vacuum metalized.

Safety features: Self healing. Over pressure tear-off fuse.

Withstand switching operations safely.

Maximum in rush current 200 times rated current.

Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.

Overloading capacity 1.5 times rated output at delta max.

Acceptable tolerances - 5/+ 10% of rated output at rated frequency.

Static life expectancy > 100,000 operating hours.

Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

8. PARTICULAR COMPONENT REQUIREMENTS

8.1 Current Transformers

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / 1A as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

8.2 Voltage Transformers

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of the same accuracy class as Current Transformers.

Voltage Transformers shall be equipped with primary fuses with an interrupting capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

8.3 Ammeters and Voltmeters

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and

black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of Current Transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

8.4 Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

8.5 Push Buttons

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

8.6 HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class QI in accordance with BS 88.

8.7 Pilot Lamps

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

8.8 Line up Terminals

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

8.9 Secondary Wiring

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not

less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

9. INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the Switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The Switchboard body shall be connected to earth as per instructions given in section "Earthing" of these specifications. The Switchboard shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications of Electrical Works, section E-1 of these specifications.

SECTION - E - 3 LOW VOLTAGE CABLES AND WIRES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

2. GENERAL

All multicore and single core wires for light circuits, socket outlets and circuits operating upto 250 volts shall be 300 / 500 volts grade. All single core sheathed cables shall be of minimum 450 / 750 volt grade. Power cables for main feeders, main to submain feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multicore cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures as given in General Specifications for Electrical Works, Section E-1 of these specifications. Cable should be capable of running 125% of full load current without any damage.

All power cabling used for external power distribution shall be armoured type.

3. STANDARDS

LV Cables and Wires shall comply with Section – E -1, Clause 3.

Particular reference shall be made to :

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each

core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colours.

4.2 Cables for Conduit Wiring

All cables / wiring in concealed or surface mounted PVC or steel conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

4.3 Cables on Surface / Concrete Trenches

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multicore PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Underground Installation

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armoured with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ. The installation work of underground cabling shall be done completely as per the prevailing standards or as per the drawings.

4.5 Cable Accessories

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands, etc.

5. INSTALLATION

5.1 General

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as

well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying 1 KV - 30KV and other cables.
- 20 cm at least between a cable carrying voltages between 50V
- 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

5.2 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

5.3 Cables on Surface / Trenches

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges.

It shall be ensured that conduit system is clear before cable is drawn in. cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

5.4 Underground Cables

The Contractor shall plan and take special care to prevent any damage to existing under ground facilities such as under ground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, under ground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between

terminations.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of RCC chamber shall be provided by contractor prior to commissioning of works.

Cables, whether installed under ground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave under ground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane foam / bituminized Hessian or equivalent method as approved by the Engineer.

5.5 Cable Termination and Joints

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Owner or his representative before use.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armored cables are used, care shall be taken to ensure that the lay of the armor is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of RCC chamber shall be provided by contractor prior to commissioning

of works. Extra loops shall be left of cables at the end of every termination.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be effected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

SECTION - E - 4 CONDUITS AND PIPES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Conduits and Pipes as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushings, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits / pipes.

3. STANDARDS

Pipes and Conduits shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

BS 31	Steel Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown in the drawings or given in BOQ. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of sharp 90 degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57 mm diameter and 40 mm depth. Round junction boxes shall be

provided with one piece bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum B-Class (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 Steel Conduit and Accessories

All conduits shall be of heavy gauge 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide anti-rust paint and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-rust paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece bakelite cover plate of suitable design.

4.3 Galvanized Iron Pipes and Accessories

The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

4.4 Inspection Boxes / Pull Boxes

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

4.5 Adaptable Boxes

Adaptable boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63 mm in depth for conduits up to 40 mm diameter and 87 mm in depth

for conduits up to 50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

4.6 Conduit / Pipe Accessories

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

4.7 Cable Trunking

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGI bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

5. INSTALLATION

5.1 PVC Conduits - Concealed

The conduit shall be installed concealed in roof, wall, column, etc.

At all joints and bends, PVC jointing solution as manufactured by Pakistan PVC Limited or approved equivalent must be used to strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. In the reinforced cement concrete (RCC) work, the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and accessories,

after pouring of concrete. The concrete shall be supported on top of bottom reinforcement of slab and shall be firmly secured by tying to the reinforcing steel in order to avoid being disturbed during pouring of concrete.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab of beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting, or in block masonry, chases shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture to have to at least 32 mm cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.
For straight runs the spacing shall not be more than 30 meters.
For runs with one 90 degree bend, the spacing shall not be more than 15 meters.
- Adaptable boxes.
For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.
For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.
For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, off setting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

5.2 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes.

Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

Equipment that is required to be removed for maintenance shall be provided with conduit unions in all conduits that enter such equipment. The use of conduit nipples shall be avoided as far as practicable.

All conduits shall be cut square and reamed at the end. All conduit ends and the inside of conduits shall be clean and free from burrs.

Where bushed spouts or tapped holes are not provided at conduit termination, the conduit shall be terminated in a flanged socket and a smooth bore brass hexagon bush, with a lead washer fitted between the flanged socket and the equipment or box.

All exposed threads and parts where the galvanizing has become damaged shall be thoroughly cleaned and painted with galvanized paint. The exposed conduit ends shall be capped to protect threads from being damaged before installing cables.

Repair painting shall take place before any making good on site or buildings is carried out. The entire conduit system shall be checked for continuity. Any observation found shall be removed without damaging the installation.

The conduit system shall be installed empty with an 16 SWG steel wire drawn through the conduits for pulling of cables. Joints in underground conduits shall be avoided or reduced to the absolute minimum.

Where adjustable dies are used they shall be so adjusted that threads cut with them shall be the same depths as machine made threads.

The use of manufactured bends shall be avoided and instead smooth bends shall be provided by using approved type of bending tools.

Flexible steel conduits shall be installed at all points locations where flexible connection is required, as directed by the Engineer. The flexible conduits when used, shall be protected by external PVC sheath, resistant to oil damages.

G.I. pipes for under ground installation shall be given bituminous paint coating and wrapped with suitable paper or cloth before installation.

5.3 Fixing of Conduits and Fittings

Conduits in process units and on steel work with "U" bolt type fixings.

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm (1")	Not less than 150 mm.
32 mm (1-1/4")	Not less than 200 mm.
38 mm (1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
75 mm (2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.
150 mm (6")	Not less than 750 mm.

Under ground conduit stud-up or kick pipe through concrete envelope shall be extended a minimum of 150 mm above grade and adequately braced to prevent shifting during concrete pouring work. The concrete envelope shall extend at least 76 mm above grade.

Under floor conduit installation shall be at a minimum depth of 120 mm from finished floor level. The G.I. pipes / conduits shall be installed at a minimum depth of 1000 mm measured from the top of size to the finished road level.

5.4 Location of Conduits and Fittings

Before conduits are installed, confirmation shall be obtained that the conduit may be installed in that position.

Particular attention shall be given to the location of conduits to prevent the infringement of headroom and access ways.

Conduits shall be located to avoid obstructions, furnaces, hot lines and other places of high temperature.

Conduit shall not be located than 150 mm (6") where it runs parallel to

or crosses hot surfaces. Under ground conduit runs shall be kept to minimum in both number and length. Conduits shall not be recessed in fair brick work.

Draw boxes shall be so positioned to enable the cables to be drawn in easily. The boxes shall not be located in the comers or other such locations and shall be positioned to avoid tight bends, bending and cable kinks.

Conduits shall not generally be installed having a greater length 12,000 mm (40 feet) between draw-in boxes.

Conduit entries shall wherever possible be located in the bottom of boxes and equipment etc.

SECTION - E - 5 WIRING ACCESSORIES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Electrical Works, Section – E - I and with other relevant provisions of the Tender document.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

3. STANDARDS

Wiring accessories and miscellaneous items shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and unswitched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Switches

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

For locations where switches and fan speed regulators are installed together, single switches shall be grouped and fixed on 3 mm thick plastic sheet screwed to a sheet steel box of appropriate dimensions. The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for switches controlling light points, all single switches for fans, sockets, etc., shall have identification symbols on the

operating levers.

Two way switches shall be used to control lights from two different locations as shown on the drawings.

4.2 Switch Socket Outlets

Switch socket units shall be of flat pin type and conform to BS 1363, 13A for fused plugs and socket outlets. 2 and 3 Pin rated for 15 Amps. or 2 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

3 Pin 15 Amps. Sockets shall be moulded type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

4.3 Sheet Steel Boxes

The outlet boxes for installation of switches, fan speed regulators and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-rust red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

4.4 Ceiling Rose

The ceiling rose shall be suitable for 5 Amps. 250V AC. It shall have white plastic moulded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multicore PVC insulated and PVC sheathed cable.

4.5 Fans

4.5.1 Bracket Type

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.

The sweep of the fan shall be as given in BOQ/drawings.

4.5.2 Exhaust Fan

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Schedule of Quantities/drawings. Fans shall be direct driven and supplied

complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type.

Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

4.5.3 Ceiling Fan

The ceiling fans shall be consist of three blade types with 56" and suitable for operation on 250 VAC with +10% tolerance. The Fan shall be mounted directly on ceiling; the lowest point of the fan blade is approximately 300mm (1 foot) below the ceiling. Make sure that the chosen location of the fan will not allow the rotating fan blades to come into contact with any object.

Ensure ceiling joists are sound and of adequate size to support a 35Kg (77lb) load. To reduce the risk of fire, electrical shock or personal injury, ensure that the fan mounting bracket is supported directly from the building structure. Do not mount to an outlet box. The mounting bracket must be firmly screwed to a load bearing structure e.g. a concrete ceiling, steel structure or timber frame. If a timber frame is to be added it must b securely nailed or screwed between two beams.

SECTION - E – 6 LIGHTING FIXTURES

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

2.0 GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3.0 STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 60598 Luminaries.
- IEC 62031 LED modules for general lighting-Safety requirements.
- IEC 62384 DC or AC supplied electronic control gear for LED modules performance requirements.
- BSEN 1838 Emergency Lighting

Any other standard referred to in above standards or these specifications.

4.0 LED Light Fixtures

The light fixture shall be as stated on drawings and bill of quantities. The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All LED light fixtures shall be of international standard and quality. The type of fixtures with manufacturer catalogue reference is given on the fixture schedule and in Bill of Quantities. Equivalent fixture may be acceptable provided that the Contractor submits for review all necessary data indicating photo-metric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for light fixtures shall be Light Emitting Diodes with driver and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof light fixture shall comprise of cast aluminum body and gasketed clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. The gasket shall be weather resistance type.

The LED light fixtures shall be supplied complete with driver and all accessories as per light fixture schedule and shall be installed in accordance with manufacturer's recommendations and sound engineering practice.

5.0 INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between terminal box and the fixture shall be carried out with 3 core 0.75 sq. mm and 1 sq. mm copper conductor, PVC / PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

5.2 LED Light Fixtures

The LED light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in accordance with manufacturer's recommendations and in coordination with ceiling installation.

5.3 Outdoor Lighting

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these

specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such. The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacture of the product and shall meet the requirement of the specifications.

SECTION – E - 7
VOICE & DATA COMMUNICATION CABLING SYSTEM
(Passive Equipment's only)

1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

2. SYSTEM DESCRIPTION

The proposed cabling system for the UTP and Fiber network cabling and Fiber Links shall be an open system (Passive Only) and application and vendor independent and shall be warranted by an International Vendor for a minimum of 25 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

3. DATA CABLING SYSTEM

Data racks shall be located in IT rooms as per drawing. Cat 6 cable for Voice and Data shall be used for interconnecting outlets with patch panels. The cable run from the IDF to the associated Data outlet is limited to 90m.

Wiring system used shall be star topology i.e. each data outlet is connected directly to the IDF (Intermediate Distribution Frame) IN Cat-6 RJ45 24 port patch panel.

Vertical runs between each IDF shall be of 8 core multimode OM4 fiber optic cable and 25 pair cat 5e cable.

Horizontal runs from a patch panel to the data outlets using 4 Pair UTP twisted pair cables Cat 6.

Data Processing system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, adapters, connectors, patch panels, patch cords, wire management, floor distributors (racks/cabinets).

The Data Cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration.

The network data cabling systems support at least 1000 Base-T (Gigabit) Ethernet or faster protocol.

The UTP (unshielded twisted pair) Category 6 cable's technical specifications shall be up to the highest industry standards and should have performance specifications better than 250 MHz and should exceed all proposed requirements for data, Gigabit applications.

The UTP Category 6 cable's technical specifications shall be up to the TIA/EIA-

568B.2-1 industry standards and should have performance specifications better than 250 MHz and ample margin compared to the Category 6 Standard for performance in factors such as NEXT.

For both voice and data cat 6 cable shall be used.

4. SCOPE

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The LAN cabling system shall meet the emerging TIA/EIA 568A/B and ISO 11801 For Voice cat6 is to be used, while for Data and WIFI access point CAT 6 is used. Category 6, Class E specifications and shall support Gigabit Ethernet, Sonet/asynchronous transfer mode (ATM) at rates (minimum of) 1 Gbits/seconds and analog broadband video in addition to existing and multimedia technologies.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

The Vendor must have completed a project with a minimum of 1000 points or higher of Category 6.

5. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

6. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

7. COPPER & FIBRE OPTIC CABLE AND CONNECTORS

Unshielded twisted-pair copper & fiber optic cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide unshielded twisted-pair copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory-installed equipment.

Computer cabling System Accessories: Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and TIA / EIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements for emerging applications such as ATM services (1.2 Gbps), including 10 Gbps Ethernet. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such

pairs twisted together.

The cables shall be fully colour coded as provided hereunder, colour contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Coloured Code	Abbreviation
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN
Pair 4	White – Brown Brown – (White)	WT – BR BR

8. SPECIFICATIONS OF CABLES:

For Voice UTP Cable

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Atténuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

For Data UTP Cable

Cable Type	Category 6
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Atténuation @ 500 MHz (dB)	32.1
Worst case NEXT @ 500 MHz (dB)	38.3

9. HORIZONTAL CABLING DISTANCES

The maximum horizontal portion of a cabling system from work area information Cat 6 outlet to a mechanical termination at the patch-panel in the wiring closets must not be more than 90 meters. The cable run must be free of bridges, taps and splices.

Both ends of the cable shall be labeled for identification, i.e., at the patch panel and work area information outlet according to EIA/TIA 606 administration standards for the Data cabling of commercial buildings.

The horizontal cabling system shall be correctly designed and the work area

outlets in each shown or required location shall be correctly mapped to an appropriate wiring closet. The star topology shall be applicable to every individual unit of the transmission media.

10. FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution frames to the data center shall be of multimode OM4 fiber cable 50/125 microns; 8-core cable with color-coded fibers. All fiber optic cables shall be laid in straight run without intermediate splices and all fibers shall be terminated at either end using suitable fiber cable patch panels mounted on the wiring closets.

OS2 9/125 microns single mode fiber optic cable shall be used to connect server room IDF rack to other premises IDFs

All fiber optic backbone links between the main cross connect and the Telecommunication rooms have a backup link using a different route from the main fiber optic link. Each of these links shall be 8-core fiber optic cable as described in this document.

The Contractor shall be responsible for the supply, installation, testing and commissioning of the complete fiber cable backbone interconnection/cross connection requirements of the "building/complex" LAN Cabling System.

The Contractor shall install suitable fiber optic pigtails/connectors needed to complete the entire fiber cable installation as per the manufacturer's recommendation and shall ensure that the backbone is capable to handle the traffic and provide error-free universal data transport for the foreseeable future.

All of the fibers in the backbone shall be terminated with LC type connectors at the time of the installation. The Contractor shall ensure proper testing of the fibers and make them available whenever they are needed. No fibers shall leave unterminated, all fibers must be terminated. A document with fiber cable test results for every fiber cable link shall be provided by the Contractor.

The Contractor shall observe the manufacturer's specifications for maximum tension and minimum bend radius for each fiber optic cable. The contractor shall provide a copy of the manufacturer's specifications to company prior to the commencement of the work.

Care must be taken when mechanical pulling devices are used, that maximum tension limits are not exceeded. Minimum bend radius specification shall not be violated when the cables are routed through walls or around corners. The contractor shall ensure that all installation personnel are aware of these limitations.

The Contractor shall follow an intelligent numbering system based upon the destination and channel number. The numbering system shall have a prefix 'F' to indicate it is a fiber optic cable, followed by the destination IDF, then a hyphen and the channel within the cable.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

11. OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION

Fiber optic cables within the premises shall use multimode, graded-index.

Fibers must comply with TIA/EIA 492 specifications and OM4 fiber specification as in ISO 11801 standard.

Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.

All fibers shall be colour coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	50 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm
Numerical Aperture:	0.200 \pm 0.015
Cladding diameter:	125 $\mu\text{m} \pm 1 \mu\text{m}$
Cladding Non-Circularity:	<2.0%
Coloured Fiber Diameter:	250 $\mu\text{m} \pm 15 \mu\text{m}$
Buffering Diameter:	890 mm \pm 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius: During Installation: After Installation:	20 times cable diameter 10 times cable diameter

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.5 dB/km at 850 NM 1.5 dB/km at 1300 NM
Minimum Bandwidth:	1500 MHz. km at 850 nm (OFL) 500 MHz. km at 1300 nm (OFL) 2000 MHz. km at 850 nm (DMD, laser) 500 MHz. km at 1300 nm (DMD, laser)

Fibers must comply with TIA/EIA 568 specifications and OS2 fiber specification as in ISO 11801 standard. It shall comply with ITU G.652.D

Core	9 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm

Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 µm ± 1 µm
Cladding Non-Circularity:	<2.0%
Minimum Tensile Strength:	1340N at installation and 400N after installation
Cable Minimum Bending Radius:	
During Installation:	230mm
After Installation:	150mm

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-104°F to 167°F (-40°C to 75°C)
Maximum Fiber Loss:	0.75 dB/km at 1310 NM 0.75 dB/km at 1550 NM

12. DATA OUTLET

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, cabinet number, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to TIA/EIA 606 Administration Standard.

The contractor has to provide clear identification labels for Data.

In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location as indicated in its design/engineering drawing, the contractor shall notify the Company of this, the contractor shall not make its own discretion in modifying or changing any information provided in the approved design drawings.

The type of information outlets shall be of modular Tool less RJ45 of Matt Chrome/ metallic or any other approved(design engineer) finish, 8 position, 8 conductor with front cover designed for high speed networking applications that use data transmission rates over frequency ranges up to and potentially beyond 250 MHz & 100 MHz.

The 8 position/8 conductor outlet shall meet the category 6 transmission requirements for connecting hardware specified in ISO/IEC 11801 and EIA/TIA-568A/B and Class E design guidelines.

The modular outlet shall provide maximum versatility in designing a premise distribution system. It shall be designed to snap into modular faceplate. When the outlet is inserted into the faceplate or frame, it shall lock into place and shall only be released using the dual-purpose wire insertion tool. The mounting and removal system shall allow easy installation and modification. The faceplate jacks must be shutter protected and shall include a label window required to write circuit identification number. Each port must support a color icon to identify the port function.

The plastic used to construct the modular data outlet shall be of high impact, flame-retardant, made of poly phenylene oxide with flammability rating meeting UL 94V-0UL, the jack wires shall be at least 50 micro-inch lubricated gold plating over 100 micro-inch nickel under plate. The connector shall be of copper alloy, at least 100 micro-inch bright solder over 100 micro-inch nickel under plate.

The insulation displacement connector shall accept 24/23 AWG solid copper wire conductors. The connector shall have multicolor labels marking wire terminals with numbers, assuring fast, accurate installation. The outlet must support wiring configuration as per T568A and T568B on the same RJ-45 jack

The connector shall be wired using the wire insertion tool (impact tool). The module shall be wired from the centre to the outside and shall not untwist paired conductors more than 12.7 mm. In the process of terminating the cables in patch panels/outlets the Contractor shall ensure ISO/IEC and TIA/EIA category 5E/6 transmission performance requirements.

13. PATCH CORDS

The contractor shall supply patch cords for all the installed points on the network switch side as well on the workstation side. The cord length shall be of two different sizes 6-ft. [1.5 m] on the network switches side and 10 ft. [3.05 m] and 2m on the workstation side as per drawing and specifications.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 wiring standards capable of connecting high speed information terminal devices to information outlets, to interconnect information terminal devices and 8-position modular jack panel applications. The patch cord shall be designed to provide support for extended multimedia transmission distance over frequency ranges up to and potentially beyond 100/250 MHz.

The patch cord shall support the computer networking applications over frequency ranges up to and potentially beyond 250 MHz and shall be compatible with voice and information applications.

The construction of the cord shall be of Cat 6 stranded type cordage tightly twisted, 24 AWG, 8 conductor. The cord shall be terminated to an 8-position RJ-45 modular plug on both ends. The cords shall support the transmission requirements warranted to meet ISO/IEC 11801 Class E, EN 50173 or TIA/EIA 568B Category 6, Class E component specifications and standards.

The Contractor supplied cord shall be of factory crimped modular plug at both ends.

14. PATCH CORD ORGANIZER

The Contractor shall supply and install sufficient patch cord organizers/ patch cord organizers that are used for routing patch cords in 19-inch (48.3-cm) frames. The patch cord organizers shall support the requirements of routing patch cords both at the equipment side as well as the Category 6-patch /Cat 6A panel cabling side at the wiring closets. These organizers shall be located in the 19-inch frame inside the wiring closet.

The Contractor supplied patch cord organizers/ patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

15. PATCH PANELS (JACK PANELS)

The Contractor shall supply and install the modular patch panels to meet the full cabling system requirement of the "building/complex". Every category 6 cables serving the information outlets at work areas shall be terminated at the patch panels. The Contractor shall ensure that the supplied patch panels meet the ISO/IEC 11801, EN 50173 and TIA/EIA 568 warranted component specifications and standards.

The patch panels shall be of 19-inch rack-mounted panels. The rear of the panel shall feature connecting blocks mounted on a printed wiring board. These connecting blocks shall be capable for use in terminating category 6 station wires, equipment, or tie cables. The modular patch panel shall be capable of supporting up to 24 jack positions (ports) as required by the design drawings of the Data system and shall have the facility to write the circuit designation details at the front side of each jack. The contractor shall provide 20% spare capacity for both the Data and voice.

The insulating displacement connector field in the patch panel shall be made continuous to the 8-pin modular tool less jack field on front of the panel through printed wiring board connections to enhance the features to confirm to TIA/EIA 568A/B cabling recommendations.

The construction of the modular jack panel shall be of category 6 – compliant and shall have the stringent requirements of connecting hardware as specified in TIA/EIA 568A/B commercial/ residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in TIA/EIA 568 A/B and ISO/IEC 11801, EN 50173 Category 6 specifications. The modular patch panels shall meet the worst-pair near-end cross talk (NEXT) requirements over the entire frequency ranges up to and potentially beyond 100/250 MHz on all pair combinations.

Care must be taken to ensure that the cables are terminated correctly at category 6 cross connect hardware (patch panels).

The cable conductors shall be terminated as described in TIA/EIA 568A/B and ISO/IEC 11801, EN 50173 Category 6, Class E wiring sequence by using the proper insertion tool (impact tool).

When terminating the cables in the insulating displacement connector field, care must be taken to ensure that the strip – back is limited only as much cable jacket as is required to perform connecting hardware terminations. The cables shall be properly secure terminations. The cables shall be properly secured to the 19" rack with cable ties as well as at the patch panels.

Each port of the patch panel must support color Icon to identify the port function.

Each port must be numbered in sequence with white printing on black

background or other high contrast colors.

Each port on the patch panel must have a label place holder and for the patch panel number.

The package must include frame mounting screws, labels, cable ties and instruction sheet.

16. CABLING CABINET (STEEL CABINET)

The Contractor shall supply and install cabling System Cabinets to house the passive and active network equipment. The cabinets shall be freestanding / wall mounting types.

Two type of 42U free standing cabinet shall be used in IT rooms and in Data centre. Furthermore 12U & 18 U Racks shall be used in Gate Office. The technical specification is as per the following:

The Contractor supplied Cabling System cabinets shall meet the requirements of accommodating the high volume of cabling 19" 24-port patch panels & LAN Equipment fully assembled with the following items.

For data Centre rack Cabinet dimension 42U 600 mm x 1000 mm nominal width & depth). The cabinets must meet the following specifications:

42U 800 x 1000 Ready Rack
1600 KG load rating
42U 4mm Safety Glass Door (On the front).
42U 1.5 mm steel Door (On the rear).
800 x 1000 mm side vented top cover.
Castors heavy duty braked.
42U Panel mounting angle kit.
Thermostat controlled Low Noise Fan Tray.

For 12U Racks dimensions will be 800 x 800mm nominal width and depth

12U 800 x 800 Ready Rack
45 KG load rating
12U 1mm Safety Glass Door (On the front).
12U 1 mm steel Door (On the rear).
800 x 800 side vented top cover.
12U Panel mounting angle kit.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light with mounting brackets. The AC Mains distribution integral at the rear pillar of the cabinet should have at least 10 of 13 amp. Power Outlets. Cable management panel inclusive of other accessories such as earthing kits, screws, washers, grip-nuts and a removable shelf, able to resist a weight of 50 to 60 kgs. The cabinets shall be rugged and strong and all steel shall be finished scratch proof in a durable enamel Grey paint on both sides.

The cabinets must include Low Noise Thermostat controlled fans and shall automatically switch on and off according to the temperature inside the

cabinets, the temperature range shall be from 10 to 60 degrees centigrade. The dimensions of the tray shall be of 600 mm x 800 mm. The fan tray shall have minimum of four fans 250 Volts AC + 6% 50 Hz. The low noise top mounted fan tray shall aid the cooling requirement of the LAN equipment installed inside the cabinets, and in the process of installing the fan tray on top of the cabinet it shall not occupy any of the usable U height in the cabinet.

The front glass door shall have at least 4 mm toughened & 50 percent light transmission smoked safety glass able to resist a weight of 80 to 100 Kgs. Placed within 200 mm of the door center. The door shall be lockable and shall have a swing handle supplied with 2 keys.

The rear door shall be the same as the front except the construction of the door shall be of rugged and strong 1.6mm steel finished in a durable enamel Grey paint on both sides, and without glass.

The internal panel mounting angles shall be supplied in pairs to provide 19" mounting positions with hole patterns to accept captive nuts on universal centers. In the design of the panel mounts the centers of each U height shall be notched, to make the positioning of cage nuts much simpler. The panel mounting shall be fitted onto panel mount angle supports to allow infinite adjustment throughout the depth of the track.

The cabinets shall be supplied at least with one shelf kit. The shelf should carry a load rating of 50 kgs. And shall be manufactured with holes/slots providing sufficient airflow to LAN equipment when installed inside the cabinets.

Four steel castors with rubber wheels at least 40 mm high. These castors shall be mounted at the corners of the cabinet and be able to support the total weight of the cabinet and all options.

The cabinets must support the installation of fire protection units and all 19" equipment including frames for 110-punch block.

The supplied cabinets must meet the following standards:

- IEC 297-2
- D/N 4/494 Part 7
- D/N 4/491 Part 1
- Load rating 500 Kg
- Rust proof coating
- EN 60950
- VDE 0100
- Material 1.6mm steel
- Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

- IEC 297-2
- D/N 4/494 Part 7
- D/N 4/491 Part 1
- Load rating 500 Kg
- Rust proof coating
- EN 60950
- VDE 0100

Material 1.6mm steel
 Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

IEC 297-2

D/N 4/494 Part 7

D/N 4/491 Part 1

Load rating 500 Kg

Rust proof coating

EN 60950

VDE 0100

Material 1.6mm steel

Paint finish according to RAL 7035

42 U free standing open frame

Integrated cable and cord management

allows for more efficient and effective cable management

Focused on accessibility

Extruded aluminium construction

Modular open frame design (no doors and side panels to remove)

Pre-threaded mounting holes

42U with 270 holes per vertical channel meets TIA/EIA RMU rack mounting unit dimension

Mounting screws with pilot point

Cable guides provide an effortless solution to transitioning cables

Flexible cable guides allow cable to snap-in easily for quick cable routing

Spacing of cable guides aligns exactly with the standard ISO 1101 rack

Unique switch gate Door / Cover provides easy access to the door

Edge protected pass through holes for transition of cables to rear side

17. VOICE CABLING SYSTEM

MTJB shall be provided at Admin Block for distribution. Incoming PTCL cable shall be coming from complex PTCL room located near complex main entrance. Each building shall have dedicated IDF racks which shall connect from MDF through Multipair backbone cable network.(It is part of infrastructure).

Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor (TJB).

Telephone system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, 110 wiring block, connectors, telephone junction box and main distributor frame.

The telephone cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

18. SCOPE

The contractor shall carefully examine all of the specifications to ensure that

he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

19. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of telephone cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for telephone system, including TJB and terminal connections.

20. TELEPHONE CABLING

Vertical runs between floors extending from the MTJB to each IDF Rack using multi pair 25 pair CAT 5e cables installed on cable tray.

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside.

Cat 6 cable shall be used for cabling from IDC block to telephone outlet.

21. IDC WIRING SYSTEM

The IDC blocks shall be used for the voice cross connect and should be 19" rack mountable type. 100 pair and 50 pair IDC block to be used.

The IDC blocks shall be capable of terminating cables as stated in drawings.

Shall be capable to terminate 22-24 AWG solid conductors or 22-24 AWG stranded conductors.

Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit includes connecting blocks, labels and label holders shall be used.

Jumper troughs shall be used to route cable horizontally and vertically.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors cables.

22. TELEPHONE JUNCTION BOX.

The telephone Junction Box (TJB) shall be made of 16 SWG sheet steel, anti-rust treated and painted to match the wall color, suitable for recess mounting and shall be of appropriate size to accommodate terminal strips with adequate space available for wiring. The terminal strip shall be made of copper, soldered type with suitable capacity for terminating all incoming and outgoing cables including direct lines. The strip shall be installed on insulated material sheet inside the sheet steel box.

The TJB shall be provided with a lockable hinged door, fastened to the steel outer Box by means of nuts and bolts.

23. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

24.0 WIRELESS LAN:

Summary Standard: 100% coverage at -65dB controller based solution supports 802.11ac wave 2

Core/ Optional: Core

Hosting Location: University

Wireless LANs are required to provide internet access throughout the university premises. The selected vendor must ensure 100% WIFI signal coverage in computer labs, waiting rooms, demo rooms, departmental libraries etc.

WLAN engineering is required to support VoIP (e.g skype, etc.) services related to business applications.

In converged networks, all wireless access points are considered capable of carrying associate back office traffic, regardless of their physical location at the property.

The strength of the WIFI must be -65dB, enough for a smartphone. The WIFI system controller is based and managed through a HSIA gateway.

To ensure compliance for above, the approved vendor for WIFI will require completing and providing relevant 'heat maps' and blue prints for WIFI topology. This will be conducted via a Site Survey during the initial design and at the final stages of university construction.

24.0.1 SITE SURVEYS

Conduct two mandatory wireless site surveys by a qualified wireless integrator to ensure adequate signal throughout the project coverage area. Depending upon the size of the property, the initial desktop survey can be performed using a passive (application generated) survey of signal and noise statistics. The second physical survey must be conducted following the completion of wireless installation.

A. Initial Desktop Survey:

- Conduct initial survey by computer modeling based on construction documents.
- Identify architectural and structural elements that obstruct or diminish wireless signal strength.
- Conduct survey prior to completion of the low voltage drawing.

B. Physical Survey:

- Conduct the second survey on site following substantial completion of the exterior building envelope (roofs and walls) and interior partitions to account for the impact of building materials (drywalls and windows) and sources of EMI/ RFI signal strength.
- Provide details on items not yet installed involving water and large metal objects.
- Consider the presence of special coatings or materials (e.g., UV) on windows if the interior wireless access points are intended to provide

coverage of exterior areas.

- Physical Survey Report shall include the following information:
- Map of signal, noise and user performance; Coverage by SSID (Service Set Identifier); Power level by access point
- The physical survey provides frame data rates; packet retries and error rates.

24.0.2 WIRELESS ACCESS POINT ANTENNAS

There are many types of antennas used with wireless access points. Use appropriate antenna types(e.g., wireless access points located outside utilize antennas designed for exterior use). Ensure that the Design Team is aware of the antenna dimensions used and accounts for appropriate allocation in the design. Generic access points are not acceptable.

Wireless Standards: Wireless access points shall support 802.11ac wave 2 standard.

24.0.3 POWER OVER ETHERNET (POE+)

Power must be provided to the wireless access points through the use of POE+ [IEEE standard 802.3 af]

- The current standard for POE+ is outlined in the IEEE 802.3at standard.
- When POE+ is utilized, there is an impact on the LAN switch models/modules used and therefore on the LAN switch infrastructure cost.
- The use of POE+ may impact power and cooling requirements for the IDF/MDF where POE switches are located.
- If POE is not used, installation of additional power outlets in the vicinity of each wireless access point is required and increases construction costs.

SECTION – E - 8 EARTHING SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the electrical lines and equipment.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Earth Rod Electrodes

Drive extensible rods of the same diameter into the ground, as per detailed item mentioned in BOQ, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode & no separate pavement shall be made for it.

4.3 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes

indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in section E - 3 of these specifications. PVC insulated cables when used as E.C.C. shall be green,

5. INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape armours are not permitted as grounding conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to LV Switchboard, LV Distribution Board or any other metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be in general run in cable trench or in conduits / pipes as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along under ground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1 : 3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter G.I. shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection

chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

SECTION – E – 09
CABLE TRAY, LADDER AND TRUNKING

1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. SUBMITTALS

General: Submit the following according to the Division 1 Specification Sections.

Product data for each component. Show tray types, dimensions, and finishes. Determine the sizes of the cable trays based on the number and size of cables laid on the cable trays plus 20% space for future growth. Cables laid on cable trays shall be spaced twice their overall diameter (consider the largest cable as reference). In case of discrepancy with the contract documents this clause shall prevail, unless approved by the Engineer otherwise.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plates connectors, expansion joint assemblies, straight lengths, and fittings.

Co-ordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

3. QUALITY ASSURANCE

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays which has a record of successful in-service performance.

Comply with the relevant standards of BS, NEMA and NEC.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

4. SEQUENCING AND SCHEDULING

Co-ordination: Co-ordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

5. CABLE TRAYS

The cable tray system shall be of one manufacturer and shall include factory made trays, tray fittings, connections and necessary accessories and supports to form a complete tray support system.

The cable tray system shall include the following factory made tray elements. Straight trays and ladders, fittings and horizontal and vertical bends of various angle crosses, tees, wyes, reducers, vertical riser elements, connectors and all necessary fixing accessories.

Cable trays shall be constructed from mild steel of minimum thickness 16 gauge (1.5 mm). Trays in excess of 300 mm width shall be of minimum thickness 14 gauge (2.0mm).

Insert elements, bolts, screws, pins etc., shall be mild steel cadmium plated.

- a. Tray work shall have oval perforations. Ladder type trays shall be used as required and/or approved by the Engineer.

- b. All trays (straight and fittings) to be heavy duty return flanged type unless specified otherwise.
- c. Tray component are to be accurately rolled or formed to close tolerance and all edges rounded. Flanges are to have full round smooth edges.
- d. Ladder racks of widths up to and including 300mm shall be constructed from rolled steel sections of minimum thickness 16 gauge (1.5 mm). Ladders in excess of 300 mm width shall be C Section construction with a minimum thickness of 14 gauge (2.0mm). the rungs shall be spaced at a maximum 300 mm.
- e. Unless indicated otherwise on drawings, cable trays shall be used in the range 150 mm to 900 mm wide, in fire preferred standard sizes: 150, 300, 450, 600 and 900 mm.
- f. Other sizes shall be used where specified or previously agreed with the Engineer.
- g. Flanges shall be a minimum of 50 mm deep.
- h. Minimum radius at side rails, horizontal and vertical tees and crosses shall be in accordance with the Manufacturer's standard.

Perforated, heavy duty, return flange type, in 2.5m nominal lengths Hot dip galvanized after completion of bending and drilling, complete with all necessary purpose made bends, tees, supports and the like. Width shall be such as to permit adequate access for installation and maintenance of cables and per the requirements of WAPDA regulations.

6. CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

7. EXAMINATION

Examine surfaces to receive cable tray, cable trunking and cable ladder for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

8. WIRING METHODS

Use cable tray of complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

9. INSTALLATION

- a. Install cable tray, cable trunking and cable ladder level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- b. Remove burrs and sharp edges of cable trays.
- c. Make changes in direction and elevation using standard fittings.
- d. Make cable tray connections using standard fittings.
- e. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- f. Fire stop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- g. Working Space: Install cable trays with sufficient space to permit access for installing cables.

10. GROUNDING

Connect cable trays, cable trunking and cable ladder to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

11. CLEANING

Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

SECTION – E – 10

PUBLIC ADDRESS SYSTEM

1. SUMMARY

This Section includes equipment for amplifying, distributing, and reproducing sound signals.

2. DEFINITIONS

Retain abbreviation and terms that remain after this Section has been edited.

Channels: Separate parallel signal paths, from sources to speakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

PA/VA Zone: Separate group of speakers and associated supply wiring that may be arranged for selective switching between different channels.

VU: Volume unit.

3. SUBMITTALS

Product Data: For the following:

Adjust list below to suit Project.

Voice Alarm Controller

Power Supply Manager

Power amplifiers.

Microphone.

Equipment rack.

Stereo Mixer

Speakers (Wall, ceiling etc).

Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Field quality-control test reports.

Operation and maintenance data.

4. QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

Comply with EN 60849 and EN 54-16 Standards as PA/VA.

5. COORDINATION

Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

6. FUNCTIONAL DESCRIPTION OF SYSTEM

Descriptions below are offered as examples only. Revise this Article to convey design intent to Contractor and Installer. PA system has built in emergency voice evacuation system so that in case of emergency it shall override the announcement and allow prerecorded emergency message.

System Functions: Include the following:

- Emergency voice announcement shall be announced in the event of fire and the system manager shall interfaced with Fire alarm panel.
- Delete functions in subparagraphs below that are not required and edit remaining descriptions to suit Project; add other functions as required.
- Selectively connecting separate zones to different signal channels.
- Selectively amplifying sound among various microphone outlets and other inputs.
- Communicating simultaneously to all zones regardless of zone or channel switch settings.
- Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.

Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed. Reproducing high-quality sound that is free of noise and distortion at all speakers at all times during equipment operation including standby mode with inputs off; and output free of non uniform coverage of amplified sound. In case of emergency built in Emergency Voice Evacuation system shall enable and announce through speakers.

7. EQUIPMENT AND MATERIALS

Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Modular equipment type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 100 to 240 V, 50 Hz.

8. VOICE ALARM SYSTEM:

Comply with EN 54

Power Source: 31V DC, removable terminal blocks (4 pins)

Speakerline: 4 channels (with AB speaker line output)

Audio Input: 4 inputs (Line: -20 dBV / Mic: -60 dBV / ANC sensor, phantom power selectable)

DSP: Feedback suppression, Equalizer/Filter, Compressor, Delay and Ambient Noise Control (ANC)

Control Input: 16 inputs, no-voltage make contact input, open voltage: 24 V DC, short-

circuit current: 2 mA

Fault Detection System: Short circuit, Open circuit, Method:

Voltage

detect ; Connector: RJ45 connector ; Connection Cable: CAT5-

STP

Power Amplifiers: 4

Dimensions (W x H x D): 482 x 132.6 x 345 mm (19", 3U)

Standby Amplifier: Input: 1, Output: 1 ; Max. Voltage/Current: 100 Vrms, 5 Arms ; Connector: Removable terminal block (2 pins) x 2

LAN A,B: No. of Connectors: 2 (LAN A, LAN B) ; Network I/F: 100BASE-TX ;
Network

Protocol: TCP, UDP, ARP, ICMP, RTP, IGMP, FTP, HTTP ; Spanning tree
 Protocol: RSTP ; AudioTransmission System: TOA Packet Audio ; Audio
 Encoding Method: PCM ; Audio Sampling Frequency: 48 kHz, 16 bits
 Connector: RJ45 connector ;
 Connection Cable: CAT5 ; Max. Cable Distance: 100 m

9. DIGITAL POWER AMPLIFIER MODULE

Comply with EN 54
 Power Source: 31V DC (operating range: 20 to 33 V DC)
 Amplification System: Class D
 Rated Output: 150W (at 100V line), 105W (at 70V line), 75W (at 50V line)
 Output Voltage: 100V(70V,50V selectable)
 Frequency Response: 40 Hz to 20 kHz: - 5 to +1 dB
 Max Capacitive Load: 0.5 uF
 Distortion: 1 % or less (at 100 V line, A-weighted)
 Min Resistive Load: 67Ω (100 V), 47Ω (70 V), 33Ω (50 V)

10. POWER SUPPLY MANAGER

Comply with EN 54
 Power Source: 220 – 230 V AC, 50/60 Hz
 Power Consumption: 2800 W max in total (at rated output with charging), 650
 W max in total, 350 W max each (EN 60065)
 Charging Method: Temperature compensated trickle charging
 Battery Connection: One each positive and negative terminal, applicable
 cable
 diameter: AWG 6 – AWG 0 (AWG 1/0) (16 mm² – 50 mm²)
 Line resistance within 4 mΩ/ total
 Control Connector: RJ45 female connector for connecting the system and
 cascade
 connection, Shielded Twisted-pair straight cable (TIA/EIA-
 568A
 standard) Type of control signal: Battery check, AC power
 status,
 DC power status, charging circuit failure, battery failure,
 and
 communication
 DC Power Output: 8 x 31 V (19 – 33 V) 25 A max. each, M4 screw terminal,
 distance
 between barriers: 11 mm 3 x 31 V (19 – 33 V) 5 A max. each,
 removable terminal block (3 x 2 pins) 1 x 24 V (16 – 25 V) 0.3
 A
 max., removable terminal block (1 x 2 pins)
 DC Power (AC Mode): Rated output: 2300 W (total DC power output), Peak
 output:
 2780 W (total DC power output)

11. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SENATE

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage
at 20 Ω		
Impedance.		
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 Ω
Number of channels	:	4
Output voltage per channel	:	100V with 100V line voltage at 20 Ω at 1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4 Ω
Impedance.		
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

12. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SEMINAR

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power line	:	2 channels: 250W x 2 with 100V and 40 ohm impedance
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	580W with impedance of 40 Ω and 100V output line
Number of channels	:	2
Output voltage per channel	:	100V with 100V line voltage at 40 Ω at 1kHz
Mounting	:	Rack mounted.
Option	:	Matching Transformer. Power cord, removable terminal plug

13. DIGITAL STEREO MIXER FOR SENATE

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Sampling Frequency	:	48kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1kHz in rated 20 to 20kHz band pass frequency.
Output	:	4 output channels with 4 dB with 24dB max with 1 recording output
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	<ol style="list-style-type: none"> 1. Feedback suppression function that eliminates feedback caused by microphone. 2. It shall have automatic resonance control measurement and processing algorithm that

optimizes speech and sound clarity for individual acoustic environments.

3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input automatically when detecting a monaural control signal.

14. GOOSENECK MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Electret condenser element with cardioids polar pattern
Phantom supply	:	9 to 52V DC
Output Connector	:	XLR – 3- 12 equivalent
Cable	:	C25J
Mounting	:	Desk stand with push to talk application, press to talk switch. It shall be mounted on base stand.

15. WIRELESS HANDHELD MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105
Type	:	Dynamic or unidirectional characteristic with built in antenna
Channel selection	:	64
Maximum input level	:	132dB SPL
Supporting accessory	:	Wireless transmitter
Power requirement	:	2, 6 or 12 single AA rechargeable batteries

16. REMOTE DIPOLE ANTENNA FOR SENATE

Power requirement	:	7 to 12V DC (from amplifier or wireless tuner)
Receiving Frequenc	:	550 to 932 UHF MHz
Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 Ω
Accessories	:	M3.5 screw for wiring box, Tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves

17. CD / USB / MP3 / TUNER PLAYER FOR SENATE:

Power source	:	7 to 12V DC (from amplifier or wireless tuner)
Receiving Frequency	:	550 to 932 UHF MHz
Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 Ω
Accessories	:	M3.5 screw for wiring box, Tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves(optional)

18. LINE MATCHING TRANSFORMER FOR SENATE:

Rated Input	:	200W
Primary Impedance	:	50 Ω on 100V line and 25 Ω on 70V line
Secondary Impedance	:	8 Ω
Supporting equipment	:	Mounting Brackets and it shall work with line array speakers with option of speaker rigging frame

19. SUBWOOFER SYSTEM FOR SENATE:

Subwoofer systems contains 15" cone type woofer as speaker component with optional speaker rigging frame.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8 Ω
Sensitivity	:	93dB
Frequency Response	:	40 Hz – 400 Hz

20. LINE ARRAY SYSTEM FOR SENATE:

It shall work on 4 different angles 15°, 30°, 45° and 60°.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8 Ω
Sensitivity on 60° mode	:	96dB
Sensitivity on 45° mode	:	97dB
Sensitivity on 30° mode	:	98dB
Sensitivity on 15° mode	:	99dB
Frequency Response on 60° mode:	:	95 Hz – 20 kHz
Frequency Response on 45° mode:	:	100 Hz – 20 kHz
Frequency Response on 30° mode:	:	105 Hz – 20 kHz
Frequency Response on 15° mode:	:	110 Hz – 20 kHz
Finish	:	Polypropylene or as required
Water Protection	:	IPX4 (install with every speaker module downward)
Accessories	:	Line matching transformer, speaker stand adapter and speaker mounting bracket and hanging bracket
Enclosure	:	Bass reflex type or sealed type

21. UHF WIRELESS TUNER FOR SENATE:

Channels	:	64 selectable frequencies
Power Requirement	:	AC Mains (supplied AC – DC adapter must be used
Receiving Frequency	:	576 – 932 MHz
Harmonic Distortion	:	1 % or less (typical)
Signal to Noise Ratio	:	110dB or more
Frequency Response	:	within \pm 3dB from 100 Hz to 15 kHz
Accessory	:	AC – DC adapter with rack mounting kit

Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 Ω with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

22. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR LECTURE HALL

Comply with TIA/EIA SE-101-A.
Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage at 20 Ω impedance.
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 Ω
Number of channels	:	4
Output voltage per Channel	:	100V with 100V line voltage at 20 Ω at 1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4 Ω
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

23. DIGITAL STEREO MIXER FOR LECTURE HALL

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Sampling Frequency	:	48kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1kHz in rated 20 to 20kHz band pass frequency.
Output with 1 recording output	:	4 output channels with 4 dB with 24dB max
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	<p>1.Feedback suppression function that eliminates feedback caused by microphone.</p> <p>2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments</p> <p>3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input automatically when detecting a monaural control signal.</p>

24. DIGITAL STEREO MIXER FOR SEMINAR:

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20kHz
Power consumption	:	14W
Power source	:	220-240V AC, 50/ 60 Hz
Sampling Frequency	:	48kHz
Input Channel	:	6 monaural and 3 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1kHz in rated 20 to 20kHz band pass frequency.
Output terminal	:	2 monaural output channels , removable blocks, 1 stereo output, and 1 stereo recording output.
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Stand alone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1.Feedback suppression function that

eliminates feedback caused by microphone.

2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments

3. Automatic clipguard function for 6 each monaural input channel with independent settings for each channel.

4. Automatic mute function with on/off function switch

Accessory : Power cord, Removable terminal plug, rack mounting bracket, machine and rack screw.

25. GOOSENECK MICROPHONE FOR SENATE HALL, SEMINAR:

Microphone : Comply with TIA/EIA SE-105.
 Type : Electret condenser element with cardioids polar Pattern
 Phantom supply : 9 to 52V DC
 Output Connector : XLR – 3- 12 equivalent
 Cable : C25J
 Mounting : Desk stand with push to talk application, press totalk switch. It shall be mounted on base stand.

26. WIRELESS HANDHELD MICROPHONE FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER:

Microphone : Comply with TIA/EIA SE-105
 Type : Dynamic or unidirectional characteristic with built in antenna
 Channel selection : 64
 Maximum input level : 132dB SPL
 Supporting accessory : Wireless transmitter
 Power requirement : 2, 6 or 12 single AA rechargeable batteries

27. UHF WIRELESS RECEIVER FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER

Channels : 64 selectable frequencies
 Power Requirement : AC Mains (supplied AC – DC adapter must be used
 Receiving Frequency : 576 – 932 MHz
 Harmonic Distortion : 1 % or less (typical)
 Signal to Noise Ratio : 110dB or more
 Frequency Response : within \pm 3dB from 100 Hz to 15 kHz

Accessory	:	AC – DC adapter with rack mounting kit
Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 Ω with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

28. REMOTE MICROPHONE:

Power Source	:	24 V DC (operating range: 15 - 40 V DC),
Current Consumption	:	240 mA or less
Microphone	:	Unidirectional electret condenser microphone with AGC (ON/OFF selectable)
Volume Control	:	Microphone volume, Monitor speaker volume, Chime volume (using the software)
Connectable Cable	:	Main line: Shielded CPEV cable or
Shielded		Category 5 twisted pair cable for LAN
(CAT5-		STP), Branch line: Shielded Category 5
connector		twisted pair cable (CAT5-STP), RJ45
Operation:		Emergency/all-zone emergency broadcast key, Talk key, 13 Function keys

29. COMPONENTS:

Parameters listed in this Article are typical values. Performance and product characteristics vary among manufacturers. Revise to suit Project.

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Dynamic, with cardioids polar or unidirectional characteristic
Impedance	:	120 ohms.
Frequency Response	:	Uniform, 60 to 20,000 Hz.
Output Level	:	Minus 58 dB minimum.
Finish	:	Satin chrome and as required.
Cable	:	C25J.
Mounting	:	Desk stand with integral-locking, press-to-talk switch.
Equipment Rack	:	Comply with TIA/EIA-310-D. House amplifiers and auxiliary equipment in standard TIA/EIA 19-inch (483-mm) racks.

Group items of same function together, either vertically or side by side, and arrange controls symmetrically.

Power-Supply Connections:	Approved plugs and receptacles.
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Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.

Blank Panels	:	Cover empty space in equipment racks so entire front of rack is occupied by panels.
Enclosure Panels	:	Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
Finish	:	Uniform, baked-enamel factory finish over rust-inhibiting primer or as required.
Power-Control Panel	:	On front of equipment housing, with master power on/off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
Service Light	:	At top rear of rack with an adjacent control switch.
Vertical Plug Strip	:	Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounted equipment.
Maintenance Receptacles:		Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
Spare Capacity	:	20 percent spare space capacity in rack for future equipment. Coordinate paragraph and subparagraphs below with Drawings.
Insulation for Wire in Conduit	:	Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
Microphone Cables	:	Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent. Plenum Cable: Listed and labeled for plenum installation.

30. CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power : 6/3/1.5/0.75W
SPL : 96 dB
Frequency : 100 Hz to 16 kHz

31. SURFACE MOUNT CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power : 6/3/1.5/0.8W
SPL : 96 dB
Frequency : 100 Hz to 16 kHz
Speaker Component: 12cm dynamic cone type

32. LINE ARRAY SPEAKER FOR SEMINAR:

It shall be compliant with EN 54

Power handling capacity : 180W
SPL : 92 dB
Frequency range : 80Hz to 18kHz
Impedance : 8 ohm
Option : Matching Transformer with 100V in primary side and 8ohm on secondary side, Digital Processor, Wall mounting Bracket and wall mounting tilt brackets.

33. EXECUTION INSTALLATION

Wiring Method

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended

by system manufacturer for control functions indicated.

Separation of Wires

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets:	Flush mounted.
Floor-Mounting Outlets:	Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.
Conductor Sizing:	Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
Speaker-Line Matching	
Transformer Connections:	Make initial connections using tap settings indicated on Drawings.

Connect wiring according to Division 16 Section "Conductors and Cables."

34. GROUNDING

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

35. FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:
Schedule tests with at least seven days' advance notice of test performance.
After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

Operational Test

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers.

Minimum acceptance ratio is 50 dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

36. ADJUSTING

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

37. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Section 01.

38. EXECUTION INSTALLATION**Wiring Method**

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

2 core 2.5 sqmm flexible PVC cable shall be used for wiring.

Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

Separation of Wires

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted

areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
Connect wiring according to Division 16 Section "Conductors and Cables."

39. GROUNDING

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

40. FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:
Schedule tests with at least seven days' advance notice of test performance.
After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

Operational Test

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers.
Minimum acceptance ratio is 50 dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure

level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

41. ADJUSTING

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

42. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Division 1 Section.

SECTION – E – 12

IP BASED CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

1.0 GENERAL

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll-free, 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.
- D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non warranty items.

2.0 GENERAL SPECIFICATIONS

IP MEGAPIXEL CAMERA (INDOORWALL TYPE):

The camera shall be compact rugged, IR, 0 Lux 2 MP 1/2.8" CMOS image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality and focal lens of 3.3 to 9mm. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	AES or 1/77000 sec.
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock
		(When powered by AC only)
		Synchronizes the camera to the
		power line zero crossing for roll-free

		vertical interval switching.
		(When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View	:	31 to 87, 25 to 880, 35 to 105 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3 Aspect ratio 1280 x 720 @ 1.3 MP x1.
Cabling type	:	Cat-6
Alarm Pan Input	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm I/P	:	10 VDC max, 75 mA max
Alarm O/P	:	0 to 15 VDC max, 75 mA.
Service Port	:	External 3 Connection 2.5 m pwds.
Certification	:	FCC, CE, UL/UL Listed.

3.0 INDOOR TYPE IP CAMERA (DOME TYPE):

The camera shall be compact rugged, IR with 0 lux 2 Mega pixel 1/2.8" CMOS (3 to 12 mm) varifocal lens & image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions. They shall be mounted on ceilings as indicated in drawing.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) Synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3

Cabling type	:	Aspect ratio 1280 x 720 @ 1.3 MP x1.
Pan I/P	:	Cat-6
Alarm I/P	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm O/P	:	10 VDC max, 75 mA max
Service Port	:	0 to 15 VDC max, 75 mA.
Certification	:	External 3 Connection 2.5 m pwds.
	:	FCC, CE, UL/UL Listed.

4.0 OUTDOOR TYPE PTZ CAMERA:

The camera shall be compact weather proof, IP Speed Dome 36 x optical zoom format digital color having the horizontal resolution of 18 x DIGITAL ZOOM 1080 resolution or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using Cat-6. The Cameras shall high speed pan up to 260°/sec and tilt up to 120°/sec. built-in web browsing.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non condensing. Shock resistance shall be minimum 50 gm.

Image Sensor	:	1/4" CCD
Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) Synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Resolution	:	530 TVL
Sensor Element	:	PAL 752 (H) x 582 (V)
Lens Type	:	36 x optical zoom, 12 x digital zoom.
Focal Length	:	F1.6 ≈r 3.8 f=3.4≈122.4mm.
Illumination	:	1.4 lux /0.01 lux.
Pan Range	:	On 360° Continuous, Speed 0.5 or

		260°/sec.
Preset Point/ Tour	:	32 Preset, 16 Camera tour.
Focus	:	Auto/manual.
Video Capture	:	H.264, 4CIF/CIF/QCIF
MJPEG	:	4CIF/CIF/QCIF
Image Frame rate	:	30 fps (N), 25 fps (P) for all resolution.
2 way audio	:	Simplex/Duplex 2 way audio.
Lan port	:	RJ45 Connector, 10/100 M auto.
Alarm/out	:	Dry contact or relay output standard.
RS 485	:	For external keyboard.
Audio In/Out	:	Microphone in/out.
Video Out	:	1.0 Vp-p/75Ω Bnc optional.
Motion Detection	:	1.5 Zone.
OS	:	Windows based.
Security	:	Password protection.
Certification	:	FCC, CE, UL

5.0 MANUFACTURER'S WARRANTY

Repair or replacement of defective parts for a period of two years from the date of shipment, installation.

6.0 IP Video Management Systems (VMS):

- A. IP VMS shall support minimum 128 channel.
- B. IP VMS shall provide 6 to 10 Mbps for recording of IP video stream, play back and export.
- C. IP VMS shall support recording of H.264, JPEG, and MPEG-4 IP Stream.
- D. IP VMS shall support third party H.264 Megapixel video stream up to 10Mps resolution with total system throughout recording of all IP & analog streams, playback and export.
- E. The IP VMS shall have fully open architecture with support for both IP Specific Cameras and as well as ONVIF Compliance.
- F. The VMS shall support H.264 compression, CIF 4CIF resolution at maximum 100 FPS, 16audio input and RS422/485 PTZ Control with supplied system/ third party compatible protocol.
- G. VMS shall support unlimited no's of system connected over network. Each system shall contain maximum network ports, one for IP Camera/Encoder data, 1 for client computer access.
- H. VMS shall view, managed, & playback through single user interface simultaneously with other compatible VMS through supplied PC Server & PC Client Software.

7.0 HARDWARE:

- A. The VMS server shall operate on 2nd generation Intel® Core i7 processor and 8 GB of Ram or approved equivalent.
- B. VMS server shall utilize windows 7" ultimate 64 bit operating system or windows based equivalent operating system. But it should not lesser than windows 7 ultimate.
- C. VMS server shall have internal DVD +RW
- D. VMS server shall have two DV1-D ports.

- E. VMS server shall have expansions of IP video channel capacity through a licensing without any modification in hardware.
- F. VMS server shall support multiple make/models of IP Camera and encoders including third party manufacturer.
- G. VMS server shall also support audio recording in addition to third party manufacturer's audio recording.
- H. VMS server shall support recording the internal storage (Built-in)server with additional storage utilize SCSI attached HDD1 storage.
- I. VMS server shall capable of continuous scheduled alarm/event and motion recording, pre and post alarm recording also be available and full programmable on per channel basis.
- J. The VMS system shall allow archival of video data to computers or SAN storage devices over a network connection with optional compatible archive utility. The archival schedule shall be either automatic at user defined intervals or manual and shall be configurable per connected per connected camera.
- K. VMS shall indicate system performance.
- L. RAIDS or NAS storage media built in an external shall be used. Minimum 48 TB built in shall be required. Manufacture should submit the data storage calculation prior to bidding.
- M. System shall have 6, 3.5 inch drive and optical DVR \pm RW.
- N. System shall have PC1-E slots x 16 and PC1-E x 4.
- O. Auxiliary interfaces shall be USB 2.0 and USB 3.0 ports.
- P. 100 to 240 VAC 50/60 Hz, Auto ranging.
- Q. The maximum frame per second for recording or storage shall be 15 fps. Supplier shall be responsible for better resolution and good result.
- R. The resolution or frame size is not less than 1280 x 720.
- S. System should have recording capacity for 90 days recording of all cameras at 24 hours a day.

8.0 CLIENT SOFTWARE

- A. The IP VMS shall be capable running client application.
- B. The minimum client hardware configuration shall be Intel core I7 with required graphic cards.
- C. The memory shall be 4 GB or high.
- D. The system shall have optical drive like DVR +.
- E. The optical system shall be windows based XP professional or as engineer approved.
- F. The system shall have required accessories like connecting cables, programming, hardware for rack mounting recovery disc etc.
- G. The client software shall include all licenses for any additional third party cameras. No additional license cost shall be barred by client.
- H. The client software shall have capable for interface the multiple DVR or NVR platforms.
- I. The client system & software shall support minimum 20 to 25 cameras matrix on required fps resolution. It is the suppliers' responsibility to provide the better resolution and performance.

- J. The client system & software shall provide live video review and record video view with at least 1, 5, 15, 30, 60 or 90 minutes.
- K. The client system & software shall capable to selectable in-video PT2 control or dashboard style control.
- L. The system & software shall capable for video export to any accessible media like HDD, DVD or network storage.
- M. The system shall have alarm pop-up featured and playback active alarm. It shall have on motion detection.
- N. The system & software shall have capable for matrix functionality whereby cameras sequences creating on monitor.

ELECTRICAL:

Input Voltage 100-240 VAC, 50Hz, auto ranging

Note:

**The active switches POE type is the responsibility of Client IT personal.
Passive equipments CAT 6 cable and Patch panel has been covered in
Telecom BOQ.**

SECTION - E - 12

ADDRESSABLE FIRE ALARM SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the system.

The Fire Alarm system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS/EN 5839/54

NFPA 72

Any other standard referred to in above standards or these specifications.

3. OPERATION

The Fire Alarm System shall be pre-signal non-coded type complete with battery standby power.

At locations indicated in the drawings the break glass type fire alarm stations and automatic detectors shall be installed. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

Circuit shall be so arranged that an open circuit in an initiating or indicating loop shall cause the individual zone and common trouble indication at the fire alarm control panel.

4. MATERIAL

4.1 Conduit and Conduit Accessories

The specifications for conduit and conduit accessories shall be same as given for electrical conduit in Section E - 5 of these specifications.

4.2 Fire Alarm Cable

Fire Alarm Cable shall be 2 core 1.5 sq mm shielded twisted pair, fire resistant, PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit. It shall have fire rating of 2 hours.

4.3 Power Supply

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure.

4.4 Fire Alarm Control and Indication Unit

The fire alarm control and indication unit shall be a Solid State Modular Unit consisting of the following Modules; suitable number of modules shall be used to provide facility for building. There shall be fire alarm control panel of 2 loop located at Faculty block of both Natural Sciences and Media Sciences, Admin Block's main entrance and 1 loop panel located at Library and Student Welfare Center. It shall not be possible to remove the key without turning the key to its normal position, thus resetting the alarm contacts.

i. Loop Module

Loop Module shall have multiple of supervised initiating circuit with a trouble and an Alarm Lamp for each loop. Detection circuit wiring shall be two wire Class 'A' and shall power all Detectors (Relay outputs and) voltage output for each zone alarm and voltage output for each zone trouble shall be provided.

ii. Audible Expander Modules

Audible Expander Modules shall provide for supervised control circuit for polarized alarm signaling devices loop activated lamp shall be provided for each loop to aid on system testing and trouble- shooting

iii. Power Module

Power Module shall supply the necessary power for the loop module and all Detectors (and shall contain a Battery Charger to charge the batteries) An AC power to Lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for AC power failure indication, ground fault detection, and low battery. All controls shall be behind a key-locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided. The panel cover shall be key-locked to prevent unauthorized access.

4.5 Manual Break Glass Station

The break-glass manual station shall be operated by pulling down on the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

4.6 Audible Signal Unit

Fire alarm (bell) shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors

Manual Functions

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

All initiating and indicating device circuits. All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.9 Function of Addressable Fire Alarm Control Panel (FACP)

i. **Design**

The FACP shall be solid state, modular design with integral static protection. All indicating lamps shall be long-life, low maintenance solid state light emitting diodes (LED).

ii. **Enclosure**

The FACP enclosure shall be semi-flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

iii. **Loops & Identification**

All controls shall be labeled, all loop locations shall be identified, and the FACP shall be provided with a set of permanently mounted operating instructions, to avoid confusion. Loop location identification shall be as approved by the Engineer In charge and contain up to three lines of text with 1/8" minimum character heights.

iv. **Components of Fire Alarm Control Panel**

The FACP shall include as minimum following:

- a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery-backed RAM. Removal of the board shall not cause loss of memory contents.

Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

- b. Indicating Loops: 1 and 2 loop indicating circuits shall be provided. Each circuit shall provide power for polarized alarm signaling devices. A red LED to indicate the energized state of the circuit and a yellow LED to indicate a trouble condition shall be provided for each circuit. A disconnect switch for each circuit shall be provided to allow the FACP to be tested with sounding alarm signals. When disconnected, the FACP shall indicate both trouble condition and disconnect.

v. **Manual Functions**

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a

key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

vi. System Supervision

- a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.
- b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.
- c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.
- d. All initiating and indicating device circuits shall be electrically supervised.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.10 Shop Drawings / Technical Specifications

Prior to installation of any equipment, the Contractor shall submit for approval, shop drawings including riser and terminal wiring diagrams and specifications data sheets. Submittals indicating typical one line

riser and typical specification data sheets only will not be acceptable.

The Contractor shall review the total system point to point wiring layout to assure that the correct number and type of wire and conduit sizes are installed.

Upon completion, the Contractor shall provide detailed written operation instructions and three sets of "as built" drawings including plan, layout, conduit runs and wiring diagrams as finally installed.

4.11 Addressable Audible Signal Unit:

Fire alarm sounder with strobe shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when the entire bells ring. The bell shall be connected in multiple cross loop conductors.

4.12 Addressable Smoke Detector:

The Smoke Detector is optical type and shall be connected to the specific loop. Base shall be provided with detector.

4.13 Addressable Heat Detector:

The Heat Detector is connected to the specific loop. Base shall be provided with detector.

4.11 Test

Upon completion and at such time as the Engineer incharge may direct, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

4.12 Fire Alarm Installation

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer Incharge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The mounting height of the sounder shall be above the false ceiling or 7' from F.F. level when false ceiling is not comes. The conduit and wiring of the Fire alarm system shall be as per installation instructions for conduits and wirings given in the relevant section of these specifications. The Fire alarm system conduit shall be laid 15 cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red colour at terminations in

order to distinguish it from other conduit system.

SECTION - E – 13 ACCESS CONTROL SYSTEM

1. STANDARDS

Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable.

NFPA 70 – National Electrical Code
UL294 – Standard for Access Control Systems
NFPA 72 – National Fire Alarm Code
NFPA 101 - Life Safety Code.

2. SYSTEM DESCRIPTION

The System shall be a modular and network capable access control system. The System shall have the ability of handling controlled access with various reader technologies supported simultaneously, alarm monitoring with text and graphics based annunciation. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes. This shall be integrated with BMS. Access Control Systems shall be located as specified in drawings.

The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, activation of remote devices and door control.

Access control functions shall include Enterprise level Time attendance Software, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.

The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information. The software shall utilize combo boxes for previously entered system-required data where applicable.

The method of communication from remote locations to the central components shall be transparent to the user.

After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the MANUFACTURER.

Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.

All controller components shall utilize "Distributed-Processing" concepts. The distributed processing shall include the ability to down-load operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of any other system component.

The system shall be capable of utilizing the existing LAN / WAN connecting the buildings or a dedicated security Ethernet network for Controller and Client communications.

Manufacturer: The access control system shall be from a single-source manufacturer that specializes in access control and intrusion detection systems with a minimum of 20 years experience.

Installer: Company specializing in access control and intrusion detection systems with a minimum of three years experience on systems of similar size and scope. Technicians working on project must have been certified on the hardware and software used for this project.

3. SUBMITTALS

A. Manufacturer's Data:

1. Submit three (3) copies of:

- a. Product Data Sheets
- b. Installation Instructions

2. Authorized Dealer Certificate and Certified Training Certificates of installers who will be working on this project.

B. Shop Drawings

Submit three (3) copies and digitally in AutoCad or later format on a CD (3 copies), shop drawings, including:

- a. Layout of equipment on supplied AutoCad drawings.
- b. Security Console elevation drawings.
- c. Field Controller equipment location wall layouts, including size requirements.
- d. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.
- e. Load calculations of all security equipment for proper sizing of electrical provided by the customer and standby emergency generator circuits.

C. As-Built Drawings

Update Shop Drawings to create final As-Built Drawings. Submit 3 copies and digitally in AutoCad 14 or later format on a CD (3 copies).

D. Operation and maintenance manuals

Operation Data: Include three (3) copies of the software Administrator

and Operator Manuals.

E. UPS

The UPS (Uninterruptible Power Supply) for the Server shall provide for 20 minutes of continued operation in the event of an AC Power Failure.

F. Control Panel Specifications

The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

G. Distributed Intelligence

1. The system shall use distributed intelligence architecture, with controllers operating independently of one another.

H. Stand Alone Operation

1. All database information required for stand-alone operation shall be stored at the control panel level. All decision-making shall be performed at the control panel, eliminating the need for degraded mode operation.

2. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Flash Downloadable Read Only Memory.

4. **HARDWARE REQUIREMENTS**

A. Controllers

There controllers shall be: access control 2 door type; alarm monitoring (16 supervised inputs); and relay control with the addition of REB8 relay expansion boards and. Each controller shall have the following common features.

B. Controller Board

The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. All powered connections to the controller board shall be protected by fuses. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.

C. Enclosure

The controller enclosure shall be a NEMA style metal cabinet designed for surface mounting. It shall have a tampered, removable hinged door with a high security key lock. It shall have conduit knockouts to allow from 25mm conduit to be used for wire entry into the cabinet.

D. Internal Power Supply

The controller shall have an internal power supply that will accept 50 Hz/ 220 - 240 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.

E. Standby Battery

The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. It shall be recharged by a charging circuit incorporated into the controller board.

F. Alarm Inputs

The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of eight (8). The sensitivity of the line supervision shall be 2% AA Standard. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16 zone alarm input controller.

G. Intelligent Reader Interface

The control panels shall utilize an intelligent reader interface to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Proximity, Bar Code, Touch Memory, RF and Biometric. The interface shall utilize a digitizing algorithm, which will convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

5. CONTROLLER FIRMWARE

A. General Features

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field upgradability of the features. All of the necessary software for a fully functional System is located in the controller.
 - a. 3 - 15 digit keypad Code's
 - b. Duress digit for keypad Code's

- c. 150 Time Zones for access restriction and automatic event control
- d. 128 Access Zones for access management
- e. 256 Control Zones for alarm and relay management
- f. Assigned to 1 – 4 Holiday Schedules.
- g. Automatic daylight savings time clock adjustment
- h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask,
- i. relay control
- j. Add user records
- k. Tag users for annunciation at host computer
- l. 4,000 Users
- m. 1500 event, 1500 alarm transaction buffer

B. Access Control Features

1. The controller shall include the following access control features at a minimum.
 - a. Restrict access by: time of day; day of week; door; holiday
 - b. Momentary Access of door up to 8100 seconds
 - c. Extended Access for User Definable Momentary Access duration (requires ScramblePad). ScramblePad will display time remaining on the minute, and annunciate at the defined "Warning Time"
 - d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
 - e. Unlock/Re-lock of door by CODE, card or Time Zone
 - f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring; door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed
 - g. Request-to-exit masks alarm and/or unlocks door
2. 2 person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.
3. 63 Pass back Zones. Can be disabled by Time Zone. A User can be designated with Pass back Executive Override.
4. Use Count limits on users
 - a. Absentee Rule limits on users
 - b. Temporary Day limits on users
 - c. Occupancy Counting / Minimum & Maximum limits per Passback Zone
 - d. Deadman CODE / Timer
 - e. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only during Time Zone can require dual, and selected User's Credentials can be disabled.

C. Alarm Management Features

1. The controller shall include the following alarm management features at a minimum.
 - a. Momentarily mask alarm by CODE and/or card
 - b. Mask/unmask alarm by CODE and/or card or by Time Zone
 - c. Alarm device supervised while masked
 - d. Tamper switch on alarm device monitored while masked
 - e. Tamper Input may be configured to operate as a "Latch Monitor" with the appropriate door lock hardware.
 - f. Entry/Exit delay per alarm input
 - g. Alarm input triggers relay/s

6. CARD READER/KEYPAD SPECIFICATIONS

Readers

1. The controllers shall accept all of the following reader technologies concurrently Proximity with Biometrics Fingerprint. The readers can be used for access control, alarm management, and/or relay control and shall be capable of being used alone (keypad only, card only) and any other reader technology may be combined to operate as a dual technology reader where two valid IDs (PIN and card) are required.

PART 1 - EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.
- C. Make conduit and wiring connections to existing door hardware devices as required.

3.2 TRAINING

- A. The two designated System Administrators shall attend the 3 Day Factory Velocity User Class.
- B. The Dealer shall coordinate with the System Administrators for two 8 hour Operator training sessions on the Operational System to be conducted on-site on the actual running system.

3.3 FIELD QUALITY CONTROL

- A. Test in accordance with system manufacturer guide lines or by engineer incharge.

SECTION-E-14

UNINTERRUPTIBLE POWER SUPPLY (UPS)

1.0 SUMMARY

This Section includes 400V, 50 Hz, three-phase in, three-phase out, on-line, double-conversion, static-type, UPS installations complete with transient voltage surge suppression, input harmonics reduction, rectifier-charger, battery, battery disconnect device, inverter, static bypass transfer switch, output isolation transformer, battery monitoring.

2.0 SUBMITTALS

- i. Product Data: For each UPS component indicated.
- ii. Shop Drawings: Detail assemblies of equipment indicating dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
- iii. Factory test reports.
- iv. Field quality-control test reports.
- v. Operation and maintenance data.
- vi. Warranties.

3.0 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use and for compliance with the following:

UL 1778.

Retain subparagraph below if UPS components for this Project are installed in computer rooms.

Suitable for installation in computer rooms according to NFPA 75.

4.0 WARRANTY

Special Battery Warranties: Specified form in which manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.

Warranted Cycle Life for Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 35 deg. C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	6 cycles
30 minutes	30 minutes	1.67	20 cycles
15 minutes	45 seconds	1.67	120 cycles

1. Warranted Cycle Life for Premium Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table,

including figures corresponding to the following, based on annual average battery temperature of 35 deg C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

See Evaluations.

Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.

Manufacturers will honor either of two options in subparagraph below. Initial cost increases with length of warranty.

Special Warranty Period: Three years from date of Substantial Completion.

5.0 PRODUCTS

5.1 MANUFACTURERS

Edit this Article with other Part 2 articles in which manufacturers are named. See Division 1 Section "Product Requirements" for an explanation of the terms "Available Manufacturers" and "Manufacturers" and the effect these terms have on "Comparable Product" and "Product Substitution" requirements.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

5.2 PERFORMANCE DESCRIPTION

Automatic operation includes the following:

1. Normal Conditions: Supply the load with ac power flowing from the normal ac power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
2. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter ac power output to the load without switching or disturbance.
3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated ac power to the load without switching or disturbance.
4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external

- source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
 6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
 7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
 8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
 9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.
 10. Battery backup time shall be 15 minutes at full load.

Manual operation includes the following:

1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.

5.3 SERVICE CONDITIONS

Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 5 to 45 deg. C.
2. Ambient Temperature for Battery: 0 to 35 deg. C.
3. Relative Humidity: 0 to 95 percent, no condensing.

5.4 PERFORMANCE REQUIREMENTS

The UPS shall perform as specified in this Article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

- i. Inverter is switched to battery source.
- ii. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
- iii. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
- iv. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single

harmonic component is a minimum of 5 percent of the fundamental value.

- v. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor for a period of 15 minutes.

Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 percent from nominal voltage.

Maximum Energizing Inrush Current: Six to Eight times the full-load current.

Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of battery voltage.

Output Frequency: 50 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.

Limitation of harmonic distortion of input current to the UPS shall be as follows:

Maximum Harmonic Content of Output-Voltage Waveform: 5 percent RMS total and 3 percent RMS for any single harmonic, for rated full load with THD up to 50 percent, with a load crest factor of 3.0.

Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.

Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 100 ms:

1. 50 Percent: Plus or minus 5 percent.
2. 100 Percent: Plus or minus 5 percent.
3. Loss of AC Input Power: Plus or minus 1 percent.
4. Restoration of AC Input Power: Plus or minus 1 percent.

Input Power Factor: A minimum of 0.95 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.

EMI Emissions: Comply with FCC Rules and Regulations, and with 47 CFR 15 for Class A equipment.

5.5 UPS SYSTEMS

Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.

Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.
Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.

Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch and static bypass transfer switch. Protect rectifier-charger, inverter, controls, and output components.

Output Circuit Neutral Bus, Conductor, and Terminal Opacity: Rated phase current times a multiple of 1.73, minimum.

5.6 RECTIFIER-CHARGER

Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.

Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.

Rectifier-Charger Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.

Response Time: Field adjustable for maximum compatibility with local generator-set power source.

Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

5.7 INVERTER

Description: Pulse-width modulated, with sinusoidal output.

5.8 STATIC BYPASS TRANSFER SWITCH

Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.

Switch Rating: Continuous duty at the rated full UPS load current, minimum.

5.9 BATTERY

Description: Valve-regulated, recombinant, lead-calcium units, factory assembled in an isolated compartment of UPS cabinet and complete with battery disconnect switch.

Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units, and factory assembled in an isolated compartment or in a separate matching cabinet, complete with battery disconnect

switch.

5.10 CONTROLS AND INDICATIONS

Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.

Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.

Indications:

- Quantitative indications shall include the following:
 - i. Input voltage, each phase, line to line.
 - ii. Input current, each phase, line to line.
 - iii. Bypass input voltage, each phase, line to line.
 - iv. Bypass input frequency.
 - v. System output voltage, each phase, line to line.
 - vi. System output current, each phase.
 - vii. System output frequency.
 - viii. DC bus voltage.
 - ix. Battery current and direction (charge/discharge).
 - x. Elapsed time discharging battery.
- Basic status condition indications shall include the following:
 - i. Normal operation.
 - ii. Load-on bypass.
 - iii. Load-on battery.
 - iv. Inverter off.
 - v. Alarm condition.
- Alarm indications shall include the following:
 - i. Bypass ac input overvoltage or under voltage.
 - ii. Bypass ac input over frequency or under frequency.
 - iii. Bypass ac input and inverter out of synchronization.
 - iv. Bypass ac input wrong-phase rotation.
 - v. Bypass ac input single-phase condition.
 - vi. Bypass ac input filter fuse blown.
 - vii. Internal frequency standard in use.
 - viii. Battery system alarm.
 - ix. Control power failure.
 - x. Fan failure.
 - xi. UPS overload.
 - xii. Battery-charging control faulty.
 - xiii. Input overvoltage or under voltage.
 - xiv. Input transformer over temperature.
 - xv. Input circuit breaker tripped.
 - xvi. Input wrong-phase rotation.
 - xvii. Input single-phase condition.
 - xviii. Approaching end of battery operation.
 - xix. Battery under voltage shutdown.

- xx. Maximum battery voltage.
- xxi. Inverter fuse blown.
- xxii. Inverter transformer over temperature.
- xxiii. Inverter over temperature.
- xxiv. Static bypass transfer switch over temperature.
- xxv. Inverter power supply fault.
- xxvi. Inverter transistors out of saturation.
- xxvii. Identification of faulty inverter section/leg.
- xxviii. Inverter output overvoltage or under voltage.
- xxix. UPS overload shutdown.
- xxx. Inverter current sensor fault.
- xxxi. Inverter output contactor open.
- xxxii. Inverter current limit.

Controls shall include the following:

- i. Inverter on-off.
- ii. UPS start.
- iii. Battery test.
- iv. Alarm silence/reset.
- v. Output-voltage adjustment.

Emergency Power off Switch: Capable of local operation and operation by means of activation by external dry contacts.

5.11 OUTPUT ISOLATION TRANSFORMER

Description: nit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:

Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a suitable K-factor.

- i. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
- ii. Regulation: 5 percent, maximum, at rated nonlinear load current.
- iii. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
- iv. Electrostatic Shielding of Windings: Independent for each winding.
- v. Coil Leads: Physically arranged for minimum inter lead capacitance.
- vi. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
- vii. Capacitive Coupling between Primary and Secondary: 33 Pico farads, maximum, over a frequency range of 20 Hz to 1 MHz

5.12 BASIC BATTERY MONITORING

Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
Annunciation of Alarms: At UPS control panel.

5.13 BATTERY-CYCLE WARRANTY MONITORING

Description: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring of charge-discharge cycle history of batteries covered by cycle-life warranties.

Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on front panel display.

5.14 SOURCE QUALITY CONTROL

Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:

- i. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - ii. Full-load test.
 - iii. Transient-load response test.
 - iv. Overload test.
 - v. Power failure test.
- Report test results.

6.0 INSTALLATION

Retain first paragraph below if required. Coordinate with Drawings.

Install system components on 100mm high concrete bases.

Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

See Evaluations for discussion of grounding for separately derived systems created by isolation transformers. Coordinate this Article with Drawings.

Separately Derived Systems: If not part of a listed power supply for a data-processing room, comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

Identify components and wiring according to relevant section of this specifications Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

7.0 FIELD QUALITY CONTROL

Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.

Manufacturer's Field Service: Engage a factory-authorized service

representative to inspect, test, and adjust equipment installation including connections and to assist in field testing. Report results in writing.

Electrical Tests and Inspections: Perform tests and inspections according to manufacturer's written instructions and as listed below to demonstrate condition and performance of each UPS component:

Inspect interiors of enclosures, including the following:

- Integrity of mechanical and electrical connections.
- Component type and labeling verification.
- Ratings of installed components.

- Test manual and automatic operational features and system protective and alarm functions.

Retest: Correct deficiencies and retest until specified requirements are met.

Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

SECTION-E-15

SELF CONTAINED EMERGENCY LIGHTS

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

The light fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section - E-1 and with other relevant provisions of the Tender document.

2. GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3. STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

- BSEN 1838 Emergency Lighting

4. EMERGENCY LIGHTS

The emergency indoor lighting shall be operative during power breakdown and emergency situation, light fitting in several areas shall be provided according to specifications.

All emergency lighting equipment utilized shall comply the standards as listed above. Emergency lighting shall be provided using self-contained 7W fluorescent type maintained for 3 hours duration battery inverter packs fitter to selected luminaries.

Along with emergency lighting 'Exit' signs shall be managed from the same lighting control modules as normal luminaries.

5. EXIT & SAFETY Luminaire

All Exit luminaires shall have pictogram legends as per DIN 4844/CEN TC 169, EN50171 or markings as per local civil defense requirements with viewing distance of 24 meters. The luminaire shall be built according to EN 60598. It's rating shall be 8W with 3 hours battery backup and IP 65 ingress protection.

Working Voltage: 220 – 240V AC/ 50/60 Hz

Viewing distance: 24 meters

Installation: It can be mounted on Wall/Side/ Ceiling

Accessories: It shall have over charge and discharge protection with charging LED and test button.

6. EMERGENCY LUMINAIRE

Luminaire shall be of fluorescent type

All luminaries shall meet following requirements:

Battery backup: 3 hr

Power rating: 7W

Supply voltage: 230V AC

Ingress Protection: IP 65

The luminaire shall comply with the requirements of EN60598

Electronic ballast shall comply with the requirements of EN60298/60294

EMC or EMI protection to EN55015

Ambient Temperature – 40 °C.

SECTION-E-16

ESE LIGHTNING PROTECTION SYSTEM

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2.0 SUMMARY

This Section includes lightning protection for buildings and associated structures and requirements for lightning protection system components.

3.0 SYSTEM DESCRIPTION

Protect relevant buildings from lightning by means of a system of conductor running on the roof top and effectively grounded, in accordance with relevant codes.

The Direct Lightning strike protection system should be based on Controlled Early Streamer Emission technology, designed to intercept the lightning by initiating an upward streamer precisely at the time of an impending lightning strike and safely convey the lightning current to earth through a known and preferred route.

The direct lightning protection system shall include components like Controlled Early Streamer Emission enabled Air terminal (CESEAT), Mechanical support, down conductor(s), Air Terminal maintenance/function test meter, LCD based Transient Event Counter, and maintenance free earthing system based on chemical earth enhancing compound to reduce the earth resistance.

Optimum lightning protection for the site shall be determined using a Risk Assessment software, strictly adhering to international guidelines laid by NFC 17-102 and IEC 62305. A certified representative/engineer from the manufacturing company shall be present at all times during the Design and Installation process.

4.0 SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections-E-01.

Product Data for each component specified. Include the following:

Shop Drawings detailing lightning protection system, include air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and information on how concealment requirements will be met.

Field inspection reports indicating compliance with specified requirements.

5.0 QUALITY ASSURANCE

Manufacturer and Installer Qualifications: Engage an experienced manufacturer who produces system components made of high quality

materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer.

Life service of the materials used shall not be less than 30 years.
Lightning protection system shall conform to BS-6651 current edition.

6.0 SEQUENCING AND SCHEDULING

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

7.0 LIGHTNING PROTECTION SYSTEM COMPONENTS:

A) Essential Requirements for Air Terminals

- a). Essential Requirements for Air Terminals
 - a. The CESEAT shall be UL Listed, to be supported with the duly verified UL-certification online access submitted against demand.
 - b. The protection area of the air-terminal shall be determined using Rolling Sphere Method as indicated in the following standards, IEC 62-305 and NFC 17-102
 - c. Components used in the LPS shall be in accordance with IEC 62305 and IEC 62651 (Part 1 – 7)
 - d. The CESEAT shall be supported with independent third party certification by the manufacturer, certifying the compliance to the Annex C of the NFC 17-102 version 2011 along with test reports for the following tests:
 - Mechanical Tests
 - Environmental Tests (salt mist treatment and humid sulphurous atmosphere)
 - Electrical Tests (High-Voltage laboratory test with a standardized waveform 10/350 μ s
 - Performance Assessment (ΔT Test in High-Voltage laboratory)
 - EMC Tests
 - e. The CESEAT Advanced Triggering performances must be $>10\mu$ s and $<60\mu$ s. Any CESEAT with a rating $>60\mu$ s, shall be deemed unfit for operation.
 - f. The CESEAT must be CE marked (EMC compliance to NF EN 61000-6-2 / NF EN 61000-6-3 / NF EN 55016-2-3 / NF EN 61000-4-3 / NF EN 61000-4-2)
 - g. The CESEAT shall have been tested in a High-Voltage laboratory with a standardized waveform 10/350 μ s. The CESEAT standard variations σ SEAT measured in the High Voltage Laboratory vs a Single Rod (σ SRAT) must be ≤ 0.8 .
 - h. The air-terminal shall be tested to support a 250kA current or more. Test to be performed in accordance to NFC 17 102 (France)
 - i. The CESEAT shall be tested in real lightning conditions.

- j. The CESEAT shall be made of Stainless Steel 316 grade non-corrosive metallic components. It shall be equipped with a central rod made of copper, copper alloy or stainless steel.
- k. The rod and the CESEAT tip shall have a conductive cross-sectional area larger than 120mm²
- l. The CESEAT shall guarantee a full electrical continuity between the tip and the down-conductor.
- m. No external power supply shall be required for the effective working of the system
- n. The CESEAT shall be active only during a storm
- o. The CESEAT shall ensure the emission of a streamer when a lightning strike is occurring in the claimed protection area.
- p. The CESEAT shall ensure the neutralization of the space charges surrounding its tip prior to the triggering of the upward streamer.
- q. Performances of the CESEAT shall not be affected by extreme climatic conditions
- r. The CESEAT shall be designed to ensure its maintenance during its lifetime: Modular design enabling to repair/replace defective components
- s. Plug and Play module, Testable on site, using hand-held smart remote monitoring system. Designed to be upgradable on site to integrate a self-sustainable, solar powered "distant testing module" to facilitate distant testing on site up to 100m from the air terminal
- t. Lightning strike counter and battery status information to be displayed on the hand-held device
- u. Single remote programmed to monitor multiple Air terminals within the range of 100m
- v. CESEAT manufacturer warranty shall be for a minimum of 5 years (60 months)

8.0 B) Air Terminal (FOR TERMINAL BUILDING)

- a) Type : Controlled Early Streamer Emission (CESE) Air Terminal.
- b) Protection levels : Level I - 20m, Level II - 30m, Level III - 45m and Level IV - 60m (Rolling sphere method)
- c) Detection of downward Streamer : Continuous measuring of Electric field gradient ($\Delta E/\Delta t$)
- d) Material used : Stainless Steel Water Proof Enclosure, central rod made of Nickel plated copper

- e) Advanced Triggering time : Greater than 10 μ s and less than or equal to 60 μ s.
- f) Radius of Protection : Min. 79 Meters with Level-I protection for ΔT of 60 μ s (When installed at a height of 5m above the finished roof level)
- g) Type of fixing arrangement : 5-meter-high fixed on GI base plate with sound mechanical fittings & guying to take care of wind velocity suitable.
- h) Constructional details : Triggering device housed in a stainless steel weather proof and non-corroding Housing. Central rod shall be surrounded by smaller electrodes to assist development of an effective early streamer
- i) Internal circuits : 6 independent and synchronized modules
- j) Triggering devices- type : Electronic triggering device, external power supply not required
- k) Sensors – type : Lower and upper series sensors arranged around the central pick-up rod internally connected with the triggering device for the fast sensing of atmospheric charge buildup.
- l) Approvals/Standards : Tested in a High voltage laboratory confirming to NFC 17-102 Appendix-C and IEC 62 305
- m) Reduction in standard deviation : 60% compared to standard deviation of Single rod
- n) Testing facility : Plug and play module. Testable on site, using hand-held smart remote control. Also, Upgradable on site to integrate a “distant testing solar module” (distant testing on site up to 100m from the air terminal)

C). Air Terminal Support

- The installation materials used should be non-corrosive and long lasting.
- The installation of the tower should be at a height of min. 2 meters from the finished roof level or the highest point on the structure
- The support shall be securely bolted to other mast materials with where necessary to enable the air termination and mast system to withstand maximum locally recorded wind velocities
- Elevation pole made of Class 'B' GI- material having ISI-marking. Consists of the following (for a typical 5m mast):
 - a. 3mtr x 60mm dia GI pipe
 - b. 2.5mtr x 50mm dia GI pipe
 - c. Reducer, M20 thread
 - d. Base plate(200x200x10mm), mounting bracket, clamps and all required fixing accessories supplied in compliance with IEC 62305

D) Down Conductors

70sqmm bare Copper down conductor is embedded in structural columns as

indicated on the drawings. It is connected to the mesh of horizontal protective conductors on roof. The down conductor is connected via test link located at the lowest level to foundation reinforcement steel for earthing the system as indicated on the drawings. Each down conductor is to be effectively Cad welded to the foundation steel using recommended method as per codes to form an earth termination network.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services. Provide additional rods, as required to achieve the required resistance without any additional cost.

9.0 EXECUTION EXAMINATION

Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.

10.0 INSTALLATION

Install lightning protection as indicated, according to manufacturer's written instructions.

Install conductors with direct paths from air terminal to ground connections. Avoid sharp bends and narrow loops.

Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

11.0 CORROSION PROTECTION

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

12.0 FIELD QUALITY CONTROL

Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion.

LIST OF APPROVED MANUFACTURER*** All Equipment shall be procured from Principal Authorized agents / distributors / resellers**

The Bidder shall fill name of only one manufacturer for each equipment/material on which the tender is based. He shall be bound to supply the equipment from the same manufacturer. In case, the Bidder gives names of more than one manufacturer against any equipment, the Engineer / Owner can ask the Bidder supply the equipment from any one of them.

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choice manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. Any deviation from the BoQ / Specification shall be listed in a separate sheet containing the details of the deviation including the deviating BoQ item number.

Bidder is required to mark the proposed Manufacturer / supplier and country of origin for each item below

S.No	Equipment	Manufacturer	Country of Origin	✓
1.	Oil Filled Transformer / PMU	Pak Elektron Limited (PEL)	Pakistan	
		Siemens	Pakistan	
		M-Tech	Pakistan	
2.	MV Cables	Pakistan Cables	Pakistan	
		Newage Cables	Pakistan	
		Pioneer Cables	Pakistan	
3.	MV Cables Accessories (Jointing & Termination Kits)	3M	USA	
		Raychem	USA	
4.	HT – CT / PT	Revalco	Italy	
		Schneider Electric	France	
		ABB	Italy	
		Siemens	Germany	
5.	MV Switchgear	Siemens	Germany	
		Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	France	
		ABB	Italy	
6.	LV Switchgear, PFI Panels	Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	Pakistan	
		Siemens	Pakistan	
		ABB	Pakistan	
		Hussain & Co.	Pakistan	
		Bilal Switchgear	Pakistan	
		Engineers & Engineering	Pakistan	
7.	Power Factor Plant, Capacitor, Relay, controller	Nokian	Finland	
		RTR	Spain	
		Lovato	Italy	
		Technologic	Italy	
8.	LV Circuit Breakers	Schneider Electric	France	
		Terasaki	Japan	
		Siemens	Germany	
		ABB	Italy	
9.	C.T, Relays & instruments	Schneider Electric.	France	
		Siemens	Germany	
		Revalco	Italy	
		ABB	Italy	

S.No	Equipment	Manufacturer	Country of Origin	✓
10	LV Cables and Wires/ Earthing Cable	Pakistan Cables	Pakistan	
		Pioneer Cables	Pakistan	
		Newage Cables	Pakistan	
		Allied Cables	Pakistan	
		Universal Cables	Pakistan	
		Fast Cables	Pakistan	
11	Load Break Switches, Isolator, Change Over Switches	Gewiss	Italy	
		Kraus & Naimer	New Zealand	
		Legrand	Italy	
		Clipsal	Australia	
12	uPVC Conduits / Pipes and Accessories	Galco	Pakistan	
		Dadex	Pakistan	
		Jeddah Polymer	Pakistan	
		Beta	Pakistan	
		Civic	Pakistan	
13	Back Box / Pull Boxes / Junction Boxes	Hussain & Co.	Pakistan	
		Hensel	Germany	
		Jeddah Polymer	Pakistan	
		Premier Engineering	Pakistan	
14	Switch & Socket Outlets / Floor Boxes	Clipsal (Schneider Electric)	Australia	
		MK Electric	UK	
		Legrand	France	
		ABB	Italy	
15	Cable Glands, Lugs, Terminals and Accessories	Cembre	UK	
		Hubbell / Hawke	UK	
		Hensel	Germany	
16	Cable Tray / Trunking	EZZI Engineering	Pakistan	
		Premier Engineering	Pakistan	
		Hussain & Co.	Pakistan	
		M-Tech	Pakistan	
17	Contactors	Telemecanique	France	
		National	Japan	
		ABB	Italy	
18	Fans and Accessories	Pak Fan	Pakistan	
		GFC Fan	Pakistan	
		Millat Fan	Pakistan	
		Royal Fan	Pakistan	

S.No	Equipment	Manufacturer	Country of Origin	✓
19	Light Fixture	Philips	Netherlands	
		Pierlite	Australia	
		Osram	Germany	
		ConxCorp	Canada	
		EAE	Turkey	
20	Diesel Generator, Fully Imported (Assembled in USA, Europe or Japan) Alternator	Engine		
		Caterpillar	USA	
		Cummins	UK	
		Volvo	UK	
		Perkins	UK	
		John Deere	USA	
		Mitsubishi	Japan	
		Alternator		
		Caterpillar	USA	
		Mecc Alte	Italy	
		Stamford	UK	
		Leroy Somer	France	
		Mitsubishi	Japan	
21	Lightning Protection & Earthing	Indelec	France	
		LPI	Australia	
		Erico	UK/USA	
		Furse	UK	
		Dehn	Germany	
		Wallis	UK	
22	UPS	Emerson-Liebert	USA	
		Eaton	UK	
		APC	USA	
		Schneider	France	
		ABB	Italy	
23	Data Communication System and IPTV (Passive Only)	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
24	Telephone Cable	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
25	Fire Alarm System	Gent by Honeywell (EN)	UK	
		Esser by Honeywell (EN)	UK	
		Hochiki	UK	
		Bosch	UK	

S.No	Equipment	Manufacturer	Country of Origin	✓
26	Closed Circuit Television (CCTV) System	DAHUA	KOREA	
		HoneyWell	USA / UK	
		Kedacom	Singapore	
27	Public Address System	TOA	Japan	
		Honeywell	UK	
		Bosch	UK / USA	
28	Exit & Emergency Lighting Fixtures	Menvier	UK	
		Technoware	Finland	
		Emergilite	Italy	
29	Communication Racks & PDU	3M /Corning	USA	
		Schneider	France	
		APC	France	
30	Fire Resistance Cable	Prysmian FP 200 Flex /Gold	UK	
		Draka	UK	
		Cavice	Italy	
31	Access Control System	HID	UK	
		Honeywell	UK	
		Virdi	Korea	
32	Speaker Cables	Firekas	Turkey	
		Cavice	Italy	
		Draka	UK	

TENDER DOCUMENT
Technical Specifications
Electrical Works
LOT-5

SECTION – E - 1 GENERAL SPECIFICATIONS

FOREWORD

This document is to describe the minimum requirements for the equipment and installations and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

1. SCOPE OF WORK

The works related to the electrical system which are included in the scope of this Contract are shown on the Drawings, stated in the Particular Specifications, Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- a. Low Voltage Switch Board /Distribution Boards (Section - E - 2)
- b. Low Voltage Cable and Wires (Section – E- 3)
- c. Conduits and Pipes (Section – E- 4)
- d. Wiring Accessories (Section – E - 5)
- e. Lighting Fixtures (Section – E - 6)
- f. Voice & Data Communication Systems (Section – E - 7)
- g. Earthing System (Section – E - 8)
- h. Cable Tray, Ladder and Trunking (Section – E - 9)
- i. Public Address System (Section – E – 10)
- j. CCTV System (Section – E – 11)
- k. Addressable Fire Alarm System (Section – E – 12)
- l. Access Control System (Section – E – 13)
- m. UPS (Section – E – 14)
- n. Self-Contained Emergency Lights (Section – E – 15)
- p. Lightning Protection System (Section – E – 16)
- q. Lighting Poles and Accessories (Section – E – 17)
- r. Standby Diesel Generator Set (Section – E – 18)
- s. Sub-Stations (Section – E – 19)
- t. Road Lighting Fixtures (Section – E – 20)
- u. Physical Security System (Section – E – 21)

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standards of Engineering design, workmanship, performance and function as here in specified and fully meet the quality level and rugged requirements of the specifications.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these documents but which is necessary for proper

operation of the works / system, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and / or approved by the Owner or his representative, to achieve proper coordination with various equipment offered in the bid and also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

2. RULES AND REGULATIONS

The entire electrical installation / work shall be carried out by licensed contractor, authorized to undertake such work under the provisions of Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the Electric Company shall be complied with.

3. STANDARDS

All works, equipment and materials shall conform to:

On the one hand:

The specification recommended practices, official standards and codes the non - restrictive list of which is given below.

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

Local Regulations

In the event of conflict between standards, the most stringent shall prevail.

Whenever the electrical equipment to be installed, does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets these standards.

In addition, even if no mention is stipulated in this specification, it is implied

that the equipment be tropicalized, if required, by the conditions of the site of installation.

In any case, the standards and codes to be taken into consideration are those in force at the date of delivery.

4. INSTALLATION AND SERVICE CONDITIONS

4.1 Site Conditions

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material / equipment:

- | | | |
|--|---|-------------|
| a. Maximum outdoor ambient temperature | : | 45 degree C |
| b. Minimum Indoor ambient temperature | : | 0 degree C |
| c. Maximum relative humidity | : | 90 % |
| d. Minimum relative humidity | : | 26 % |

4.2 Service Conditions

Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

5. MAIN ELECTRICAL CHARACTERISTICS

5.1 Power Supply System

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- | | |
|-------------|--------------------|
| - Voltage | 400 \pm 10% |
| - Phase | 3, 4 wire system |
| - Frequency | 50 Hz. \pm 2 Hz. |

5.2 Degree of Protection of Enclosures

For indoors, IP42 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529. For outdoor, IP 55 minimum degree of ingress protection of the enclosures shall be provided.

6. GUARANTEE

The Contractor shall furnish written grantee which should clearly state that the works he will carry out as well as the materials he will supply, meet with this specification and that compliance thereto constitutes an official clause, added by implication to the general conditions of his offer when signing the Contract.

Guarantee shall also be for replacement and repair of part or whole of the equipment which may be found defective in material or workmanship. The grantee shall cover the duration of Maintenance Period as defined in the conditions of the Contract. This guarantee shall not relieve the Contractor of his obligations and he will fully be responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/ or replacements.

The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project under the

Contract, to be carried out by the Contractor.

7. EXCEPTIONS TO SPECIFICATION

Any exception or deviation from this specification or the codes and standards shall be listed separately in the Contractor's "List of Deviations". Any exception, which shall not be listed, shall not be considered later.

8. AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE

The Contractor shall assume at his own cost the permanent availability of this specification and drawings on site where applicable.

9. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

10. MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are the estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor shall carry out actual measurement of works at the site.

11. INSTALLATIONS DETAILS

The locations, routings, installation heights, detail etc. for electrical equipment are indicated on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or his representative.

12. DRAWINGS AND DATA

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

13. PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's representative before commencing any portion of the works. All such working drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

a. Cable entry ducts into buildings:

Working drawings shall be submitted within two weeks of handing over the site.

b. All other working drawings shall be submitted to the Engineer against signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant working drawings at

least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the working drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the working drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval within eight weeks after signing of the Contract. No extension of time shall be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

14. MATERIAL ORIGIN AND QUALITY

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to demand, at any time, the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

15. IDENTIFICATION OF EQUIPMENT

For each piece of equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white background of trifoliate and fixed with screws.

16. MARKINGS

The contractor shall provide "Danger Boards "and" Shock Charts "wherever required to comply with the requirements of local Electricity Rules and according to normal practice.

17. FACTORY TESTS

All equipment supplied by and installed as part of the Contract such as distribution boards and like shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of

test of each equipment at least two weeks in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees referred to in Clause 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been included in the tender bid.

18. STORAGE

The Contractor shall store the equipment in such conditions that it cannot be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer when requested to do so.

19. LABOR AND STAFF OF CONTRACTOR

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

20. SMALL INSTALLATION MATERIAL

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

21. INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly position the equipment on specified foundation / location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

22. ASSOCIATED CIVIL WORKS

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.
- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and laying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or pipe suspensions.
- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be cut must be directed without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

23. TESTING - GENERAL

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. The Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of

demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization (whether official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

23.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than specified value, the cause of the low reading shall be determined and removed.

Corrective measures shall include dry-out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

23.2 Earth Resistance Test

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

23.3 Switchgear

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for connections to give proper phase sequence.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses, disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Nameplates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

23.4 Special Systems Tests

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

23.5 Complete Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other

equipment do not cause any damage to the already tested equipment.

24. ELECTRICAL CONNECTION

Electrical connection for each building shall be supplied by other but necessary arrangement coordination to be done by this Contractor.

25. AS BUILT DRAWINGS AND SERVICE MANUALS

A record shall be kept as the work proceeds of any work not in accordance with the working drawings, and upon completion of the work, the Contractor shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.
- b. Duplicate prints of as built drawings of lighting, power, telephone, fire alarm, as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

26. WORK COMPLETION

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

27. PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION - E - 2

LOW VOLTAGE SWITCHBOARDS / DISTRIBUTION BOARDS

1. GENERAL

1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard.

1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete switchboard as specified herein and/ or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

1.3 Standards

Switchboards shall comply with Section - E - 1, Clause 3.
Particular reference shall be made to:

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push bottoms
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switch gear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

1.4 Installation and Service Conditions

For general site conditions refer to Section - E- 1, Clause 4.

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency as stated in Section - E-1, Clause 5.1.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

2.0 MAIN ELECTRICAL CHARACTERISTICS

2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 415 V \pm 10%
- Phase 3 ϕ , 4 Wire.
- Frequency 50 Hz. \pm 2 Hz.
- Neutral system Solidly grounded.
- Peak asymmetrical SCC To be specified by the bidders.
- RMS symmetrical SCC To be specified by the bidders.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

2.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours. Per day, without exceeding the permitted temperature.

The current ratings of all equipment must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

Pins of auxiliary circuits shall be sized for a rated circuit of 10 Amp Minimum.

3. GENERAL REQUIREMENTS

3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor mounting type/wall mounted, totally enclosed, dead front, dust tight and vermin proof requiring front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.
- be designed for flush mounting of all instruments on the front side.
- have all incoming or outgoing connections from the top or

bottom as required. Have the components mounted so as to facilitate ease of maintenance from the front. Have common lamp test facility for all lamps.

- have wiring diagram on the inside of door of the switchboard. Be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.

3.2 Accessibility

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

3.3 Heaters

Space heaters shall be provided for prevention of moisture in each cubicle. Heaters shall be wired together and shall be automatically controlled to avoid over heating the equipment. Heater shall be suitable for operation on 230 VAC supply from an external source (to be provide in main Distribution Board)

3.4 Name plates

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white back ground, to be made from traffolite and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

4.0 MECHANICAL DESIGN

4.1 General Construction

The switchboard shall be fabricated, welded; grinded, finished with angle iron framework and clad with 14 SWG MS sheet, to form a rigid, free standing, flush mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to be accessible during normal maintenance operations, shall be adequately protected and / or barred to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and interchangeability of common parts. Removable gland plates shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for unarmoured and armoured cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.2 Bus Bars

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with their respective colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Neutral Bus bar should be of same ampere rating as phase bar.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

4.3 Earthing

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow colour. Earthing mass continuity between withdrawable parts and fixed frame shall be correctly ensured whatever the withdrawable part position.

Provision shall be made adjacent to cable termination for earthing cable armour to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions :

- impossibility of closing the earth switch if the switching device is closed.
- visual check of earthing switch positions to be possible.
- possibility of locking the earthing switch operating handle in open and closed position.
- the earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

5.0 DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel recess mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door of Distribution Board.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at both the top and / or bottom, as required.

The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6.0 COMPONENTS

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and of the electrical system. Typical specifications are given here under :

6.1 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' and intermediate 'Tripped' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

6.2 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 100 Amps. shall be conforming to BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalized.

The MCBs shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF/TRIP positions.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

6.3 Earth Leakage Circuit Breakers (ELCB)

ELCBs shall be four pole, current operated type with tripping current of 0.3A and tripping time not more than 0.1 seconds.

6.4 Load Break Switch and Contactor

Load Break Switches and contactors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminium plate shall be provided for cable entry to ACBs / MCCBs cubicles of 630A and above rating.

7 POWER FACTOR IMPROVEMENT PLANT

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic-cum-manual.

The power factor improvement plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12 stages, 6 stages and 4 stages. Each capacitor bank unit shall be 25 and 50 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

1 No. Multi stage power factor correction relay for automatic/manual control.

1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.

- 1 No. Auto-off-Manual selector switch
- 1 No. Current transformer with 5 amps secondary current, having suitable output burden and accuracy.
- 3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 250 KVAR capacitor bank:

- 1 No. 630 amps, triple pole 415 volts air break contactor with auxiliary contacts (2 NO+2 NC) Contractor shall be suitable for AC 3 duty.
- 1 Set of 2 Nos 630 Amps H RC back-up fuses with base and carrier.
- 1 Set of ON and OFF push buttons.
- 1 No. Red lamp for "On" indication of the contractor.

7.1 Requirement of Capacitor Banks

According to IEC-83 1 -1 and 831-2.

Fully insulated, terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminium coating vacuum metalized.

Safety features: Self healing. Over pressure tear-off fuse.

Withstand switching operations safely.

Maximum in rush current 200 times rated current.

Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.

Overloading capacity 1.5 times rated output at delta max.

Acceptable tolerances - 5/+ 10% of rated output at rated frequency.

Static life expectancy > 100,000 operating hours.

Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

8. PARTICULAR COMPONENT REQUIREMENTS

8.1 Current Transformers

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / 1A as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

8.2 Voltage Transformers

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of the same accuracy class as Current Transformers.

Voltage Transformers shall be equipped with primary fuses with an interrupting capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

8.3 Ammeters and Voltmeters

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of Current Transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

8.4 Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate, grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

8.5 Push Buttons

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

8.6 HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class QI in accordance with BS 88.

8.7 Pilot Lamps

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

8.8 Line up Terminals

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

8.9 Secondary Wiring

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked

with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

9. INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the Switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armour shall be connected effectively to ground.

The Switchboard body shall be connected to earth as per instructions given in section "Earthing" of these specifications. The Switchboard shall be tested and commissioned in the presence of the Engineer. The tests to be carried out shall be tested before energizing as per instructions contained in the article "Testing" of General Specifications of Electrical Works, section E-1 of these specifications.

SECTION - E - 3 LOW VOLTAGE CABLES AND WIRES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

All multicore and single core wires for light circuits, socket outlets and circuits operating upto 250 volts shall be 300 / 500 volts grade. All single core sheathed cables shall be of minimum 450 / 750 volt grade. Power cables for main feeders, main to submain feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multicore cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures as given in General Specifications for Electrical Works, Section E-1 of these specifications. Cable should be capable of running 125% of full load current without any damage.

All power cabling used for external power distribution shall be armoured type.

3. STANDARDS

LV Cables and Wires shall comply with Section – E -1, Clause 3.

Particular reference shall be made to :

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings.

All cables shall have phase identification colours on insulation of each core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured cables shall be properly marked for clock-wise and anti clock-wise sequence of core colours.

4.2 Cables for Conduit Wiring

All cables / wiring in concealed or surface mounted PVC or steel conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

4.3 Cables on Surface / Concrete Trenches

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multicore PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Underground Installation

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armoured with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ. The installation work of underground cabling shall be done completely as per the prevailing standards or as per the drawings.

4.5 Cable Accessories

All cable accessories shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands, etc.

5. INSTALLATION

5.1 General

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying 1 KV - 30KV and other cables.
- 20 cm at least between a cable carrying voltages between 50V
- 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labour, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

5.2 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

5.3 Cables on Surface / Trenches

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved

saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges.

It shall be ensured that conduit system is clear before cable is drawn in. cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks housed in outlet boxes.

The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

5.4 Underground Cables

The Contractor shall plan and take special care to prevent any damage to existing under ground facilities such as under ground piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, under ground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of

cables shall allow about 3% more in the measured lengths between terminations.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of RCC chamber shall be provided by contractor prior to commissioning of works.

Cables, whether installed under ground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave under ground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane foam / bituminized Hessian or equivalent method as approved by the Engineer.

5.5 Cable Termination and Joints

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Owner or his representative before use.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armored cables are used, care shall be taken to ensure that the lay of the armor is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.

Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

The RCC chamber of appropriate size shall be provided at every joint of cables as per standards and actual site requirements. The details of

RCC chamber shall be provided by contractor prior to commissioning of works. Extra loops shall be left of cables at the end of every termination.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be effected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. The outdoor apparatus shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

SECTION - E - 4 CONDUITS AND PIPES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Conduits and Pipes as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E- 1 and with other relevant provisions of the Tender document.

2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushings, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits / pipes.

3. STANDARDS

Pipes and Conduits shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

BS 31	Steel Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown in the drawings or given in BOQ. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of sharp 90 degree bends and tees will not be allowed for concealed wiring.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57

mm diameter and 40 mm depth. Round junction boxes shall be provided with one piece bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum B-Class (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 Steel Conduit and Accessories

All conduits shall be of heavy gauge 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide anti-rust paint and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-rust paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece bakelite cover plate of suitable design.

4.3 Galvanized Iron Pipes and Accessories

The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

4.4 Inspection Boxes / Pull Boxes

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

4.5 Adaptable Boxes

Adaptable boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63

mm in depth for conduits up to 40 mm diameter and 87 mm in depth for conduits up to 50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

4.6 Conduit / Pipe Accessories

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

4.7 Cable Trunking

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGI bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

5. INSTALLATION

5.1 PVC Conduits - Concealed

The conduit shall be installed concealed in roof, wall, column, etc.

At all joints and bends, PVC jointing solution as manufactured by Pakistan PVC Limited or approved equivalent must be used to strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. In the reinforced cement concrete (RCC) work, the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be

made in the RCC structure for concealing conduit and accessories, after pouring of concrete. The concrete shall be supported on top of bottom reinforcement of slab and shall be firmly secured by tying to the reinforcing steel in order to avoid being disturbed during pouring of concrete.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab of beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting, or in block masonry, chases shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture to have to at least 32 mm cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.
For straight runs the spacing shall not be more than 30 meters.
For runs with one 90 degree bend, the spacing shall not be more than 15 meters.
- Adaptable boxes.
For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.
For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.
For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, off setting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

5.2 Steel and G.I Conduit

The minimum size of conduit shall be 20 mm.

The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes.

Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

Equipment that is required to be removed for maintenance shall be provided with conduit unions in all conduits that enter such equipment. The use of conduit nipples shall be avoided as far as practicable.

All conduits shall be cut square and reamed at the end. All conduit ends and the inside of conduits shall be clean and free from burrs.

Where bushed spouts or tapped holes are not provided at conduit termination, the conduit shall be terminated in a flanged socket and a smooth bore brass hexagon bush, with a lead washer fitted between the flanged socket and the equipment or box.

All exposed threads and parts where the galvanizing has become damaged shall be thoroughly cleaned and painted with galvanized paint. The exposed conduit ends shall be capped to protect threads from being damaged before installing cables.

Repair painting shall take place before any making good on site or buildings is carried out. The entire conduit system shall be checked for continuity. Any observation found shall be removed without damaging the installation.

The conduit system shall be installed empty with an 16 SWG steel wire drawn through the conduits for pulling of cables. Joints in underground conduits shall be avoided or reduced to the absolute minimum.

Where adjustable dies are used they shall be so adjusted that threads cut with them shall be the same depths as machine made threads.

The use of manufactured bends shall be avoided and instead smooth bends shall be provided by using approved type of bending tools.

Flexible steel conduits shall be installed at all points locations where flexible connection is required, as directed by the Engineer. The flexible conduits when used, shall be protected by external PVC sheath,

resistant to oil damages.

G.I. pipes for under ground installation shall be given bituminous paint coating and wrapped with suitable paper or cloth before installation.

5.3 Fixing of Conduits and Fittings

Conduits in process units and on steel work with "U" bolt type fixings.

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm (1")	Not less than 150 mm.
32 mm (1-1/4")	Not less than 200 mm.
38 mm (1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
75 mm (2-1/2")	Not less than 380 mm.
82 mm (3")	Not less than 460 mm.
100 mm (4")	Not less than 610 mm.
150 mm (6")	Not less than 750 mm.

Under ground conduit stud-up or kick pipe through concrete envelope shall be extended a minimum of 150 mm above grade and adequately braced to prevent shifting during concrete pouring work. The concrete envelope shall extend at least 76 mm above grade.

Under floor conduit installation shall be at a minimum depth of 120 mm from finished floor level. The G.I. pipes / conduits shall be installed at a minimum depth of 1000 mm measured from the top of size to the finished road level.

5.4 Location of Conduits and Fittings

Before conduits are installed, confirmation shall be obtained that the conduit may be installed in that position.

Particular attention shall be given to the location of conduits to prevent the infringement of headroom and access ways.

Conduits shall be located to avoid obstructions, furnaces, hot lines and other places of high temperature.

Conduit shall not be located than 150 mm (6") where it runs parallel to or crosses hot surfaces. Under ground conduit runs shall be kept to minimum in both number and length. Conduits shall not be recessed in fair brick work.

Draw boxes shall be so positioned to enable the cables to be drawn in easily. The boxes shall not be located in the comers or other such locations and shall be positioned to avoid tight bends, bending and cable kinks.

Conduits shall not generally be installed having a greater length 12,000 mm (40 feet) between draw-in boxes.

Conduit entries shall wherever possible be located in the bottom of boxes and equipment etc.

SECTION - E - 5 WIRING ACCESSORIES

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Electrical Works, Section – E - I and with other relevant provisions of the Tender document.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

3. STANDARDS

Wiring accessories and miscellaneous items shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and unswitched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Switches

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

For locations where switches and fan speed regulators are installed together, single switches shall be grouped and fixed on 3 mm thick plastic sheet screwed to a sheet steel box of appropriate dimensions. The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for switches controlling light points, all single switches for fans, sockets, etc., shall have identification symbols on the

operating levers.

Two way switches shall be used to control lights from two different locations as shown on the drawings.

4.2 Switch Socket Outlets

Switch socket units shall be of flat pin type and conform to BS 1363, 13A for fused plugs and socket outlets. 2 and 3 Pin rated for 15 Amps. or 2 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

3 Pin 15 Amps. Sockets shall be moulded type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

4.3 Sheet Steel Boxes

The outlet boxes for installation of switches, fan speed regulators and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-rust red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

4.4 Ceiling Rose

The ceiling rose shall be suitable for 5 Amps. 250V AC. It shall have white plastic moulded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multicore PVC insulated and PVC sheathed cable.

4.5 Fans

4.5.1 Bracket Type

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.

The sweep of the fan shall be as given in BOQ/drawings.

4.5.2 Exhaust Fan

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Schedule of Quantities/drawings. Fans shall be direct driven and supplied

complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type.

Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

4.5.3 Ceiling Fan

The ceiling fans shall be consist of three blade types with 56" and suitable for operation on 250 VAC with +10% tolerance. The Fan shall be mounted directly on ceiling; the lowest point of the fan blade is approximately 300mm (1 foot) below the ceiling. Make sure that the chosen location of the fan will not allow the rotating fan blades to come into contact with any object.

Ensure ceiling joists are sound and of adequate size to support a 35Kg (77lb) load. To reduce the risk of fire, electrical shock or personal injury, ensure that the fan mounting bracket is supported directly from the building structure. Do not mount to an outlet box. The mounting bracket must be firmly screwed to a load bearing structure e.g. a concrete ceiling, steel structure or timber frame. If a timber frame is to be added it must b securely nailed or screwed between two beams.

SECTION - E – 6 LIGHTING FIXTURES

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

2.0 GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3.0 STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 60598 Luminaries.
- IEC 62031 LED modules for general lighting-Safety requirements.
- IEC 62384 DC or AC supplied electronic control gear for LED modules performance requirements.
- BSEN 1838 Emergency Lighting

Any other standard referred to in above standards or these specifications.

4.0 LED Light Fixtures

The light fixture shall be as stated on drawings and bill of quantities. The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All LED light fixtures shall be of international standard and quality. The type of fixtures with manufacturer catalogue reference is given on the fixture schedule and in Bill of Quantities. Equivalent fixture may be acceptable provided that the Contractor submits for review all necessary data indicating photo-metric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for light fixtures shall be Light Emitting Diodes with driver and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof light fixture shall comprise of cast aluminum body and gasketed clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. The gasket shall be weather resistance type.

The LED light fixtures shall be supplied complete with driver and all accessories as per light fixture schedule and shall be installed in accordance with manufacturer's recommendations and sound engineering practice.

5.0 INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between terminal box and the fixture shall be carried out with 3 core 0.75 sq. mm and 1 sq. mm copper conductor, PVC / PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

5.2 LED Light Fixtures

The LED light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in accordance with manufacturer's recommendations and in coordination with ceiling installation.

5.3 Outdoor Lighting

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these

specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such. The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacture of the product and shall meet the requirement of the specifications.

SECTION – E - 7
VOICE & DATA COMMUNICATION CABLING SYSTEM
(Passive Equipment's only)

1. RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

2. SYSTEM DESCRIPTION

The proposed cabling system for the UTP and Fiber network cabling and Fiber Links shall be an open system (Passive Only) and application and vendor independent and shall be warranted by an International Vendor for a minimum of 25 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

3. DATA CABLING SYSTEM

Data racks shall be located in IT rooms as per drawing. Cat 6 cable for Voice and Data shall be used for interconnecting outlets with patch panels. The cable run from the IDF to the associated Data outlet is limited to 90m.

Wiring system used shall be star topology i.e. each data outlet is connected directly to the IDF (Intermediate Distribution Frame) IN Cat-6 RJ45 24 port patch panel.

Vertical runs between each IDF shall be of 8 core multimode OM4 fiber optic cable and 25 pair cat 5e cable.

Horizontal runs from a patch panel to the data outlets using 4 Pair UTP twisted pair cables Cat 6.

Data Processing system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, adapters, connectors, patch panels, patch cords, wire management, floor distributors (racks/cabinets).

The Data Cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration.

The network data cabling systems support at least 1000 Base-T (Gigabit) Ethernet or faster protocol.

The UTP (unshielded twisted pair) Category 6 cable's technical specifications shall be up to the highest industry standards and should have performance specifications better than 250 MHz and should exceed all proposed requirements for data, Gigabit applications.

The UTP Category 6 cable's technical specifications shall be up to the TIA/EIA-

568B.2-1 industry standards and should have performance specifications better than 250 MHz and ample margin compared to the Category 6 Standard for performance in factors such as NEXT.

For both voice and data cat 6 cable shall be used.

4. SCOPE

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The LAN cabling system shall meet the emerging TIA/EIA 568A/B and ISO 11801 for Voice cat6 is to be used, while for Data and WIFI access point CAT 6 is used. Category 6, Class E specifications and shall support Gigabit Ethernet, Sonet/asynchronous transfer mode (ATM) at rates (minimum of) 1 G bits/seconds and analog broadband video in addition to existing and multimedia technologies.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labor, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

The Vendor must have completed a project with a minimum of 1000 points or higher of Category 6.

5. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

6. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

7. COPPER & FIBRE OPTIC CABLE AND CONNECTORS

Unshielded twisted-pair copper & fiber optic cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide unshielded twisted-pair copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory-installed equipment.

Computer cabling System Accessories: Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and TIA / EIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements for emerging applications such as ATM services (1.2 Gbps), including 10 Gbps Ethernet. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such

pairs twisted together.

The cables shall be fully color coded as provided hereunder, color contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Colored Code	Abbreviation
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN
Pair 4	White – Brown Brown – (White)	WT – BR BR

8. SPECIFICATIONS OF CABLES:

For Voice UTP Cable

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Attenuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

For Data UTP Cable

Cable Type	Category 6
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of light)	69
Frequency (MHz)	250
Max. Attenuation @ 500 MHz (dB)	32.1
Worst case NEXT @ 500 MHz (dB)	38.3

9. HORIZONTAL CABLING DISTANCES

The maximum horizontal portion of a cabling system from work area information Cat 6 outlet to a mechanical termination at the patch-panel in the wiring closets must not be more than 90 meters. The cable run must be free of bridges, taps and splices.

Both ends of the cable shall be labeled for identification, i.e., at the patch panel and work area information outlet according to EIA/TIA 606 administration standards for the Data cabling of commercial buildings.

The horizontal cabling system shall be correctly designed and the work area

outlets in each shown or required location shall be correctly mapped to an appropriate wiring closet. The star topology shall be applicable to every individual unit of the transmission media.

10. FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution frames to the data center shall be of multimode OM4 fiber cable 50/125 microns; 8-core cable with color-coded fibers. All fiber optic cables shall be laid in straight run without intermediate splices and all fibers shall be terminated at either end using suitable fiber cable patch panels mounted on the wiring closets.

OS2 9/125 microns single mode fiber optic cable shall be used to connect server room IDF rack to other premises IDFs

All fiber optic backbone links between the main cross connect and the Telecommunication rooms have a backup link using a different route from the main fiber optic link. Each of these links shall be 8-core fiber optic cable as described in this document.

The Contractor shall be responsible for the supply, installation, testing and commissioning of the complete fiber cable backbone interconnection/cross connection requirements of the "building/complex" LAN Cabling System.

The Contractor shall install suitable fiber optic pigtails/connectors needed to complete the entire fiber cable installation as per the manufacturer's recommendation and shall ensure that the backbone is capable to handle the traffic and provide error-free universal data transport for the foreseeable future.

All of the fibers in the backbone shall be terminated with LC type connectors at the time of the installation. The Contractor shall ensure proper testing of the fibers and make them available whenever they are needed. No fibers shall leave unterminated, all fibers must be terminated. A document with fiber cable test results for every fiber cable link shall be provided by the Contractor.

The Contractor shall observe the manufacturer's specifications for maximum tension and minimum bend radius for each fiber optic cable. The contractor shall provide a copy of the manufacturer's specifications to company prior to the commencement of the work.

Care must be taken when mechanical pulling devices are used, that maximum tension limits are not exceeded. Minimum bend radius specification shall not be violated when the cables are routed through walls or around corners. The contractor shall ensure that all installation personnel are aware of these limitations.

The Contractor shall follow an intelligent numbering system based upon the destination and channel number. The numbering system shall have a prefix 'F' to indicate it is a fiber optic cable, followed by the destination IDF, then a hyphen and the channel within the cable.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

11. OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION

Fiber optic cables within the premises shall use multimode, graded-index.

Fibers must comply with TIA/EIA 492 specifications and OM4 fiber specification as in ISO 11801 standard.

Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.

All fibers shall be color coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	50 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm
Numerical Aperture:	0.200 \pm 0.015
Cladding diameter:	125 $\mu\text{m} \pm 1 \mu\text{m}$
Cladding Non-Circularity:	<2.0%
Coloured Fiber Diameter:	250 $\mu\text{m} \pm 15 \mu\text{m}$
Buffering Diameter:	890 mm \pm 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius: During Installation: After Installation:	20 times cable diameter 10 times cable diameter

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.5 dB/km at 850 NM 1.5 dB/km at 1300 NM
Minimum Bandwidth:	1500 MHz. km at 850 nm (OFL) 500 MHz. km at 1300 nm (OFL) 2000 MHz. km at 850 nm (DMD, laser) 500 MHz. km at 1300 nm (DMD, laser)

Fibers must comply with TIA/EIA 568 specifications and OS2 fiber specification as in ISO 11801 standard. It shall comply with ITU G.652.D

Core	9 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm

Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 µm ± 1 µm
Cladding Non-Circularity:	<2.0%
Minimum Tensile Strength:	1340N at installation and 400N after installation
Cable Minimum Bending Radius:	
During Installation:	230mm
After Installation:	150mm

Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-104°F to 167°F (-40°C to 75°C)
Maximum Fiber Loss:	0.75 dB/km at 1310 NM 0.75 dB/km at 1550 NM

12. DATA OUTLET

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, cabinet number, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to TIA/EIA 606 Administration Standard.

The contractor has to provide clear identification labels for Data.

In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location as indicated in its design/engineering drawing, the contractor shall notify the Company of this, the contractor shall not make its own discretion in modifying or changing any information provided in the approved design drawings.

The type of information outlets shall be of modular Tool less RJ45 of Matt Chrome/ metallic or any other approved(design engineer) finish, 8 position, 8 conductor with front cover designed for high speed networking applications that use data transmission rates over frequency ranges up to and potentially beyond 250 MHz & 100 MHz.

The 8 position/8 conductor outlet shall meet the category 6 transmission requirements for connecting hardware specified in ISO/IEC 11801 and EIA/TIA-568A/B and Class E design guidelines.

The modular outlet shall provide maximum versatility in designing a premise distribution system. It shall be designed to snap into modular faceplate. When the outlet is inserted into the faceplate or frame, it shall lock into place and shall only be released using the dual-purpose wire insertion tool. The mounting and removal system shall allow easy installation and modification. The faceplate jacks must be shutter protected and shall include a label window required to write circuit identification number. Each port must support a color icon to identify the port function.

The plastic used to construct the modular data outlet shall be of high impact, flame-retardant, made of poly phenylene oxide with flammability rating meeting UL 94V-0UL, the jack wires shall be at least 50 micro-inch lubricated gold plating over 100 micro-inch nickel under plate. The connector shall be of copper alloy, at least 100 micro-inch bright solder over 100 micro-inch nickel under plate.

The insulation displacement connector shall accept 24/23 AWG solid copper wire conductors. The connector shall have multicolor labels marking wire terminals with numbers, assuring fast, accurate installation. The outlet must support wiring configuration as per T568A and T568B on the same RJ-45 jack

The connector shall be wired using the wire insertion tool (impact tool). The module shall be wired from the centre to the outside and shall not untwist paired conductors more than 12.7 mm. In the process of terminating the cables in patch panels/outlets the Contractor shall ensure ISO/IEC and TIA/EIA category 5E/6 transmission performance requirements.

13. PATCH CORDS

The contractor shall supply patch cords for all the installed points on the network switch side as well on the workstation side. The cord length shall be of two different sizes 6-ft. [1.5 m] on the network switches side and 10 ft. [3.05 m] and 2m on the workstation side as per drawing and specifications.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 wiring standards capable of connecting high speed information terminal devices to information outlets, to interconnect information terminal devices and 8-position modular jack panel applications. The patch cord shall be designed to provide support for extended multimedia transmission distance over frequency ranges up to and potentially beyond 100/250 MHz.

The patch cord shall support the computer networking applications over frequency ranges up to and potentially beyond 250 MHz and shall be compatible with voice and information applications.

The construction of the cord shall be of Cat 6 stranded type cordage tightly twisted, 24 AWG, 8 conductor. The cord shall be terminated to an 8-position RJ-45 modular plug on both ends. The cords shall support the transmission requirements warranted to meet ISO/IEC 11801 Class E, EN 50173 or TIA/EIA 568B Category 6, Class E component specifications and standards.

The Contractor supplied cord shall be of factory crimped modular plug at both ends.

14. PATCH CORD ORGANIZER

The Contractor shall supply and install sufficient patch cord organizers/ patch cord organizers that are used for routing patch cords in 19-inch (48.3-cm) frames. The patch cord organizers shall support the requirements of routing patch cords both at the equipment side as well as the Category 6-patch /Cat 6A panel cabling side at the wiring closets. These organizers shall be located in the 19-inch frame inside the wiring closet.

The Contractor supplied patch cord organizers/ patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

15. PATCH PANELS (JACK PANELS)

The Contractor shall supply and install the modular patch panels to meet the full cabling system requirement of the "building/complex". Every category 6 cables serving the information outlets at work areas shall be terminated at the patch panels. The Contractor shall ensure that the supplied patch panels meet the ISO/IEC 11801, EN 50173 and TIA/EIA 568 warranted component specifications and standards.

The patch panels shall be of 19-inch rack-mounted panels. The rear of the panel shall feature connecting blocks mounted on a printed wiring board. These connecting blocks shall be capable for use in terminating category 6 station wires, equipment, or tie cables. The modular patch panel shall be capable of supporting up to 24 jack positions (ports) as required by the design drawings of the Data system and shall have the facility to write the circuit designation details at the front side of each jack. The contractor shall provide 20% spare capacity for both the Data and voice.

The insulating displacement connector field in the patch panel shall be made continuous to the 8-pin modular tool less jack field on front of the panel through printed wiring board connections to enhance the features to confirm to TIA/EIA 568A/B cabling recommendations.

The construction of the modular jack panel shall be of category 6 – compliant and shall have the stringent requirements of connecting hardware as specified in TIA/EIA 568A/B commercial/ residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in TIA/EIA 568 A/B and ISO/IEC 11801, EN 50173 Category 6 specifications. The modular patch panels shall meet the worst-pair near-end cross talk (NEXT) requirements over the entire frequency ranges up to and potentially beyond 100/250 MHz on all pair combinations.

Care must be taken to ensure that the cables are terminated correctly at category 6 cross connect hardware (patch panels).

The cable conductors shall be terminated as described in TIA/EIA 568A/B and ISO/IEC 11801, EN 50173 Category 6, Class E wiring sequence by using the proper insertion tool (impact tool).

When terminating the cables in the insulating displacement connector field, care must be taken to ensure that the strip – back is limited only as much cable jacket as is required to perform connecting hardware terminations. The cables shall be properly secure terminations. The cables shall be properly secured to the 19" rack with cable ties as well as at the patch panels.

Each port of the patch panel must support color Icon to identify the port function.

Each port must be numbered in sequence with white printing on black

background or other high contrast colors.

Each port on the patch panel must have a label place holder and for the patch panel number.

The package must include frame mounting screws, labels, cable ties and instruction sheet.

16. CABLING CABINET (STEEL CABINET)

The Contractor shall supply and install cabling System Cabinets to house the passive and active network equipment. The cabinets shall be freestanding / wall mounting types.

Two type of 42U free standing cabinet shall be used in IT rooms and in Data centre. Furthermore 12U & 18 U Racks shall be used in Gate Office. The technical specification is as per the following:

The Contractor supplied Cabling System cabinets shall meet the requirements of accommodating the high volume of cabling 19" 24-port patch panels & LAN Equipment fully assembled with the following items.

For data Centre rack Cabinet dimension 42U 600 mm x 1000 mm nominal width & depth). The cabinets must meet the following specifications:

42U 800 x 1000 Ready Rack
1600 KG load rating
42U 4mm Safety Glass Door (On the front).
42U 1.5 mm steel Door (On the rear).
800 x 1000 mm side vented top cover.
Castors heavy duty braked.
42U Panel mounting angle kit.
Thermostat controlled Low Noise Fan Tray.

For 12U Racks dimensions will be 800 x 800mm nominal width and depth

12U 800 x 800 Ready Rack
45 KG load rating
12U 1mm Safety Glass Door (On the front).
12U 1 mm steel Door (On the rear).
800 x 800 side vented top cover.
12U Panel mounting angle kit.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light with mounting brackets. The AC Mains distribution integral at the rear pillar of the cabinet should have at least 10 of 13 amp. Power Outlets. Cable management panel inclusive of other accessories such as earthing kits, screws, washers, grip-nuts and a removable shelf, able to resist a weight of 50 to 60 kgs. The cabinets shall be rugged and strong and all steel shall be finished scratch proof in a durable enamel Grey paint on both sides.

The cabinets must include Low Noise Thermostat controlled fans and shall automatically switch on and off according to the temperature inside the

cabinets, the temperature range shall be from 10 to 60 degrees centigrade. The dimensions of the tray shall be of 600 mm x 800 mm. The fan tray shall have minimum of four fans 250 Volts AC + 6% 50 Hz. The low noise top mounted fan tray shall aid the cooling requirement of the LAN equipment installed inside the cabinets, and in the process of installing the fan tray on top of the cabinet it shall not occupy any of the usable U height in the cabinet.

The front glass door shall have at least 4 mm toughened & 50 percent light transmission smoked safety glass able to resist a weight of 80 to 100 Kgs. Placed within 200 mm of the door center. The door shall be lockable and shall have a swing handle supplied with 2 keys.

The rear door shall be the same as the front except the construction of the door shall be of rugged and strong 1.6mm steel finished in a durable enamel Grey paint on both sides, and without glass.

The internal panel mounting angles shall be supplied in pairs to provide 19" mounting positions with hole patterns to accept captive nuts on universal centers. In the design of the panel mounts the centers of each U height shall be notched, to make the positioning of cage nuts much simpler. The panel mounting shall be fitted onto panel mount angle supports to allow infinite adjustment throughout the depth of the track.

The cabinets shall be supplied at least with one shelf kit. The shelf should carry a load rating of 50 kgs. And shall be manufactured with holes/slots providing sufficient airflow to LAN equipment when installed inside the cabinets.

Four steel castors with rubber wheels at least 40 mm high. These castors shall be mounted at the corners of the cabinet and be able to support the total weight of the cabinet and all options.

The cabinets must support the installation of fire protection units and all 19" equipment including frames for 110-punch block.

The supplied cabinets must meet the following standards:

- IEC 297-2
- D/N 4/494 Part 7
- D/N 4/491 Part 1
- Load rating 500 Kg
- Rust proof coating
- EN 60950
- VDE 0100
- Material 1.6mm steel
- Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

- IEC 297-2
- D/N 4/494 Part 7
- D/N 4/491 Part 1
- Load rating 500 Kg
- Rust proof coating
- EN 60950
- VDE 0100

Material 1.6mm steel
Paint finish according to RAL 7035

The supplied cabinets must meet the following standards:

IEC 297-2

D/N 4/494 Part 7

D/N 4/491 Part 1

Load rating 500 Kg

Rust proof coating

EN 60950

VDE 0100

Material 1.6mm steel

Paint finish according to RAL 7035

42 U free standing open frame

Integrated cable and cord management

allows for more efficient and effective cable management

Focused on accessibility

Extruded aluminium construction

Modular open frame design (no doors and side panels to remove)

Pre-threaded mounting holes

42U with 270 holes per vertical channel meets TIA/EIA RMU rack mounting unit dimension

Mounting screws with pilot point

Cable guides provide an effortless solution to transitioning cables

Flexible cable guides allow cable to snap-in easily for quick cable routing

Spacing of cable guides aligns exactly with the standard ISO 1101 rack

Unique switch gate Door / Cover provides easy access to the door

Edge protected pass through holes for transition of cables to rear side

17. VOICE CABLING SYSTEM

MTJB shall be provided at Admin Block for distribution. Incoming PTCL cable shall be coming from complex PTCL room located near complex main entrance. Each building shall have dedicated IDF racks which shall connect from MDF through Multipair backbone cable network.(It is part of infrastructure).

Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor (TJB).

Telephone system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, 110 wiring block, connectors, telephone junction box and main distributor frame.

The telephone cabling System shall be designed using standard, proven equipment and materials with the latest Technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

18. SCOPE

The contractor shall carefully examine all of the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.

Authorized and certified installers registered with their respective Manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labour, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

19. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of telephone cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for telephone system, including TJB and terminal connections.

20. TELEPHONE CABLING

Vertical runs between floors extending from the MTJB to each IDF Rack using multi pair 25 pair CAT 5e cables installed on cable tray.

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted

for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside. Cat 6 cable shall be used for cabling from IDC block to telephone outlet.

21. IDC WIRING SYSTEM

The IDC blocks shall be used for the voice cross connect and should be 19" rack mountable type. 100 pair and 50 pair IDC block to be used.

The IDC blocks shall be capable of terminating cables as stated in drawings.

Shall be capable to terminate 22-24 AWG solid conductors or 22-24 AWG stranded conductors.

Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit includes connecting blocks, labels and label holders shall be used.

Jumper troughs shall be used to route cable horizontally and vertically.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors cables.

22. TELEPHONE JUNCTION BOX.

The telephone Junction Box (TJB) shall be made of 16 SWG sheet steel, anti-rust treated and painted to match the wall color, suitable for recess mounting and shall be of appropriate size to accommodate terminal strips with adequate space available for wiring. The terminal strip shall be made of copper, soldered type with suitable capacity for terminating all incoming and outgoing cables including direct lines. The strip shall be installed on insulated material sheet inside the sheet steel box.

The TJB shall be provided with a lockable hinged door, fastened to the steel outer Box by means of nuts and bolts.

23. QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

24.0 WIRELESS LAN:

Summary Standard: 100% coverage at -65dB controller based solution supports 802.11ac wave 2

Core/ Optional: Core

Hosting Location: University

Wireless LANs are required to provide internet access throughout the university premises. The selected vendor must ensure 100% WIFI signal coverage in computer labs, waiting rooms, demo rooms, departmental libraries etc.

WLAN engineering is required to support VoIP (e.g skype, etc.) services related to business applications.

In converged networks, all wireless access points are considered capable of carrying associate back office traffic, regardless of their physical location at the property.

The strength of the WIFI must be -65dB, enough for a smartphone. The WIFI system controller is based and managed through a HSIA gateway.

To ensure compliance for above, the approved vendor for WIFI will require completing and providing relevant 'heat maps' and blue prints for WIFI topology. This will be conducted via a Site Survey during the initial design and at the final stages of university construction.

24.0.1 SITE SURVEYS

Conduct two mandatory wireless site surveys by a qualified wireless integrator to ensure adequate signal throughout the project coverage area. Depending upon the size of the property, the initial desktop survey can be performed using a passive (application generated) survey of signal and noise statistics. The second physical survey must be conducted following the completion of wireless installation.

A. Initial Desktop Survey:

- Conduct initial survey by computer modeling based on construction documents.
- Identify architectural and structural elements that obstruct or diminish wireless signal strength.
- Conduct survey prior to completion of the low voltage drawing.

B. Physical Survey:

- Conduct the second survey on site following substantial completion of the exterior building envelope (roofs and walls) and interior partitions to account for the impact of building materials (drywalls and windows) and sources of EMI/ RFI signal strength.
- Provide details on items not yet installed involving water and large metal objects.

- Consider the presence of special coatings or materials (e.g., UV) on windows if the interior wireless access points are intended to provide coverage of exterior areas.
- Physical Survey Report shall include the following information:
- Map of signal, noise and user performance; Coverage by SSID (Service Set Identifier); Power level by access point
- The physical survey provides frame data rates; packet retries and error rates.

24.0.2 WIRELESS ACCESS POINT ANTENNAS

There are many types of antennas used with wireless access points. Use appropriate antenna types(e.g., wireless access points located outside utilize antennas designed for exterior use). Ensure that the Design Team is aware of the antenna dimensions used and accounts for appropriate allocation in the design. Generic access points are not acceptable.

Wireless Standards: Wireless access points shall support 802.11ac wave 2 standard.

24.0.3 POWER OVER ETHERNET (POE+)

Power must be provided to the wireless access points through the use of POE+ [IEEE standard 802.3 af]

- The current standard for POE+ is outlined in the IEEE 802.3at standard.
- When POE+ is utilized, there is an impact on the LAN switch models/ modules used and therefore on the LAN switch infrastructure cost.
- The use of POE+ may impact power and cooling requirements for the IDF/ MDF where POE switches are located.
- If POE is not used, installation of additional power outlets in the vicinity of each wireless access point is required and increases construction costs.

SECTION – E - 8 EARTHING SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the electrical lines and equipment.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. GENERAL

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS 951	Earthing Clamps
BS 1433	Hard drawn bare copper conductor for earthing.
BS 2874	Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346	PVC Insulated Cables.
CP 1013	Earthing

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Earth Rod Electrodes

Drive extensible rods of the same diameter into the ground, as per detailed item mentioned in BOQ, to a suitable depth to obtain low resistivity in the particular soil.

Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size shown on the drawings. The cost of earthing leads deemed to have been included in the price of earth electrode & no separate pavement shall be made for it.

4.3 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes

indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in section E - 3 of these specifications. PVC insulated cables when used as E.C.C. shall be green,

5. INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape armours are not permitted as grounding conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to LV Switchboard, LV Distribution Board or any other metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be in general run in cable trench or in conduits / pipes as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along under ground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or 1 meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1 : 3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter G.I. shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection

chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

SECTION – E – 09

CABLE TRAY, LADDER AND TRUNKING

1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. SUBMITTALS

General: Submit the following according to the Division 1 Specification Sections.

Product data for each component. Show tray types, dimensions, and finishes. Determine the sizes of the cable trays based on the number and size of cables laid on the cable trays plus 20% space for future growth. Cables laid on cable trays shall be spaced twice their overall diameter (consider the largest cable as reference). In case of discrepancy with the contract documents this clause shall prevail, unless approved by the Engineer otherwise.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plates connectors, expansion joint assemblies, straight lengths, and fittings.

Co-ordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

3. QUALITY ASSURANCE

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays which has a record of successful in-service performance.

Comply with the relevant standards of BS, NEMA and NEC.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

4. SEQUENCING AND SCHEDULING

Co-ordination: Co-ordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

5. CABLE TRAYS

The cable tray system shall be of one manufacturer and shall include factory made trays, tray fittings, connections and necessary accessories and supports to form a complete tray support system.

The cable tray system shall include the following factory made tray elements. Straight trays and ladders, fittings and horizontal and vertical bends of various angle crosses, tees, wyes, reducers, vertical riser elements, connectors and all necessary fixing accessories.

Cable trays shall be constructed from mild steel of minimum thickness 16 gauge (1.5 mm). Trays in excess of 300 mm width shall be of minimum thickness 14 gauge (2.0mm).

Insert elements, bolts, screws, pins etc., shall be mild steel cadmium plated.

- a. Tray work shall have oval perforations. Ladder type trays shall be used as required and/or approved by the Engineer.

- b. All trays (straight and fittings) to be heavy duty return flanged type unless specified otherwise.
- c. Tray component are to be accurately rolled or formed to close tolerance and all edges rounded. Flanges are to have full round smooth edges.
- d. Ladder racks of widths up to and including 300mm shall be constructed from rolled steel sections of minimum thickness 16 gauge (1.5 mm). Ladders in excess of 300 mm width shall be C Section construction with a minimum thickness of 14 gauge (2.0mm). the rungs shall be spaced at a maximum 300 mm.
- e. Unless indicated otherwise on drawings, cable trays shall be used in the range 150 mm to 900 mm wide, in fire preferred standard sizes: 150, 300, 450, 600 and 900 mm.
- f. Other sizes shall be used where specified or previously agreed with the Engineer.
- g. Flanges shall be a minimum of 50 mm deep.
- h. Minimum radius at side rails, horizontal and vertical tees and crosses shall be in accordance with the Manufacturer's standard.

Perforated, heavy duty, return flange type, in 2.5m nominal lengths Hot dip galvanized after completion of bending and drilling, complete with all necessary purpose made bends, tees, supports and the like. Width shall be such as to permit adequate access for installation and maintenance of cables and per the requirements of WAPDA regulations.

6. CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws, nor on removal on site paint finish from ferrous metal.

7. EXAMINATION

Examine surfaces to receive cable tray, cable trunking and cable ladder for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

8. WIRING METHODS

Use cable tray of complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

9. INSTALLATION

- a. Install cable tray, cable trunking and cable ladder level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- b. Remove burrs and sharp edges of cable trays.
- c. Make changes in direction and elevation using standard fittings.
- d. Make cable tray connections using standard fittings.
- e. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- f. Fire stop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- g. Working Space: Install cable trays with sufficient space to permit access for installing cables.

10. GROUNDING

Connect cable trays, cable trunking and cable ladder to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

11. CLEANING

Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

SECTION – E – 10 PUBLIC ADDRESS SYSTEM

1. SUMMARY

This Section includes equipment for amplifying, distributing, and reproducing sound signals.

2. DEFINITIONS

Retain abbreviation and terms that remain after this Section has been edited.

Channels: Separate parallel signal paths, from sources to speakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

PA/VA Zone: Separate group of speakers and associated supply wiring that may be arranged for selective switching between different channels.

VU: Volume unit.

3. SUBMITTALS

Product Data: For the following:

Adjust list below to suit Project.

Voice Alarm Controller

Power Supply Manager

Power amplifiers.

Microphone.

Equipment rack.

Stereo Mixer

Speakers (Wall, ceiling etc.).

Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Field quality-control test reports.

Operation and maintenance data.

4. QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

Comply with EN 60849 and EN 54-16 Standards as PA/VA.

5. COORDINATION

Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

6. FUNCTIONAL DESCRIPTION OF SYSTEM

Descriptions below are offered as examples only. Revise this Article to convey design intent to Contractor and Installer. PA system has built in emergency voice evacuation system so that in case of emergency it shall override the announcement and allow prerecorded emergency message.

System Functions: Include the following:

- Emergency voice announcement shall be announced in the event of fire and the system manager shall interfaced with Fire alarm panel.
- Delete functions in subparagraphs below that are not required and edit remaining descriptions to suit Project; add other functions as required.
- Selectively connecting separate zones to different signal channels.
- Selectively amplifying sound among various microphone outlets and other inputs.
- Communicating simultaneously to all zones regardless of zone or channel switch settings.
- Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.

Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed. Reproducing high-quality sound that is free of noise and distortion at all speakers at all times during equipment operation including standby mode with inputs off; and output free of non uniform coverage of amplified sound. In case of emergency built in Emergency Voice Evacuation system shall enable and announce through speakers.

7. EQUIPMENT AND MATERIALS

Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Modular equipment type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 100 to 240 V, 50 Hz.

8. VOICE ALARM SYSTEM:

Comply with EN 54

Power Source: 31V DC, removable terminal blocks (4 pins)

Speakerline: 4 channels (with AB speaker line output)

Audio Input: 4 inputs (Line: -20 dBV / Mic: -60 dBV / ANC sensor, phantom power selectable)

DSP: Feedback suppression, Equalizer/Filter, Compressor, Delay and Ambient Noise Control (ANC)

Control Input: 16 inputs, no-voltage make contact input, open voltage: 24 V DC, short-

circuit current: 2 mA

Fault Detection System: Short circuit, Open circuit, Method:

Voltage

detect ; Connector: RJ45 connector ; Connection Cable: CAT5-

STP

Power Amplifiers: 4

Dimensions (W x H x D): 482 x 132.6 x 345 mm (19", 3U)

Standby Amplifier: Input: 1, Output: 1 ; Max. Voltage/Current: 100 Vrms, 5 Arms ; Connector: Removable terminal block (2 pins) x 2

LAN A,B: No. of Connectors: 2 (LAN A, LAN B) ; Network I/F: 100BASE-TX ;
Network

Protocol: TCP, UDP, ARP, ICMP, RTP, IGMP, FTP, HTTP ; Spanning tree
 Protocol: RSTP ; AudioTransmission System: TOA Packet Audio ; Audio
 Encoding Method: PCM ; Audio Sampling Frequency: 48 kHz, 16 bits
 Connector: RJ45 connector ;
 Connection Cable: CAT5 ; Max. Cable Distance: 100 m

9. DIGITAL POWER AMPLIFIER MODULE

Comply with EN 54
 Power Source: 31V DC (operating range: 20 to 33 V DC)
 Amplification System: Class D
 Rated Output: 150W (at 100V line), 105W (at 70V line), 75W (at 50V line)
 Output Voltage: 100V (70V,50V selectable)
 Frequency Response: 40 Hz to 20 kHz: - 5 to +1 dB
 Max Capacitive Load: 0.5 uF
 Distortion: 1 % or less (at 100 V line, A-weighted)
 Min Resistive Load: 67Ω (100 V), 47Ω (70 V), 33Ω (50 V)

10. POWER SUPPLY MANAGER

Comply with EN 54
 Power Source: 220 – 230 V AC, 50/60 Hz
 Power Consumption: 2800 W max in total (at rated output with charging), 650
 W max in total, 350 W max each (EN 60065)
 Charging Method: Temperature compensated trickle charging
 Battery Connection: One each positive and negative terminal, applicable
 cable
 diameter: AWG 6 – AWG 0 (AWG 1/0) (16 mm² – 50 mm²)
 Line resistance within 4 mΩ/ total
 Control Connector: RJ45 female connector for connecting the system and
 cascade
 connection, Shielded Twisted-pair straight cable (TIA/EIA-
 568A
 standard) Type of control signal: Battery check, AC power
 status,
 DC power status, charging circuit failure, battery failure,
 and
 communication
 DC Power Output: 8 x 31 V (19 – 33 V) 25 A max. each , M4 screw terminal,
 distance
 between barriers: 11 mm 3 x 31 V (19 – 33 V) 5 A max. each ,
 removable terminal block (3 x 2 pins) 1 x 24 V (16 – 25 V) 0.3
 A
 max., removable terminal block (1 x 2 pins)
 DC Power (AC Mode): Rated output: 2300 W (total DC power output), Peak
 output:
 2780 W (total DC power output)

11. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SENATE

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage
at 20 Ω		
Impedance.		
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20 kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 Ω
Number of channels	:	4
Output voltage per channel	:	100V with 100V line voltage at 20 Ω at 1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4 Ω
Impedance.		
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

12. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR SEMINAR

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power line	:	2 channels: 250W x 2 with 100V
		And 40 ohm impedance
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from 50 to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20 kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	580W with impedance of 40 Ω and 100V output line
Number of channels	:	2
Output voltage per channel	:	100V with 100V line voltage at 40 Ω at 1 kHz
Mounting	:	Rack mounted.
Option	:	Matching Transformer. Power
cord,		Removable terminal plug

13. DIGITAL STEREO MIXER FOR SENATE

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20 kHz
Sampling Frequency	:	48 kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1 kHz in rated 20 to 20 kHz band pass frequency.
Output	:	4 output channels with 4 dB with 24dB max with 1 recording output
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Standalone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1. Feedback suppression function that eliminates feedback caused

by microphone.

2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments.
3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input automatically when detecting a monaural control signal.

14. GOOSENECK MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Electret condenser element with cardioids
	:	Polar pattern
Phantom supply	:	9 to 52V DC
Output Connector	:	XLR – 3- 12 equivalent
Cable	:	C25J
Mounting	:	Desk stand with push to talk application, press to talk switch. It shall be mounted on base stand.

15. WIRELESS HANDHELD MICROPHONE FOR SENATE

Microphone	:	Comply with TIA/EIA SE-105
Type	:	Dynamic or unidirectional characteristic with built in antenna
Channel selection	:	64
Maximum input level	:	132dB SPL
Supporting accessory	:	Wireless transmitter
Power requirement	:	2, 6 or 12 single AA rechargeable batteries

16. REMOTE DIPOLE ANTENNA FOR SENATE

Power requirement	:	7 to 12V DC (from amplifier or wireless tuner)
Receiving Frequency	:	550 to 932 UHF MHz
Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 Ω
Accessories	:	M3.5 screw for wiring box, Tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves

17. CD / USB / MP3 / TUNER PLAYER FOR SENATE:

Power source	:	7 to 12V DC (from amplifier or wireless tuner)
Receiving Frequency	:	550 to 932 UHF MHz

Dipole Ratio Relative Gain	:	8dB or more
Voltage Standing Wave Ratio	:	3
Output Impedance	:	75 Ω
Accessories	:	M3.5 screw for wiring box, tapping screw M4 for wiring wall and RG6/U and RG11/U sleeves (optional)

18. LINE MATCHING TRANSFORMER FOR SENATE:

Rated Input	:	200W
Primary Impedance	:	50 Ω on 100V line and 25 Ω on 70V line
Secondary Impedance	:	8 Ω
Supporting equipment with	:	Mounting Brackets and it shall work Line Array speakers with option of Speaker rigging frame

19. SUBWOOFER SYSTEM FOR SENATE:

Subwoofer systems contains 15" cone type woofer as speaker component with optional speaker rigging frame.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8 Ω
Sensitivity	:	93dB
Frequency Response	:	40 Hz – 400 Hz

20. LINE ARRAY SYSTEM FOR SENATE:

It shall work on 4 different angles 15°, 30°, 45° and 60°.

Power handling capacity	:	Continuous pink noise: 200W
Continuous program	:	600W
Impedance	:	8 Ω
Sensitivity on 60° mode	:	96dB
Sensitivity on 45° mode	:	97dB
Sensitivity on 30° mode	:	98dB
Sensitivity on 15° mode	:	99dB
Frequency Response on 60° mode	:	95 Hz – 20 kHz
Frequency Response on 45° mode	:	100 Hz – 20 kHz
Frequency Response on 30° mode	:	105 Hz – 20 kHz
Frequency Response on 15° mode	:	110 Hz – 20 kHz
Finish	:	Polypropylene or as required
Water Protection module	:	IPX4 (install with every speaker Downward)
Accessories	:	Line matching transformer, speaker stand adapter and speaker mounting bracket and hanging bracket
Enclosure	:	Bass reflex type or sealed type

21. UHF WIRELESS TUNER FOR SENATE:

Channels	:	64 selectable frequencies
Power Requirement	:	AC Mains (supplied AC – DC adapter must be used)
Receiving Frequency	:	576 – 932 MHz
Harmonic Distortion	:	1 % or less (typical)
Signal to Noise Ratio	:	110dB or more
Frequency Response	:	within ± 3 dB from 100 Hz to 15 kHz
Accessory	:	AC – DC adapter with rack mounting kit
Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 Ω with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

22. MULTICHANNEL DIGITAL POWER AMPLIFIERS FOR LECTURE HALL

Comply with TIA/EIA SE-101-A.

Revise first paragraph below to suit Project.

Mounting	:	Rack mounted.
Output Power	:	2000W with 100V line voltage
at 20 Ω		impedance.
Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 3 dB from
50		to 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.3% at 100Hz to 20kHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and
providing		full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	220 to 240V AC 50/60 Hz
Total Output (all channel Driven)	:	500W at 1 kHz frequency with impedance of 19.6 Ω
Number of channels	:	4
Output voltage per Channel	:	100V with 100V line voltage at 20 Ω
at		1kHz
Mounting	:	Rack mounted.
Rated Output Power	:	550W X 4 with impedance of 4

Ω

Amplification System	:	Class D
Frequency Response	:	Within plus 1 dB and minus 2 dB from 20 To 20,000 Hz.
Minimum Signal-to-Noise Ratio	:	100 dB, at rated output.
Total Harmonic Distortion	:	0.1% at 1 kHz and 0.15% at 20Hz to 20 KHz.
Output Regulation	:	Less than 2 dB from full to no load.
Controls	:	On/off, input levels, and low-cut filter.
Input Sensitivity	:	Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
Power Requirement	:	120V AC 50/60 Hz
Number of channels	:	4

23. DIGITAL STEREO MIXER FOR LECTURE HALL

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20 kHz
Sampling Frequency	:	48 kHz
Input Channel	:	8 monaural and 7 stereo inputs
Total Harmonic Distortion kHz	:	0.03% or less, 1 kHz in rated 20 to 20 kHz
Output	:	Band pass frequency. 4 output channels with 4 dB with 24dB Max with 1 recording output
Power Requirement	:	24V DC Phantom power
Software	:	Dedicated GUI facilitating high precision Parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Standalone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1.Feedback suppression function that eliminates feedback caused by microphone. 2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments 3. Automatic stereo input (Auto mute or Ducker) function that mutes stereo input

automatically when detecting a monaural control signal.

24. DIGITAL STEREO MIXER FOR SEMINAR:

Mounting	:	Rack mounted.
Frequency Response	:	20Hz to 20 kHz
Power consumption	:	14W
Power source	:	220-240V AC, 50/ 60 Hz
Sampling Frequency	:	48 kHz
Input Channel	:	6 monaural and 3 stereo inputs
Total Harmonic Distortion	:	0.03% or less, 1 kHz in rated 20 to 20 kHz band
Output terminal	:	2 monaural output channels, removable
recording	:	Blocks, 1 stereo output, and 1 stereo
Power Requirement	:	Output.
Software	:	24V DC Phantom power
	:	Dedicated GUI facilitating high precision parameter setting adjustment on PC via Ethernet LAN
Configuration	:	Standalone system with 4U mountable. It can be used with digital speaker processor as optional
Features	:	1.Feedback suppression function that eliminates feedback caused by microphone.
	:	2. It shall have automatic resonance control measurement and processing algorithm that optimizes speech and sound clarity for individual acoustic environments
	:	3. Automatic clip guard function for 6 each monaural input channel with independent settings for each channel.
	:	4. Automatic mute function with on/off function switch
Accessory	:	Power cord, Removable terminal plug, rack
mounting	:	Mounting bracket, machine and rack
	:	Screw.

25. GOOSENECK MICROPHONE FOR SENATE HALL, SEMINAR:

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Electret condenser element with
cardioids	:	Polar Pattern
Phantom supply	:	9 to 52V DC
Output Connector	:	XLR – 3- 12 equivalent

Cable	:	C25J
Mounting	:	Desk stand with push to talk application, press to talk switch. It shall be mounted on base stand.

26. WIRELESS HANDHELD MICROPHONE FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER:

Microphone	:	Comply with TIA/EIA SE-105
Type	:	Dynamic or unidirectional characteristic with built in antenna
Channel selection	:	64
Maximum input level	:	132dB SPL
Supporting accessory	:	Wireless transmitter
Power requirement	:	2, 6 or 12 single AA rechargeable batteries

27. UHF WIRELESS RECEIVER FOR SENATE HALL, SEMINAR & STUDENT FACILITY CENTER

Channels	:	64 selectable frequencies
Power Requirement	:	AC Mains (supplied AC – DC adapter must be used)
Receiving Frequency	:	576 – 932 MHz
Harmonic Distortion	:	1 % or less (typical)
Signal to Noise Ratio	:	110dB or more
Frequency Response	:	within ± 3 dB from 100 Hz to 15 kHz
Accessory	:	AC – DC adapter with rack mounting kit
Channel Check	:	Built in usable frequency scanning
Antenna Input	:	75 Ω with phantom powering for antenna which is 9V DC 30 mA maximum current consumption

28. REMOTE MICROPHONE:

Power	Source	24 V DC (operating range: 15 - 40 V DC), Supplied from the audio input unit or DC Input power supply connector
Current	Consumption	240 mA or less
Microphone		Unidirectional electret condenser Microphone with AGC (ON/OFF selectable)
Volume	Control	Microphone volume, Monitor speaker volume, Chime volume (using the software)
Connectable	Cable	Main line: Shielded CPEV cable or shielded Category 5 twisted pair cable for LAN (CAT5-STP), Branch line: Shielded Category 5

	Twisted pair cable (CAT5-STP), RJ45 connector
Operation :	Emergency/all-zone emergency broadcast key, Talk key, 13 Function keys

29. MIXER POWER AMPLIFIER:

Power :	Source	230V AC, 50/ 60 Hz
Rated :	Output	360W
Frequency :	Response	50Hz – 18kHz
Zones :		2
Accessory :		AC power cord
Distortion :		Less than 0.3% at 1 kHz, 1/3 Rated Power

30. COMPONENTS:

Parameters listed in this Article are typical values. Performance and product characteristics vary among manufacturers. Revise to suit Project.

Microphone	:	Comply with TIA/EIA SE-105.
Type	:	Dynamic, with cardioids polar or unidirectional characteristic
Impedance	:	120 ohms.
Frequency Response	:	Uniform, 60 to 20,000 Hz.
Output Level	:	Minus 58 dB minimum.
Finish	:	Satin chrome and as required.
Cable	:	C25J.
Mounting	:	Desk stand with integral-locking, press-to-talk switch.
Equipment Rack	:	Comply with TIA/EIA-310-D. House amplifiers and auxiliary equipment in standard TIA/EIA 19-inch (483-mm) racks.

Group items of same function together, either vertically or side by side, and
Arrange controls symmetrically.

Power-Supply Connections: Approved plugs and receptacles.

Arrange all inputs, outputs, interconnections, and test points so they are Accessible at rear of rack for maintenance and testing, with each item Removable from rack without disturbing other items or connections.

Blank Panels	:	Cover empty space in equipment racks so entire front of rack is occupied by panels.
Enclosure Panels	:	Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
Finish	:	Uniform, baked-enamel factory finish over rust-inhibiting primer or as required.
Power-Control Panel	:	On front of equipment housing, with master power on/off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
Service Light	:	At top rear of rack with an adjacent control switch.
Vertical Plug Strip	:	Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounted equipment.
Maintenance Receptacles:		Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
Spare Capacity	:	20 percent spare space capacity in rack for future equipment. Coordinate paragraph and subparagraphs below with Drawings.
Insulation for Wire in Conduit	:	Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
Microphone Cables	:	Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent. Plenum Cable: Listed and labeled for plenum installation.

31. CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power	:	6/3/1.5/0.75W
SPL	:	96 dB

Frequency : 100 Hz to 16 kHz

32. SURFACE MOUNT CEILING SPEAKERS:

It shall be compliant with EN 54

Rated power : 6/3/1.5/0.8W
 SPL : 96 dB
 Frequency : 100 Hz to 16 kHz
 Speaker Component : 12cm dynamic cone type

33. LINE ARRAY SPEAKER FOR SEMINAR:

It shall be compliant with EN 54

Power handling capacity : 180W
 SPL : 92 dB
 Frequency range : 80Hz to 18 kHz
 Impedance : 8 ohm
 Option : Matching Transformer with 100V in primary
 Side and 8ohm on secondary side, Digital
 Processor, Wall mounting Bracket and wall
 Mounting tilt brackets.

34. HORN SPEAKER FOR MOSQUE:

It shall be compliant with EN 54. Horn speakers shall be located at minaret of mosque.

Rated	Input	50W
:		
Line	Voltage	100V line or 70V line
:		
Rated	Impedance	100V line: 200 Ω (50W), 300 Ω (30W), 670 Ω (15W)
:		70V line: 100 Ω (50W), 200 Ω (30W), 330 Ω (15W), 670 Ω (7.5W)
Sensitivity		111 dB (1W,1m)
:		
Frequency	Response	200 Hz – 6 kHz
:		
Dust/	Water	Protection IP 65
:		

35. WALL MOUNTED SPEAKERS

Enclosure	2 way bass reflex type
:	
Rated	Input 30W
:	
Impedance	8 Ω
:	
Sensitivity	90dB (1W, 1m)

:	Accessory	Bracket, Bracket mounting screw, Bracket mounting washer
:		

36. LAVELIER MICROPHONE

Type	: Electret Condenser Type
Directivity	: Unidirectional
Rated Impedance	: 2k Ω , unbalanced
Frequency Response	: 100 Hz to 16 kHz
Connector	: Unbalanced phone plug

37. MICROPHONE WITH BOOM STAND

Type	: Moving coil microphone
Directivity	: Unidirectional
Rated impedance	: 600 Ω , balanced
Frequency Response	: 100 Hz to 12 kHz

38. EXECUTION INSTALLATION

Wiring Method

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

Separation of Wires

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets:	Flush mounted.
Floor-Mounting Outlets:	Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.
Conductor Sizing:	Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
Speaker-Line Matching	
Transformer Connections:	Make initial connections using tap settings indicated on Drawings.

Connect wiring according to Division 16 Section "Conductors and Cables."

39. GROUNDING

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

40. FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:
Schedule tests with at least seven days' advance notice of test performance.
After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

Operational Test

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio. Repeat test for each separately controlled zone of loudspeakers. Minimum acceptance ratio is 50dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

41. ADJUSTING

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

42. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Section 01.

43. EXECUTION INSTALLATION

Wiring Method

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and

raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

2 core 2.5 sq. mm flexible PVC cable shall be used for wiring.

Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

Separation of Wires

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

Connect wiring according to Division 16 Section "Conductors and Cables."

44. GROUNDING

Revise this Article to suit system requirements. Include grounding electrodes for special applications only.

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding and Bonding."

45. FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports: Schedule tests with at least seven days' advance notice of test performance. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

Operational Test

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.

Repeat test for each separately controlled zone of loudspeakers. Minimum acceptance ratio is 50dB.

Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.

Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3dB.

Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1dB.

Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding and Bonding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

46. ADJUSTING

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

47. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Division 1 Section.

SECTION – E – 11

IP BASED CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

1.0 GENERAL

- A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All systems and components shall be provided with the availability of a toll-free, 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.
- D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non-warranty items.

2.0 GENERAL SPECIFICATIONS

IP MEGAPIXEL CAMERA (INDOORWALL TYPE):

The camera shall be compact rugged, IR, 0 Lux 2 MP 1/2.8" CMOS image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality and focal lens of 3.3 to 9mm. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non-condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	AES or 1/77000 sec.
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock
		(When powered by AC only)
		Synchronizes the camera to the
		power line zero crossing for roll-free

		vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View	:	31 to 87, 25 to 880, 35 to 105 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3 Aspect ratio 1280 x 720 @ 1.3 MP x1.
Cabling type	:	Cat-6
Alarm Pan Input	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm I/P	:	10 VDC max, 75 mA max
Alarm O/P	:	0 to 15 VDC max, 75 mA.
Service Port	:	External 3 Connection 2.5 m pwds.
Certification	:	FCC, CE, UL/UL Listed.

3.0 INDOOR TYPE IP CAMERA (DOME TYPE):

The camera shall be compact rugged, IR with 0 lux 2 Mega pixel 1/2.8" CMOS (3 to 12 mm) vari focal lens & image sensor format digital color having the horizontal resolution of 1280x720 TVL or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions. They shall be mounted on ceilings as indicated in drawing.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using standard video cable. The camera shall be line locked to the power line zero crossing to ensure roll free vertical interval video switching and recording.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non-condensing. Shock resistance shall be minimum 50 gm.

Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 Vp-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Image Resolution	:	Main stream 1280 x 720 @ 25/30 fps. Feature: Extra stream shall be provided.
Audio Compression	:	Built-in
Support Protocol	:	TCP/IP, UDP, SMTP, UPNP, FTP, HTTP or etc.
Data Storage	:	Video or Snapshot. Built-in (Micro SD).
Low light Capabilities	:	0.0013 Lux. Additional feature should be removable IR cut filter mechanism for increased sensitivity.
Lens	:	DC Iris.
Security	:	Password protection, IP address filtering, user access log.
Users	:	10 Simultaneous users.
Video Analytic	:	Adaptive motion analytic to intelligently detect motion within the field of vision and trigger an alarm. Also detects vehicles near sensitive areas longer than the users define time. Also count the objects that enter in a define zone. Also any object placed in a define zone and then trigger alarm. Cameras shall have maximum feature which shall meet clients' requirements.
Imaging Device	:	16:9 Aspect Ratio 1/3 inch, effect 4:3

Cabling type	:	Aspect ratio 1280 x 720 @ 1.3 MP x1.
Pan I/P	:	Cat-6
Alarm I/P	:	22 to 34 VAC 24 VAC nominal or POE.
Alarm O/P	:	10 VDC max, 75 mA max
Service Port	:	0 to 15 VDC max, 75 mA.
Certification	:	External 3 Connection 2.5 m pwds.
	:	FCC, CE, UL/UL Listed.

4.0 OUTDOOR TYPE PTZ CAMERA:

The camera shall be compact weather proof, IP Speed Dome 36 x optical zoom format digital color having the horizontal resolution of 18 x DIGITAL ZOOM 1080 resolution or above with outstanding picture quality. The camera shall provide easy installation, digital signal processing, on screen displays, superior picture quality reliability. The camera shall accept AC or DC POE type. The camera shall provide auto-detection of lens type with lens wizard. The camera shall provide night sense feature to extend the excellent sensitivity by a factor 3 in low light conditions.

The camera shall provide automatic sensing for tracking white balance. The camera shall support bidirectional communication technology using Cat-6. The Cameras shall high speed pan up to 260°/sec and tilt up to 120°/sec. built-in web browsing.

The rated voltage shall be 12VDC, 24 VAC 50 Hz and POE option. The operating temperature shall be -20 to 50 degree Celsius. Humidity shall be 5 to 93% non-condensing. Shock resistance shall be minimum 50 gm.

Image Sensor	:	1/4" CCD
Signal to Noise Ratio	:	50 dB
Electronic shutter	:	Automatic, 1/5 to 1 /132,000 sec. CCIR, 1/60 to 1/150000 sec. (EIA)
White Balance	:	Automatic sensing, (2500 – 9000K)
Video output	:	Composite video 1.0 V p-p, 75 ohms.
Aperture correction	:	Horizontal and vertical, symmetrical.
BLC	:	Center window weighting
Synchronization	:	Line Lock (When powered by AC only) synchronizes the camera to the power line zero crossing for roll-free vertical interval switching. (When DC supply) Internal crystal.
Video Compression	:	H. 264, multicast streaming.
Networking	:	10/100/1000 Mbps gigabit Ethernet, RJ-45
Viewing Requirement	:	ONVIF
Field Of View (mm)	:	24 to 65, 15 to 37, 28 to 75 (Horizontal, Vertical & Diagonal)
Resolution	:	530 TVL
Sensor Element	:	PAL 752 (H) x 582 (V)
Lens Type	:	36 x optical zoom, 12 x digital zoom.
Focal Length	:	F1.6 ≈r 3.8 f=3.4≈122.4mm.
Illumination	:	1.4 lux /0.01 lux.
Pan Range	:	On 360° Continuous, Speed 0.5 or

		260°/sec.
Preset Point/ Tour	:	32 Preset, 16 Camera tour.
Focus	:	Auto/manual.
Video Capture	:	H.264, 4CIF/CIF/QCIF
MJPEG	:	4CIF/CIF/QCIF
Image Frame rate	:	30 fps (N), 25 fps (P) for all resolution.
2 way audio	:	Simplex/Duplex 2 way audio.
Lan port	:	RJ45 Connector, 10/100 M auto.
Alarm/out	:	Dry contact or relay output standard.
RS 485	:	For external keyboard.
Audio In/Out	:	Microphone in/out.
Video Out	:	1.0 V p-p/75Ω BNC optional.
Motion Detection	:	1.5 Zone.
OS	:	Windows based.
Security	:	Password protection.
Certification	:	FCC, CE, UL

5.0 MANUFACTURER'S WARRANTY

Repair or replacement of defective parts for a period of two years from the date of shipment, installation.

6.0 IP Video Management Systems (VMS):

- A. IP VMS shall support minimum 128 channel.
- B. IP VMS shall provide 6 to 10 Mbps for recording of IP video stream, play back and export.
- C. IP VMS shall support recording of H.264, JPEG, and MPEG-4 IP Stream.
- D. IP VMS shall support third party H.264 Megapixel video stream up to 10Mps resolution with total system throughout recording of all IP & analog streams, playback and export.
- E. The IP VMS shall have fully open architecture with support for both IP Specific Cameras and as well as ONVIF Compliance.
- F. The VMS shall support H.264 compression, CIF 4CIF resolution at maximum 100 FPS, 16 audio input and RS422/485 PTZ Control with supplied system/ third party compatible protocol.
- G. VMS shall support unlimited no's of system connected over network. Each system shall contain maximum network ports, one for IP Camera/Encoder data, 1 for client computer access.
- H. VMS shall view, managed, & playback through single user interface simultaneously with other compatible VMS through supplied PC Server & PC Client Software.

7.0 HARDWARE:

- A. The VMS server shall operate on 2nd generation Intel® Core i7 processor and 8 GB of Ram or approved equivalent.
- B. VMS server shall utilize windows 7" ultimate 64 bit operating system or windows based equivalent operating system. But it should not lesser than windows 7 ultimate.
- C. VMS server shall have internal DVD +RW
- D. VMS server shall have two DV1-D ports.

- E. VMS server shall have expansions of IP video channel capacity through a licensing without any modification in hardware.
- F. VMS server shall support multiple make/models of IP Camera and encoders including third party manufacturer.
- G. VMS server shall also support audio recording in addition to third party manufacturer's audio recording.
- H. VMS server shall support recording the internal storage (Built-in) server with additional storage utilize SCSI attached HDD storage.
- I. VMS server shall capable of continuous scheduled alarm/event and motion recording, pre and post alarm recording also be available and full programmable on per channel basis.
- J. The VMS system shall allow archival of video data to computers or SAN storage devices over a network connection with optional compatible archive utility. The archival schedule shall be either automatic at user defined intervals or manual and shall be configurable per connected per connected camera.
- K. VMS shall indicate system performance.
- L. RAIDS or NAS storage media built in an external shall be used. Minimum 48 TB built in shall be required. Manufacture should submit the data storage calculation prior to bidding.
- M. System shall have 6, 3.5 inch drive and optical DVR \pm RW.
- N. System shall have PC1-E slots x 16 and PC1-E x 4.
- O. Auxiliary interfaces shall be USB 2.0 and USB 3.0 ports.
- P. 100 to 240 VAC 50/60 Hz, Auto ranging.
- Q. The maximum frame per second for recording or storage shall be 15 fps. Supplier shall be responsible for better resolution and good result.
- R. The resolution or frame size is not less than 1280 x 720.
- S. System should have recording capacity for 90 days recording of all cameras at 24 hours a day.

8.0 CLIENT SOFTWARE

- A. The IP VMS shall be capable running client application.
- B. The minimum client hardware configuration shall be Intel core I7 with required graphic cards.
- C. The memory shall be 4 GB or high.
- D. The system shall have optical drive like DVR +.
- E. The optical system shall be windows based XP professional or as engineer approved.
- F. The system shall have required accessories like connecting cables, programming, hardware for rack mounting recovery disc etc.
- G. The client software shall include all licenses for any additional third party cameras. No additional license cost shall be barred by client.
- H. The client software shall have capable for interface the multiple DVR or NVR platforms.
- I. The client system & software shall support minimum 20 to 25 cameras matrix on required fps resolution. It is the suppliers' responsibility to provide the better resolution and performance.

- J. The client system & software shall provide live video review and record video view with at least 1, 5, 15, 30, 60 or 90 minutes.
- K. The client system & software shall capable to selectable in-video PT2 control or dashboard style control.
- L. The system & software shall capable for video export to any accessible media like HDD, DVD or network storage.
- M. The system shall have alarm pop-up featured and playback active alarm. It shall have on motion detection.
- N. The system & software shall have capable for matrix functionality whereby cameras sequences creating on monitor.

ELECTRICAL:

Input Voltage 100-240 VAC, 50Hz, auto ranging

Note:

**The active switches POE type is the responsibility of Client IT personal.
Passive equipments CAT 6 cable and Patch panel has been covered in
Telecom BOQ.**

SECTION - E - 12

ADDRESSABLE FIRE ALARM SYSTEM

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of the system.

The Fire Alarm system with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2. STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

BS/EN 5839/54

NFPA 72

Any other standard referred to in above standards or these specifications.

3. OPERATION

The Fire Alarm System shall be pre-signal non-coded type complete with battery standby power.

At locations indicated in the drawings the break glass type fire alarm stations and automatic detectors shall be installed. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

Circuit shall be so arranged that an open circuit in an initiating or indicating loop shall cause the individual zone and common trouble indication at the fire alarm control panel.

4. MATERIAL

4.1 Conduit and Conduit Accessories

The specifications for conduit and conduit accessories shall be same as given for electrical conduit in Section E - 5 of these specifications.

4.2 Fire Alarm Cable

Fire Alarm Cable shall be 2 core 1.5 sq. mm shielded twisted pair, fire resistant, PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit. It shall have fire rating of 2 hours.

4.3 Power Supply

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure.

4.4 Fire Alarm Control and Indication Unit

The fire alarm control and indication unit shall be a Solid State Modular Unit consisting of the following Modules; suitable number of modules shall be used to provide facility for building. We would be installing 1 loop panel at substations as per drawing. It shall not be possible to remove the key without turning the key to its normal position, thus resetting the alarm contacts.

i. Loop Module

Loop Module shall have multiple of supervised initiating circuit with a trouble and an Alarm Lamp for each loop. Detection circuit wiring shall be two wire Class 'A' and shall power all Detectors (Relay outputs and) voltage output for each zone alarm and voltage output for each zone trouble shall be provided.

ii. Audible Expander Modules

Audible Expander Modules shall provide for supervised control circuit for polarized alarm signaling devices loop activated lamp shall be provided for each loop to aid on system testing and trouble- shooting

iii. Power Module

Power Module shall supply the necessary power for the loop module and all Detectors (and shall contain a Battery Charger to charge the batteries) An AC power to Lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for AC power failure indication, ground fault detection, and low battery. All controls shall be behind a key-locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided. The panel cover shall be key-locked to prevent unauthorized access.

4.5 Manual Break Glass Station

The break-glass manual station shall be operated by pulling down on the handle. When operated, the handle shall remain down with the

pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

4.6 Audible Signal Unit

Fire alarm (bell) shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors

Manual Functions

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

All initiating and indicating device circuits. All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.9 Function of Addressable Fire Alarm Control Panel (FACP)

i. **Design**

The FACP shall be solid state, modular design with integral static protection. All indicating lamps shall be long-life, low maintenance solid state light emitting diodes (LED).

ii. **Enclosure**

The FACP enclosure shall be semi-flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

iii. **Loops & Identification**

All controls shall be labeled, all loop locations shall be identified, and the FACP shall be provided with a set of permanently mounted operating instructions, to avoid confusion. Loop location identification shall be as approved by the Engineer In charge and contain up to three lines of text with 1/8" minimum character heights.

iv. **Components of Fire Alarm Control Panel**

The FACP shall include as minimum following:

- a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery-backed RAM. Removal of the board shall not cause loss of memory contents.

Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

- b. Indicating Loops: 1 and 2 loop indicating circuits shall be provided. Each circuit shall provide power for polarized alarm signaling devices. A red LED to indicate the energized state of the circuit and a yellow LED to indicate a trouble condition shall be provided for each circuit. A disconnect switch for each circuit shall be provided to allow the FACP to be tested with sounding alarm signals. When disconnected, the FACP shall indicate both trouble condition and disconnect.

v. **Manual Functions**

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual

capabilities in the FACP by means of switches located behind a key-locked cover:

- a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).
- b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously 'ON'.
- c. Silence the alarm signals.
- d. Reset the FACP, after all initiating devices have been restored to normal.
- e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.
- f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.
- g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

vi. System Supervision

- a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.
- b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.
- c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.
- d. All initiating and indicating device circuits shall be electrically supervised.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.10 Shop Drawings / Technical Specifications

Prior to installation of any equipment, the Contractor shall submit for approval, shop drawings including riser and terminal wiring diagrams

and specifications data sheets. Submittals indicating typical one line riser and typical specification data sheets only will not be acceptable.

The Contractor shall review the total system point to point wiring layout to assure that the correct number and type of wire and conduit sizes are installed.

Upon completion, the Contractor shall provide detailed written operation instructions and three sets of "as built" drawings including plan, layout, conduit runs and wiring diagrams as finally installed.

4.11 Addressable Audible Signal Unit:

Fire alarm sounder with strobe shall be red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when the entire bells ring. The bell shall be connected in multiple cross loop conductors.

4.12 Addressable Smoke Detector:

The Smoke Detector is optical type and shall be connected to the specific loop. Base shall be provided with detector.

4.13 Addressable Heat Detector:

The Heat Detector is connected to the specific loop. Base shall be provided with detector.

4.11 Test

Upon completion and at such time as the Engineer In charge may direct, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

4.12 Fire Alarm Installation

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer In charge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The mounting height of the sounder shall be above the false ceiling or 7' from F.F. level when false ceiling is not comes. The conduit and wiring of the Fire alarm system shall be as per installation instructions for conduits and wirings given in the relevant section of these specifications. The Fire alarm system conduit shall be laid 15 cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire

alarm system conduit shall be marked with red colour at terminations in order to distinguish it from other conduit system.

SECTION - E – 13 ACCESS CONTROL SYSTEM

1. STANDARDS

Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable.

NFPA 70 – National Electrical Code
UL294 – Standard for Access Control Systems
NFPA 72 – National Fire Alarm Code
NFPA 101 - Life Safety Code.

2. SYSTEM DESCRIPTION

The System shall be a modular and network capable access control system. The System shall have the ability of handling controlled access with various reader technologies supported simultaneously, alarm monitoring with text and graphics based annunciation. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes. This shall be integrated with BMS. Access Control Systems shall be located as specified in drawings.

The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, activation of remote devices and door control.

Access control functions shall include Enterprise level Time attendance Software, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.

The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information. The software shall utilize combo boxes for previously entered system-required data where applicable.

The method of communication from remote locations to the central components shall be transparent to the user.

After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the MANUFACTURER.

Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.

All controller components shall utilize "Distributed-Processing" concepts. The distributed processing shall include the ability to down-load operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of any other system component.

The system shall be capable of utilizing the existing LAN / WAN connecting the buildings or a dedicated security Ethernet network for Controller and Client communications.

Manufacturer: The access control system shall be from a single-source manufacturer that specializes in access control and intrusion detection systems with a minimum of 20 years' experience.

Installer: Company specializing in access control and intrusion detection systems with a minimum of three years' experience on systems of similar size and scope. Technicians working on project must have been certified on the hardware and software used for this project.

3. SUBMITTALS

A. Manufacturer's Data:

1. Submit three (3) copies of:

- a. Product Data Sheets
- b. Installation Instructions

2. Authorized Dealer Certificate and Certified Training Certificates of installers who will be working on this project.

B. Shop Drawings

Submit three (3) copies and digitally in AutoCAD or later format on a CD (3 copies), shop drawings, including:

- a. Layout of equipment on supplied AutoCAD drawings.
- b. Security Console elevation drawings.
- c. Field Controller equipment location wall layouts, including size requirements.
- d. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.
- e. Load calculations of all security equipment for proper sizing of electrical provided by the customer and standby emergency generator circuits.

C. As-Built Drawings

Update Shop Drawings to create final As-Built Drawings. Submit 3 copies and digitally in AutoCAD 14 or later format on a CD (3 copies).

D. Operation and maintenance manuals

Operation Data: Include three (3) copies of the software Administrator

and Operator Manuals.

E. UPS

The UPS (Uninterruptible Power Supply) for the Server shall provide for 20 minutes of continued operation in the event of an AC Power Failure.

F. Control Panel Specifications

The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

G. Distributed Intelligence

1. The system shall use distributed intelligence architecture, with controllers operating independently of one another.

H. Stand Alone Operation

1. All database information required for stand-alone operation shall be stored at the control panel level. All decision-making shall be performed at the control panel, eliminating the need for degraded mode operation.

2. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Flash Downloadable Read Only Memory.

4. HARDWARE REQUIREMENTS

A. Controllers

There controllers shall be: access control 2 door type; alarm monitoring (16 supervised inputs); and relay control with the addition of REB8 relay expansion boards and. Each controller shall have the following common features.

B. Controller Board

The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, and Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. All powered connections to the controller board shall be protected by fuses. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.

C. Enclosure

The controller enclosure shall be a NEMA style metal cabinet designed for surface mounting. It shall have a tampered, removable hinged door with a high security key lock. It shall have conduit knockouts to allow from 25mm conduit to be used for wire entry into the cabinet.

D. Internal Power Supply

The controller shall have an internal power supply that will accept 50 Hz/ 220 - 240 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.

E. Standby Battery

The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. It shall be recharged by a charging circuit incorporated into the controller board.

F. Alarm Inputs

The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of eight (8). The sensitivity of the line supervision shall be 2% AA Standard. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16 zone alarm input controller.

G. Intelligent Reader Interface

The control panels shall utilize an intelligent reader interface to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Proximity, Bar Code, Touch Memory, RF and Biometric. The interface shall utilize a digitizing algorithm, which will convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

5. CONTROLLER FIRMWARE

A. General Features

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field upgradability of the features. All of the necessary software for a fully functional System is located in the controller.
 - a. 3 - 15 digit keypad Code's
 - b. Duress digit for keypad Code's

- c. 150 Time Zones for access restriction and automatic event control
- d. 128 Access Zones for access management
- e. 256 Control Zones for alarm and relay management
- f. Assigned to 1 – 4 Holiday Schedules.
- g. Automatic daylight savings time clock adjustment
- h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask,
- i. relay control
- j. Add user records
- k. Tag users for annunciation at host computer
- l. 4,000 Users
- m. 1500 event, 1500 alarm transaction buffer

B. Access Control Features

1. The controller shall include the following access control features at a minimum.
 - a. Restrict access by: time of day; day of week; door; holiday
 - b. Momentary Access of door up to 8100 seconds
 - c. Extended Access for User Definable Momentary Access duration (requires Scramble Pad). Scramble Pad will display time remaining on the minute, and annunciate at the defined "Warning Time"
 - d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
 - e. Unlock/Re-lock of door by CODE, card or Time Zone
 - f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring; door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed
 - g. Request-to-exit masks alarm and/or unlocks door
2. 2 person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.
3. 63 Pass back Zones. Can be disabled by Time Zone. A User can be designated with Pass back Executive Override.
4. Use Count limits on users
 - a. Absentee Rule limits on users
 - b. Temporary Day limits on users
 - c. Occupancy Counting / Minimum & Maximum limits per Passback Zone
 - d. Deadman CODE / Timer
 - e. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only during Time Zone can require dual, and selected User's Credentials can be disabled.

C. Alarm Management Features

1. The controller shall include the following alarm management features at a minimum.
 - a. Momentarily mask alarm by CODE and/or card
 - b. Mask/unmask alarm by CODE and/or card or by Time Zone
 - c. Alarm device supervised while masked
 - d. Tamper switch on alarm device monitored while masked
 - e. Tamper Input may be configured to operate as a "Latch Monitor" with the appropriate door lock hardware.
 - f. Entry/Exit delay per alarm input
 - g. Alarm input triggers relay/s

6. CARD READER/KEYPAD SPECIFICATIONS

Readers

1. The controllers shall accept all of the following reader technologies concurrently Proximity with Biometrics Fingerprint. The readers can be used for access control, alarm management, and/or relay control and shall be capable of being used alone (keypad only, card only) and any other reader technology may be combined to operate as a dual technology reader where two valid IDs (PIN and card) are required.

PART 1 - EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.
- C. Make conduit and wiring connections to existing door hardware devices as required.

3.2 TRAINING

- A. The two designated System Administrators shall attend the 3 Day Factory Velocity User Class.
- B. The Dealer shall coordinate with the System Administrators for two 8 hour Operator training sessions on the Operational System to be conducted on-site on the actual running system.

3.3 FIELD QUALITY CONTROL

- A. Test in accordance with system manufacturer guide lines or by engineer incharge.

SECTION-E-14

UNINTERRUPTIBLE POWER SUPPLY (UPS)

1.0 SUMMARY

This Section includes 400V, 50 Hz, three-phase in, three-phase out, on-line, double-conversion, static-type, UPS installations complete with transient voltage surge suppression, input harmonics reduction, rectifier-charger, battery, battery disconnect device, inverter, static bypass transfer switch, output isolation transformer, battery monitoring.

2.0 SUBMITTALS

- i. Product Data: For each UPS component indicated.
- ii. Shop Drawings: Detail assemblies of equipment indicating dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
- iii. Factory test reports.
- iv. Field quality-control test reports.
- v. Operation and maintenance data.
- vi. Warranties.

3.0 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use and for compliance with the following:

UL 1778.

Retain subparagraph below if UPS components for this Project are installed in computer rooms.

Suitable for installation in computer rooms according to NFPA 75.

4.0 WARRANTY

Special Battery Warranties: Specified form in which manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.

Warranted Cycle Life for Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 35 deg. C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	6 cycles
30 minutes	30 minutes	1.67	20 cycles
15 minutes	45 seconds	1.67	120 cycles

1. Warranted Cycle Life for Premium Valve-Regulated, Lead-Acid Batteries: Equal to or greater than that represented in manufacturer's published table,

including figures corresponding to the following, based on annual average battery temperature of 35 deg C:

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

See Evaluations.

Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.

Manufacturers will honor either of two options in subparagraph below. Initial cost increases with length of warranty.

Special Warranty Period: Three years from date of Substantial Completion.

5.0 PRODUCTS

5.1 MANUFACTURERS

Edit this Article with other Part 2 articles in which manufacturers are named. See Division 1 Section "Product Requirements" for an explanation of the terms "Available Manufacturers" and "Manufacturers" and the effect these terms have on "Comparable Product" and "Product Substitution" requirements.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

5.2 PERFORMANCE DESCRIPTION

Automatic operation includes the following:

1. Normal Conditions: Supply the load with ac power flowing from the normal ac power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
2. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter ac power output to the load without switching or disturbance.
3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated ac power to the load without switching or disturbance.
4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external

- source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
 6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
 7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
 8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
 9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.
 10. Battery backup time shall be 15 minutes at full load.

Manual operation includes the following:

1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.

5.3 SERVICE CONDITIONS

Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 5 to 45 deg. C.
2. Ambient Temperature for Battery: 0 to 35 deg. C.
3. Relative Humidity: 0 to 95 percent, no condensing.

5.4 PERFORMANCE REQUIREMENTS

The UPS shall perform as specified in this Article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

- i. Inverter is switched to battery source.
- ii. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
- iii. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
- iv. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single

harmonic component is a minimum of 5 percent of the fundamental value.

- v. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor for a period of 15 minutes.

Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 percent from nominal voltage.

Maximum Energizing Inrush Current: Six to Eight times the full-load current.

Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of battery voltage.

Output Frequency: 50 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.

Limitation of harmonic distortion of input current to the UPS shall be as follows:

Maximum Harmonic Content of Output-Voltage Waveform: 5 percent RMS total and 3 percent RMS for any single harmonic, for rated full load with THD up to 50 percent, with a load crest factor of 3.0.

Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.

Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 100 ms:

1. 50 Percent: Plus or minus 5 percent.
2. 100 Percent: Plus or minus 5 percent.
3. Loss of AC Input Power: Plus or minus 1 percent.
4. Restoration of AC Input Power: Plus or minus 1 percent.

Input Power Factor: A minimum of 0.95 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.

EMI Emissions: Comply with FCC Rules and Regulations, and with 47 CFR 15 for Class A equipment.

5.5 UPS SYSTEMS

Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.

Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.
Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.

Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch and static bypass transfer switch. Protect rectifier-charger, inverter, controls, and output components.

Output Circuit Neutral Bus, Conductor, and Terminal Opacity: Rated phase current times a multiple of 1.73, minimum.

5.6 RECTIFIER-CHARGER

Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.

Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.

Rectifier-Charger Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.

Response Time: Field adjustable for maximum compatibility with local generator-set power source.

Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

5.7 INVERTER

Description: Pulse-width modulated, with sinusoidal output.

5.8 STATIC BYPASS TRANSFER SWITCH

Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.

Switch Rating: Continuous duty at the rated full UPS load current, minimum.

5.9 BATTERY

Description: Valve-regulated, recombinant, lead-calcium units, factory assembled in an isolated compartment of UPS cabinet and complete with battery disconnect switch.

Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units, and factory assembled in an isolated compartment or in a separate matching cabinet, complete with battery disconnect

switch.

5.10 CONTROLS AND INDICATIONS

Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.

Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.

Indications:

- Quantitative indications shall include the following:
 - i. Input voltage, each phase, line to line.
 - ii. Input current, each phase, line to line.
 - iii. Bypass input voltage, each phase, line to line.
 - iv. Bypass input frequency.
 - v. System output voltage, each phase, line to line.
 - vi. System output current, each phase.
 - vii. System output frequency.
 - viii. DC bus voltage.
 - ix. Battery current and direction (charge/discharge).
 - x. Elapsed time discharging battery.
- Basic status condition indications shall include the following:
 - i. Normal operation.
 - ii. Load-on bypass.
 - iii. Load-on battery.
 - iv. Inverter off.
 - v. Alarm condition.
- Alarm indications shall include the following:
 - i. Bypass ac input overvoltage or under voltage.
 - ii. Bypass ac input over frequency or under frequency.
 - iii. Bypass ac input and inverter out of synchronization.
 - iv. Bypass ac input wrong-phase rotation.
 - v. Bypass ac input single-phase condition.
 - vi. Bypass ac input filter fuse blown.
 - vii. Internal frequency standard in use.
 - viii. Battery system alarm.
 - ix. Control power failure.
 - x. Fan failure.
 - xi. UPS overload.
 - xii. Battery-charging control faulty.
 - xiii. Input overvoltage or under voltage.
 - xiv. Input transformer over temperature.
 - xv. Input circuit breaker tripped.
 - xvi. Input wrong-phase rotation.
 - xvii. Input single-phase condition.
 - xviii. Approaching end of battery operation.
 - xix. Battery under voltage shutdown.

- xx. Maximum battery voltage.
- xxi. Inverter fuse blown.
- xxii. Inverter transformer over temperature.
- xxiii. Inverter over temperature.
- xxiv. Static bypass transfer switch over temperature.
- xxv. Inverter power supply fault.
- xxvi. Inverter transistors out of saturation.
- xxvii. Identification of faulty inverter section/leg.
- xxviii. Inverter output overvoltage or under voltage.
- xxix. UPS overload shutdown.
- xxx. Inverter current sensor fault.
- xxxi. Inverter output contactor open.
- xxxii. Inverter current limit.

Controls shall include the following:

- i. Inverter on-off.
- ii. UPS start.
- iii. Battery test.
- iv. Alarm silence/reset.
- v. Output-voltage adjustment.

Emergency Power off Switch: Capable of local operation and operation by means of activation by external dry contacts.

5.11 OUTPUT ISOLATION TRANSFORMER

Description: nit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:

Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a suitable K-factor.

- i. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
- ii. Regulation: 5 percent, maximum, at rated nonlinear load current.
- iii. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
- iv. Electrostatic Shielding of Windings: Independent for each winding.
- v. Coil Leads: Physically arranged for minimum inter lead capacitance.
- vi. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
- vii. Capacitive Coupling between Primary and Secondary: 33 Pico farads, maximum, over a frequency range of 20 Hz to 1 MHz

5.12 BASIC BATTERY MONITORING

Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
Annunciation of Alarms: At UPS control panel.

5.13 BATTERY-CYCLE WARRANTY MONITORING

Description: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring of charge-discharge cycle history of batteries covered by cycle-life warranties.

Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on front panel display.

5.14 SOURCE QUALITY CONTROL

Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:

- i. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - ii. Full-load test.
 - iii. Transient-load response test.
 - iv. Overload test.
 - v. Power failure test.
- Report test results.

6.0 INSTALLATION

Retain first paragraph below if required. Coordinate with Drawings.

Install system components on 100mm high concrete bases.

Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

See Evaluations for discussion of grounding for separately derived systems created by isolation transformers. Coordinate this Article with Drawings.

Separately Derived Systems: If not part of a listed power supply for a data-processing room, comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

Identify components and wiring according to relevant section of this specifications Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

7.0 FIELD QUALITY CONTROL

Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.

Manufacturer's Field Service: Engage a factory-authorized service

representative to inspect, test, and adjust equipment installation including connections and to assist in field testing. Report results in writing.

Electrical Tests and Inspections: Perform tests and inspections according to manufacturer's written instructions and as listed below to demonstrate condition and performance of each UPS component:

Inspect interiors of enclosures, including the following:

- Integrity of mechanical and electrical connections.
- Component type and labeling verification.
- Ratings of installed components.

- Test manual and automatic operational features and system protective and alarm functions.

Retest: Correct deficiencies and retest until specified requirements are met.

Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

SECTION-E-15

SELF CONTAINED EMERGENCY LIGHTS

1. SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and positions of light fixtures.

The light fixtures with accessories shall also comply with the General Specifications for Electrical Works, Section - E-1 and with other relevant provisions of the Tender document.

2. GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3. STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

- BSEN 1838 Emergency Lighting

4. EMERGENCY LIGHTS

The emergency indoor lighting shall be operative during power breakdown and emergency situation, light fitting in several areas shall be provided according to specifications.

All emergency lighting equipment utilized shall comply the standards as listed above. Emergency lighting shall be provided using self-contained 7W fluorescent type maintained for 3 hours duration battery inverter packs fitter to selected luminaries.

Along with emergency lighting 'Exit' signs shall be managed from the same lighting control modules as normal luminaires.

5. EXIT & SAFETY Luminaire

All Exit luminaires shall have pictogram legends as per DIN 4844/CEN TC 169, EN50171 or markings as per local civil defense requirements with viewing distance of 24 meters. The luminaire shall be built according to EN 60598. It's rating shall be 8W with 3 hours battery backup and IP 65 ingress protection.

Working Voltage: 220 – 240V AC/ 50/60 Hz

Viewing distance: 24 meters

Installation: It can be mounted on Wall/Side/ Ceiling

Accessories: It shall have over charge and discharge protection with charging LED and test button.

6. EMERGENCY LUMINAIRE

Luminaire shall be of fluorescent type

All luminaires shall meet following requirements:

Battery backup: 3 hr

Power rating: 7W

Supply voltage: 230V AC

Ingress Protection: IP 65

The luminaire shall comply with the requirements of EN60598

Electronic ballast shall comply with the requirements of EN60298/60294

EMC or EMI protection to EN55015

Ambient Temperature – 40 °C.

SECTION-E-16 (a)
ESE LIGHTNING PROTECTION SYSTEM
(For Buildings)

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2.0 SUMMARY

This Section includes lightning protection for buildings and associated structures and requirements for lightning protection system components.

3.0 SYSTEM DESCRIPTION

Protect relevant buildings from lightning by means of a system of conductor running on the roof top and effectively grounded, in accordance with relevant codes.

The Direct Lightning strike protection system should be based on Controlled Early Streamer Emission technology, designed to intercept the lightning by initiating an upward streamer precisely at the time of an impending lightning strike and safely convey the lightning current to earth through a known and preferred route.

The direct lightning protection system shall include components like Controlled Early Streamer Emission enabled Air terminal (CESEAT), Mechanical support, down conductor(s), Air Terminal maintenance/function test meter, LCD based Transient Event Counter, and maintenance free earthing system based on chemical earth enhancing compound to reduce the earth resistance.

Optimum lightning protection for the site shall be determined using a Risk Assessment software, strictly adhering to international guidelines laid by NFC 17-102 and IEC 62305. A certified representative/engineer from the manufacturing company shall be present at all times during the Design and Installation process.

4.0 SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections-E-01.

Product Data for each component specified. Include the following:

Shop Drawings detailing lightning protection system, include air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and information on how concealment requirements will be met.

Field inspection reports indicating compliance with specified requirements.

5.0 QUALITY ASSURANCE

Manufacturer and Installer Qualifications: Engage an experienced manufacturer who produces system components made of high quality materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer.

Life service of the materials used shall not be less than 30 years.
Lightning protection system shall conform to BS-6651 current edition.

6.0 SEQUENCING AND SCHEDULING

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

7.0 LIGHTNING PROTECTION SYSTEM COMPONENTS:

A) Essential Requirements for Air Terminals

- a). Essential Requirements for Air Terminals
 - a. The CESEAT shall be UL Listed, to be supported with the duly verified UL-certification online access submitted against demand.
 - b. The protection area of the air-terminal shall be determined using Rolling Sphere Method as indicated in the following standards, IEC 62-305 and NFC 17-102
 - c. Components used in the LPS shall be in accordance with IEC 62305 and IEC 62651(Part 1 – 7)
 - d. The CESEAT shall be supported with independent third party certification by the manufacturer, certifying the compliance to the Annex C of the NFC 17-102 version 2011 along with test reports for the following tests:
 - Mechanical Tests
 - Environmental Tests (salt mist treatment and humid sulphurous atmosphere)
 - Electrical Tests (High-Voltage laboratory test with a standardized waveform 10/350µs
 - Performance Assessment (ΔT Test in High-Voltage laboratory)
 - EMC Tests
 - e. The CESEAT Advanced Triggering performances must be >10µs and <60µs. Any CESEAT with a rating >60µs, shall be deemed unfit for operation.
 - f. The CESEAT must be CE marked (EMC compliance to NF EN 61000-6-2 / NF EN 61000-6-3 / NF EN 55016-2-3 / NF EN 61000-4-3 / NF EN 61000-4-2)
 - g. The CESEAT shall have been tested in a High-Voltage laboratory with a standardized waveform 10/350µs. The CESEAT standard variations σESEAT measured in the High Voltage Laboratory vs a Single Rod (σSRAT) must be ≤0.8.
 - h. The air-terminal shall be tested to support a 250kA current or more. Test to be performed in accordance to NFC 17 102 (France)

- i. The CESEAT shall be tested in real lightning conditions.
- j. The CESEAT shall be made of Stainless Steel 316 grade non-corrosive metallic components. It shall be equipped with a central rod made of copper, copper alloy or stainless steel.
- k. The rod and the CESEAT tip shall have a conductive cross-sectional area larger than 120mm²
- l. The CESEAT shall guarantee a full electrical continuity between the tip and the down-conductor.
- m. No external power supply shall be required for the effective working of the system
- n. The CESEAT shall be active only during a storm
- o. The CESEAT shall ensure the emission of a streamer when a lightning strike is occurring in the claimed protection area.
- p. The CESEAT shall ensure the neutralization of the space charges surrounding its tip prior to the triggering of the upward streamer.
- q. Performances of the CESEAT shall not be affected by extreme climatic conditions
- r. The CESEAT shall be designed to ensure its maintenance during its lifetime: Modular design enabling to repair/replace defective components
- s. Plug and Play module, Testable on site, using hand-held smart remote monitoring system. Designed to be upgradable on site to integrate a self-sustainable, solar powered "distant testing module" to facilitate distant testing on site up to 100m from the air terminal
- t. Lightning strike counter and battery status information to be displayed on the hand-held device
- u. Single remote programmed to monitor multiple Air terminals within the range of 100m
- v. CESEAT manufacturer warranty shall be for a minimum of 5 years (60 months)

8.0 B) Air Terminal (FOR TERMINAL BUILDING)

- a) Type : Controlled Early Streamer Emission (CESE) Air Terminal.
- b) Protection levels : Level I - 20m, Level II - 30m, Level III - 45m and Level IV - 60m (Rolling sphere method)
- c) Detection of downward Streamer : Continuous measuring of Electric field gradient ($\Delta E/\Delta t$)

- d) Material used : Stainless Steel Water Proof Enclosure, central rod made of Nickel plated copper
- e) Advanced Triggering time : Greater than 10 μ s and less than or equal to 60 μ s.
- f) Radius of Protection : Min. 79 Meters with Level-I protection for ΔT of 60 μ s (When installed at a height of 5m above the finished roof level)
- g) Type of fixing arrangement : 5-meter-high fixed on GI base plate with sound mechanical fittings & guying to take care of wind velocity suitable.
- h) Constructional details : Triggering device housed in a stainless steel weather proof and non-corroding Housing. Central rod shall be surrounded by smaller electrodes to assist development of an effective early streamer
- i) Internal circuits : 6 independent and synchronized modules
- j) Triggering devices- type : Electronic triggering device, external power supply not required
- k) Sensors – type : Lower and upper series sensors arranged around the central pick-up rod internally connected with the triggering device for the fast sensing of atmospheric charge buildup.
- l) Approvals/Standards : Tested in a High voltage laboratory confirming to NFC 17-102 Appendix-C and IEC 62 305
- m) Reduction in standard deviation : 60% compared to standard deviation of Single rod
- n) Testing facility : Plug and play module. Testable on site, using hand-held smart remote control. Also, Upgradable on site to integrate a "distant testing solar module" (distant testing on site up to 100m from the air terminal)

C). Air Terminal Support

- The installation materials used should be non-corrosive and long lasting.
- The installation of the tower should be at a height of min. 2 meters from the finished roof level or the highest point on the structure
- The support shall be securely bolted to other mast materials with where necessary to enable the air termination and mast system to withstand maximum locally recorded wind velocities
- Elevation pole made of Class 'B' GI- material having ISI-marking. Consists of the following (for a typical 5m mast):
 - a. 3mtr x 60mm dia GI pipe
 - b. 2.5mtr x 50mm dia GI pipe
 - c. Reducer, M20 thread
 - d. Base plate(200x200x10mm), mounting bracket, clamps and all required fixing accessories supplied in compliance with IEC 62305

D) Down Conductors

70sqmm bare Copper down conductor is embedded in structural columns as indicated on the drawings. It is connected to the mesh of horizontal protective conductors on roof. The down conductor is connected via test link located at the lowest level to foundation reinforcement steel for earthing the system as indicated on the drawings. Each down conductor is to be effectively Cad welded to the foundation steel using recommended method as per codes to form an earth termination network.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services. Provide additional rods, as required to achieve the required resistance without any additional cost.

9.0 EXECUTION EXAMINATION

Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.

10.0 INSTALLATION

Install lightning protection as indicated, according to manufacturer's written instructions.

Install conductors with direct paths from air terminal to ground connections. Avoid sharp bends and narrow loops.

Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

11.0 CORROSION PROTECTION

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

12.0 FIELD QUALITY CONTROL

Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion.

SECTION-E-16 (b)
LIGHTNING PROTECTION SYSTEM
(For Substations)

1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. SUMMARY

This Section includes lightning protection for buildings and associated structures and requirements for lightning protection system components.

3. SYSTEM DESCRIPTION

Protect relevant buildings from lightning by means of a system of conductors running on the roof top and effectively grounded, in accordance with relevant codes.

4. SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections-E-01. Product Data for each component specified. Include the following:

Shop Drawings detailing lightning protection system, include air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and information on how concealment requirements will be met. Field inspection reports indicating compliance with specified requirements.

5. QUALITY ASSURANCE

Manufacturer and Installer Qualifications: Engage an experienced manufacturer who produces system components made of high quality materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer. Life service of the materials used shall not be less than 30 years.

Lightning protection system shall conform to BS-6651 current edition.

6. SEQUENCING AND SCHEDULING

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

7. LIGHTNING PROTECTION SYSTEM COMPONENTS:

Air Terminal

Air terminal shall be taper pointed copper 1000 mm long, 15 mm dia. with

base. The air terminal shall be similar to Furse Cat. No. RAD 215 or equal. Use all accessories for fixing as recommended by the manufacturer.

Horizontal Roof Conductor

Roof conductor shall be bare copper tape of minimum 25 x 3 mm size similar to Furse TC-030 or equal. Horizontal bare conductor shall form a cage on the roof as per BS 6651. All fixing accessories shall be of high grade copper as manufactured by an approved specialist. Provide horizontal copper tape around the building at every 10 meter as per BS Standard 6651.

Bonding of Metal Structures

All external metal structures above the roof surface and on building facade shall be effectively bonded to the lightning protection system as per BS 6651.

Down Conductors

70sqmm PVC Copper down conductor in 50 mm GI pipe is embedded in structural columns as indicated on the drawings. It is connected to the mesh of horizontal protective conductors on roof. The down conductor is connected via test link located at the lowest level to foundation reinforcement steel for earthing the system as indicated on the drawings. Each down conductor is to be effectively Cad welded to the foundation steel using recommended method as per codes to form an earth termination network.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services. Provide additional rods, as required to achieve the required resistance without any additional cost.

8. EXECUTION EXAMINATION

Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.

9. INSTALLATION

Install lightning protection as indicated, according to manufacturer's written instructions. Comply BS-6651. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing. Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

10. CORROSION PROTECTION

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials. Use conductors with protective coatings where conditions would cause deterioration or

corrosion of conductors.

11. FIELD QUALITY CONTROL

Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion.

SECTION - E – 17 LIGHTING POLES & ACCESSORIES

1. Description

These shall be manufactured generally in accordance with the latest edition of BS EN 40-2:2004 & BS EN 40-5:2002. The base plates and bracket arms (Single or Double) shall be manufactured as separate units and suitable for mounting or fixing on to the poles.

The galvanized Iron poles shall be of mild steel as shown on drawing from base plate to luminaire connection, well-proportioned and neatly finished. The height of the pole from the centre line of the spigot for luminaire connection to the ground line and out-reach of each arm from the vertical centre line of the pole to the tip of the spigot for luminaire attachment shall be as shown on drawing. Approval of the Consultant shall be obtained before ordering the poles for manufacturing.

2. Applicable Standards/Codes

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this Section:

BS 5649	-	Specifications for lighting columns
NV 65	-	Specifications for lighting columns
CM 66	-	Specifications for lighting columns
XP P 97 406-1	-	Specifications for lighting columns
ASTM A36	-	Steel for pole and Base plate
ASTM A307	-	Anchor Bolts
BS EN ISO 1461	-	Galvanization
ASTM A123 & A385	-	Galvanization

3. Poles and Brackets

Pole for road lights shall be both single and double bracket type and shall be fabricated from 4 to 6 mm thick MS sheet.

- (a) The poles shall be suitably designed for ground mounting. The J-bolt size shall be of 25mm diameter and of galvanized stainless steel grade SS 316. Each individual J-bolt shall be complete with washers and nuts (the quantity of J-bolt shall be recommended by the pole manufacturer/supplier).
- (b) Mounting details including all data, calculations, imposed loads and forces and dimensional drawings for the foundations required for the poles shall be endorsed by a registered Structural Professional Engineer.
- (c) The soil bearing capacity at the site shall be ascertained so that the foundations can be correctly designed.
- (d) Poles shall be made in such a way that only one (1) sheet of steel plate is used to form an octagonal/tubular pole. Welding shall be carried out along one edge of the poles only.
- (e) Poles seam welding shall comply with the latest edition of EN 1011-2 by automatic continuous welding process.
- (f) As bitumen coating shall be applied internally and externally to the base section of the poles, extra care shall be taken during the transportation

and storage to prevent the poles from being dirtied by the bitumen coating. The poles shall be packed for transportation and storage in such a way that the clean galvanized surfaces are not side-by-side, below or above the bitumen coating. Wrapping of the bitumen portion with newspapers is not acceptable, as the removal of the latter will pose a problem. The protection of the bitumen from smearing the non-bitumen part of the poles shall be such that it could be easily removed during erection.

- (g) The material used for strapping the poles together during the delivery shall be of non-rust type. This is to prevent rust from appearing at the straps due to weather if stored for a long period.

4. Material Requirements

The pole (vertical portion) along with base plate shall preferably be in one piece. But if manufacturing in one length is not possible, it can be in two or three pieces with force fit lap joint. The steel poles after fabrication shall be galvanized by hot dip process both in and outside as per BS-729. Hot Dip Galvanizing shall be carried out after removing grease, burs and slag etc. so that zinc coating is adherent, dense, smooth, continuous and uniform. The steel used in the manufacture of poles shall be made by open hearth or electric furnace process.

The contractor shall ensure before placing of order that the firm has adequate facility for hot dip galvanizing process as per standard practice.

The steel for poles shall have the following requirements:

Tensile Strength

- | | |
|-----------|-------------------------|
| ○ Minimum | 39.9 kg/mm ² |
| ○ Maximum | 56.3 kg/mm ² |

Yield Point

- | | |
|-----------|-------------------------|
| ○ Minimum | 24.7 kg/mm ² |
|-----------|-------------------------|

Elongation

for a 200 mm sample: = 20% min.

The straight portion of the pole shall be truly vertical and no deviation more than 100 mm in the entire length shall be accepted.

Other tolerances shall be as follows:

- | | | |
|--------------------------|---|-------|
| ○ Outside diameter | = | +1% |
| ○ Wall thickness | = | +10% |
| ○ Overall Length of pole | = | +0.5% |
| ○ Weight | = | -0.3% |

+Not Limited

The pole and the bracket shall be so designed that when subjected to wind at a velocity of 160 km/hour on the full projected area of pole, bracket and the luminaire; a factor of safety of 3 on minimum tensile strength of the material shall be obtained. In addition, the temporary horizontal deflections at the luminaire position shall not exceed 1/40 of the length of the pole above ground at aforementioned wind velocity.

IMPORTANT: Adequate arrangements shall be made to restrict bracket to rotate around the axis of pole at aforementioned wind velocity.

The poles shall have a base compartment, designed to accommodate a loop-in services cutout for 4 cores PVC/SWA/PVC cable of given sizes. An 8 mm stainless steel stud complete with nut and washers shall be provided in the base compartment of the pole for earthing purpose.

The edges of the door opening on the pole shall be reinforced with a 10 mm thick M.S square bar to reinstate the strength of this location. The opening cover shall consist of waterproof hinged door with rubber gasket. The door shall be provided with heavy duty non-rusting lock .

5. Construction Requirements

Lighting poles shall be handled/transported and erected in such a way so as to avoid any damage. Any damage to pole or galvanizing shall be made good to the satisfaction of the Engineer. The lighting poles shall be stored clear of soil, ground water or other rust producing materials. The fixing of poles shall be carried out in accordance with manufacturer's instructions and good engineering practice.

The poles shall be erected in a true vertical position. The contractor shall be responsible until completion of the maintenance period for correcting the alignment of any pole/bracket from its original position except where it is due to vehicle impact.

Where lighting poles are to be installed in the vicinity of overhead power lines, the Contractor shall inform the Engineer and act as directed by him. Contractor shall number all the poles with high quality paint using stencil of 50 mm high lettering. The numbering shall be at 1200 mm from the bottom of pole towards the road . The numbering shall be in a manner as directed by the Engineer.

Earth backfill around pole foundation, shall be done in 150 mm thick layers and shall be well rammed and compacted to provide full lateral support.

5.1 Pole internal wiring

(a) An adequate length of PVC/PVC sheath cable, 3-core, 2.5mm^2 rated at 450 / 750 Volts, shall be provided for the connection between the fuse cut-out unit and the Light Fixture. The cables shall be properly supported to prevent undue strain on the cable terminations. The cable color identification shall comply with the latest Standards

(b) The cables used shall be manufactured to the latest edition of IEC 60502-1.

6. Data To Be Submitted

Before manufacturing, the contractor shall provide the following data.

High Mast/ Lighting Poles

- Manufactures
- Country of origin
- Type with manufacturer's catalogue and descriptive leaflet

- Details of construction with detailed specifications of material used for Column and holding down bolts
- Calculation showing details of stresses under maximum wind loading and gusting
- Calculations and sizes for necessary concrete support bases
- Design calculation sheets for the poles from manufacture shall also be submitted by the Contractor to show that poles/foundations are safe for all specified stresses

7. TESTING OF ROAD LIGHT POLES

7.1 General

The poles shall be tested and results recorded for each test by the manufacturer in the presence of an authorized representative of the owner or Engineer as stated below.

7.2 Inspection

The material, weight and dimensions of poles as specified shall be certified by the manufacturer. The Poles shall be inspected and in case being found below the limits of tolerance as aforementioned, shall be rejected.

7.3 Loading Test

The poles shall be cantilevered horizontally and rigidly supported at base plate and loads applied at right angle to axis of the pole at some distance from top. The test items shall be as follows:

- Deflection test
- Permanent set test and Breaking Load Test

Sample comprising four poles shall be selected random out of each lot 50 and subjected to deflection test. One pole per 250 shall be tested for permanent set test and breaking load test. When the poles in Tender are limited in number, the manufacturer may avoid deflection, permanent set and breaking load test and supply results of tests already done for prototype testing on such poles or supply calculation based results.

7.4 Galvanizing

Weight, uniformity of coating and other requirements shall be strictly inspected in accordance with BS-729 or other relevant international standards.

7.5 Service Cutouts

Each pole shall be provided with a waterproof and dust tight loop-in-service cutout accommodated in the base compartment of the pole.

The junction box shall comprise one (1) 6 A MCB single arm poles and two (2) 6 A MCBs for double arm poles (all MCBs shall be capable of operating at 55° C), a solid neutral link and earthing terminal. It shall incorporate arrangements for looping "IN" and "OUT" for 4 core upto 70 mm² PVC/SWA/PVC cable having copper conductor. The earth terminals, nuts and washers shall be adequately sized to take the earth

continuity conductor with tight connections.

Dimensional drawing and details of the junction cutout box of pole shall be submitted for approval of the Engineer;

SECTION – E-18 STANDBY DIESEL GENERATOR SET

1. SCOPE OF WORK

To continue feeding electrical energy to specified main distribution board during main failure hours, an emergency diesel generating set shall be provided and installed in Generator Room as shown on the drawing. The installation shall be complete with all necessary auxiliary equipments, control and protective gears, oil tank and related piping, exhaust piping, ducting and control cabling to provide a complete operational system of emergency power supply.

2. RATING

The prime power diesel engine driven generating set shall have the following rating and electrical characteristics:

a.	Generating Capacity (Prime Power Rating)	As indicated in the BOQ
b.	Voltage	400 Volts, $\pm 5\%$
c.	System	3 Phase 4 wire
d.	Frequency	50 Hz, $\pm 2\%$
e.	Number of revolutions	1500 RPM

3. CLIMATE CONDITIONS

The diesel generating set shall be designed to withstand the climatic conditions prevailing in Turbat throughout the year and as such maximum and minimum ambient temperatures, maximum humidity and altitude shall be considered as stated in Section-1. The tender shall quote in his offer the above climatic parameters he has considered for the design of his equipment.

4. SPECIAL REQUIREMENTS

The generating set shall be designed in such a way that the capacity shall be sufficient to give 10% overload for one hour in any period of twelve hours operation.

5. OPERATION DESCRIPTION

The A.C. diesel engine driven electric generating set shall be arranged for electric starting mains within limits, the set shall stay in stand-by position.

It shall automatically start and supply power to the load within approximately 0 to 5 Second of the complete cessation of mains supply failure on one or more phases, or when the voltage is reduced by 20% of nominal, and automatically shut down the plant and re-transfer the load back to the mains supply to stabilize before retransfer of the load takes place, and shall be adjustable over the 1-10 minute range.

6. ALTERNATOR SPECIFICATIONS

- a. The alternator shall be continuously rated and be of steel construction. It shall be A.C. Brushless type. The bearings shall be grease lubricated or roller bearings.
- b. The rotor shall consist of dynamically balanced salient pole revolving field. The poles shall be equipped with damper windings. The field coils shall be to withstand high centrifugal stresses without developing any damage. Rotor insulation shall conform to Class-H.
- c. The stator core shall be made from high grade laminated silicon steel and carefully tightened to prevent occurrence of magnetic vibrations. The stator windings shall be provided insulation conforming to Class-F. All windings shall be fully impregnated for tropical climates with high quality oil resistant varnish.
- d. The A.C. exciter shall have permanent magnets in its field ensuring positive voltage build-up. The rectification shall be affected by a suitably rated silicon diode assembly over-hung to the shaft. The rotating rectifier assembly shall be built to withstand vibration and centrifugal forces.
- e. The inherent characteristics of the alternator shall be such to maintain the output voltage under all conditions of load, power factor and temperature, within the limits of $\pm 5\%$ of nominal.
- f. The alternator shall have self contained excitation system with transistorized automatic voltage regulator. The automatic voltage regulator and control gear shall be mounted in a component box on the side of the machine using antivibration mounting. Electrical connections to the voltage regulator shall be taken through a multi-way plug and socket.
- g. The alternator shall be screen protected and drip proof. It shall have efficient cooling system using centrifugal fans. It shall be provided with a large terminal box for outgoing cable connections.
- h. The alternator shall be able to suppress radio or television interference in accordance with BS 800. Line voltage waveform shall contain not more than approximately 2% total harmonic contents.
- i. The temperature rise and performance shall comply with BSS 2613/1957.

7. ALTERNATOR PROTECTION

Alternator protection shall be incorporated to shut down automatically the set with a visual cum-audio alarm of the following conditions:

- a. Over / Short circuit current
- b. Over and under voltage.
- c. Over and under frequency
- d. Reverse power
- e. Rotor ground fault protection

8. DIESEL ENGINE SPECIFICATIONS

- a. The engine shall be 6 cylinder, 4 stroke, direct injection, continuously

- rating as in the BOQ, water cooled industrial diesel engine.
- b. The engine shall withstand a 10% overload for a period of 1 hour (in 12 hours) in accordance with BS 5514).
 - c. An engine driven pump shall circulate the lubricating oil under pressure and full flow filters with replace-able elements shall be fitted.
 - d. An inline fuel injection pump and a diaphragm type lift pump with full filters with replaceable element and a fuel solenoid shall be provided.
 - e. Governing shall conform to Class-A limits of BS 649/1958 and an electronic Governor shall be provided.

9. ENGINE PROTECTION EQUIPMENTS

Engine protection equipment shall be incorporated to shut down automatically the set with a visual cum-audio alarm of the following conditions:

- a. Low lubricating oil pressure (Below a safe working value).
- b. High cooling water temperature
- c. Engine Over speed.
- d. With fuel oil level down engine protection system shall develop visual cum-audio alarm.

10. GENSET CONTROL PANEL

The control panel shall be electronic solid state type. Automatic start Engine management and instrumentation system module in cubical is installed on individual bracket with anti-vibration isolator, with instruments and graphical icon in LCD display as follows.

- a. Generator running indicator.
- b. Voltage adjuster.
- c. Emergency stop button
- d. Selector Switch with key (STOP / RESET, AUTO, MANUAL).
- e. Manual start button.
- f. Common alarm indicator
- g. Scroll button for the display on LCD.
- h. Value display on LCD.
 - ✓ Frequency / RPM.
 - ✓ AC voltage Line-Neutral.
 - ✓ AC voltage Line-Line.
 - ✓ AC line current.
 - ✓ Oil pressure.
 - ✓ Coolant temperature.
 - ✓ Engine hours run.
 - ✓ DC battery voltage.
- i. Alaram indication with graphical symbol on LCD.
- j. Status indicator.
- k. Remote communication via RS 232 or RS 485 "modbus" output

11. MECHANICAL COUPLING

- a. The Diesel Engine and A.C. brushless Generator shall be coupled with each other by means of flexible coupling complete with all necessary control equipment mounted on a substantially fabricated type steel base.
- b. The generator end shield and the engine flywheel housing faces shall be fully machined with spigots concentric to their shafts. A fabricated steel coupling ring with both faces machined shall be flange mounted to the flywheel housing and generator end shield by steel bolts.
- c. A flexible coupling shall be fitted between the engine and generator to provide the drive and shall be suitable to absorb the transmissions of shock loads.
- d. The distortional flexibility shall be designed to match the distortional characteristics of the system to prevent resonant conditions.

12. MOUNTING DESCRIPTION

The combined engine-generator unit shall be bolted to a separate sub-frame which shall be attached to the main frame through 'Resilient Mountings including vibration isolator so providing complete protection from the engine vibration to the control gear, and other set mounted components.

13. COOLING SYSTEM

- a. The diesel engine shall be water cooled. The cooling water shall be circulated by a centrifugal pump through a tropical duty radiator, cooled by a reverse flow fan.
- b. A fan cowl and hand protection guard shall be fitted.
- c. A thermostat shall be pass the coolant, until a pre-determined operating temperature is reached.
- d. An immersion heater shall be incorporated in the cooling system.
- e. In order to provide sufficient air flow along the radiator a canvas / G.I air duct shall be made from the radiator to the outside wall with out any extra cost of the owner.
- f. The Contractor shall provide all material and labour that is necessary to achieve purpose.

14. STARTING SYSTEM

- a. The starting system shall consist of a heavy duty starter motor and starter switch, a set of 24 volt heavy duty lead acid starting batteries of adequate capacity, all arranged for automatic electric starting.
- b. The starter motor shall automatically disengage when the engine shall fire. There shall be three automatic starting attempts before the starting batteries are, should the engine fail to start due to shortage of fuel, etc.
- c. Battery charging shall be provided from a suitable single-phase full wave rectification static charger. Charger shall be complete with all necessary relays, cutouts, controls, switches and instruments for automatic charging of batteries.
- d. The batteries shall be housed in a cradle on the main base frame.

15. GENSET GROUNDING

The genset frame shall be grounded at two points by two independent earth protected conductor and it is necessary to bond to a grounding electrode.

The genset neutral earthing shall be done with PVC insulated cables and connect to grounding electrode.

Earthing resistance shall be less than one ohm.

16. EXHAUST

A large and efficient critical acoustic type silencer with a suitable length of flanged flexible exhaust pipe shall be installed. The pipe shall be of suitable dimensions to fit direct in the exhaust manifold to allow for the free movement of the engine alternator and to give some isolation from vibration to the surrounding fabric. The exhaust pipe shall be thermal insulated and brought outside the building to a suitable height and have a rain cap at the other end.

17. FINISH

- a. All sheet steel used shall be zinc coated.
- b. The set shall be painted with good quality primer and finished with a high gloss paint.

18. ACCESSORIES

The AC diesel engine driven electric generating set shall be supplied with the following accessories and manuals.

- ✓ One - Kit of engine tools.
- ✓ One - Set of holding down bolts.
- ✓ Three - sets of installation drawings.
- ✓ Three - sets of circuit diagram.
- ✓ Three - sets of engine maintenance book.
- ✓ Three - sets of spare parts manual.
- ✓ Three - sets of generating set instruction manual.

19. FUEL STORAGE TANK

- a. A fuel storage tank with a capacity of as specified in the BOQ shall be provided inside the building. The tank shall be complete with fill pipe with connection and vent pipe with cap.
- b. The tank shall be provided with fuel level gauge.
- c. 25 mm diameter schedule 40 pipe with socket, elbow and valve etc. for fuel filling from inside the building to fuel storage tank and fuel storage tank to genset skid base tank.
- d. The fuel storage tank shall be sheet steel of 10 Gauge.
- e. Filling pipe with valve and flange shall be provided.

The overflow pipe going back from fuel tank to the Genset Skid tank shall be of 50mm diameter.

20. AUTOMATIC SYNCHRONIZING PANEL

The contractor shall provide an automatic synchronizing and load sharing system for the generators. The system shall operate fully automatically, starting, synchronizing, accepting load and load sharing within 10-15 seconds.

The synchronization panel shall be installed in the LV room and consist of but not limited to the following:

Free standing or wall mounted panel having front access and having

- 1- Bus Bar Circuit
- 2- Circuit Breakers
- 3- Instrumentation and Controls
- 4- Automatic Start / Manual Function Switch
- 5- Supervisory Control
- 6- System Status Indicators
- 7- Alarm Indicators
- 8- Start-stop and automatic mains monitoring system
- 9- Automatic Synchronization system
- 10- Load Sharing module
- 11- Provision for connection of a load bank (100% load)

The synchronization Panel shall incorporate the following accessories and shall include but not be limited to the following:

- 1- Energy Analyzer
- 2- Synch module
- 3- Emergency off push button
- 4- Manual speed adjusting, reset switches for alarm mounting, etc
- 5- Fully automatic trickle battery charger with battery voltmeter
- 6- Indicating lamps for 'Mains Available', 'Mains on Load', 'Standby Available', 'Standby on Load', 'Alarm', 'Main Fail', etc

Audio and Visual (flasher) Alarm System

21. GENERATOR TESTS

A manufacturer's standard test report/certificate shall be submitted, which shall include the following as a minimum:

- a. Load test temperature rise
 - ✓ 25 % load ½ hour
 - ✓ 50 % load ½ hour
 - ✓ 100 % load 1 hour
 - ✓ 110 % load 1 hour
- b. Operation of automatic starting, control sequence and all protection circuit/sensor.
- c. Prior to acceptance of installation, the equipment shall be subjected to an on-site test with full load for a minimum period of 8 hours, plus one hour at 110% load.

All operating fluids (including fuel, oil, lubricants, coolant etc.) and load banks for the testing shall be provided by the contractor, who shall commission the genset, making all initial adjustment and setting required and test all the control and protection function and circuit. Three copies of the witnessed test report shall be submitted to the Employer.

The contractor shall have the kWh meters sealed and the installation approved by the electrical inspector.

22. MAINTENANCE AND WARRANTY

The contractor, as a representative of the manufacture, shall warranty the set and system to be free from all defects for a period of one year or 1000 hours (whichever is less) from the date of commissioning. All defective parts shall be replaced by the contractor free of charge during warranty period. The contractor shall train the Employer's staff in the proper operation and maintenance of the set.

23. APPROVED MANUFACTURERS OF GENERATOR SET

- a. Caterpillar
- b. Siemens
- c. Cummins
- d. FG Wilson
- e. Mitsubishi

24. SPARES

The contractor shall submit, in the format given below, a detailed itemized price list of manufacturer' recommended spares for the generator, engine and control panel for 1000 hours in the environmental condition.

a. Required Spare Parts

Type No.	Description	Qty Set	Rate (Rs)	Amount (Rs)
	<u>Engine:</u>			
	Fuel filter	4 sets		
	Oil filter	4 sets		
	Air filter	1 set		
	Water filter	4 sets		
	Fan belt	1 set		
	Water-pump belt	1 set		
	Alternator belt	1 set		
	Rocker cover gasket	2 sets		
	Gasket	2 sets		
	<u>Alternator & Panel:</u>			
	AVR	1 set		
	Forward diodes	3 set		
	Reverse diodes	3 set		
	Fuses 2 amp	5 Nos		
	Fuses 6/8 amp	5 Nos		
	Fuses 10 amp	5 Nos		

Total = -----

b. Additional spare parts:

Type No.	Description	Qty Set	Rate (Rs)	Amount (Rs)
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Total = -----

SECTION E - 19 SUB-STATION

FOREWORD

This document is to describe the minimum requirements for the supply, installation, testing & commissioning of 11 KV switchgear, 15 KV Cables and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

1. SCOPE OF WORK

The works related to the electrical system, which are included in the scope of this Contract, are shown on the Drawings, stated in these specifications. The works shall broadly include but not limited to the following:

11/0 415 kV-3-Phase transformer

11 KV Switchgear

15 KV Cable XLPE

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these documents but which is necessary for proper operation of the works / system, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and / or approved by the Manager Contract or his representative, to achieve proper coordination with various equipment offered in the bid and also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

2. SHOP DRAWINGS

The Contractor shall submit the shop drawings to the Engineer showing the detailed scheme of installation, explaining the method of installation, proposed position of termination etc., for approved before commencement of installation.

3. TRANSFORMER

3.1 Scope

The scope of this section of specification is to supply install, test and commission the transformers. The transformers shall be installed at locations shown on the drawings. For installation details the manufacturer's recommendations is to be followed.

3.2 Specifications

The capacity of the transformers shall be as shown on the drawings and mentioned in the BOQ. The transformers shall be oil-immersed type naturally cooled 3-phase indoor type to BS 171 / IEC 76 specifications in all respects.

The transformers shall meet the following specifications.

- Type : ONAN
- Voltage ratio at no-load : 11000 / 415 volts.
- Frequency : 50 Hz
- Vector Group : DY 11
- Off load tap changer (HT) : +2.5%, +5%, +7%
- HT connection : 11 KV Delta
- LT connection : 415 V with grounded star point.
- Neutral on LT side : Solidly earthed
- Ambient temperature : 50 degrees centigrade
- Temperature rise of oil over: 40 degrees centigrade ambient temperature.
- Temperature rises of winding: 50 degrees centigrade over ambient temperature.
- Impedance voltage : 4.5% to 6%
- Rated max. voltage HT/LT : 15 KV 0.6 KV
- Voltage regulation for rated : Not to exceed 2.5% of no-load operating condition at 0.85 P.F. secondary voltage.

The transformers shall be provided with the following accessories.

- Double float Bucholz relay for alarm and tripping with testing facility.
- Oil conservator.
- Silicagel breather, with oil bath
- Lifting Jugs
- Bi-directional rollers.
- Pressure release safety valve.
- Oil filling valve
- Oil drain valve
- Earth terminal
- Dial level gauge
- Dial type thermometer with maximum temperature indicator pointer and tripping facility.
- Diagram and name plate
- Pressure Release safety valve
- Off-load tap changer fitted with position indicator and pad-locking arrangement.
- HT porcelain bushings with protective spark gaps.
- LT and neutral porcelain bushings.

- Cable Termination Box on LT and HT side
- Marshalling box

The transformer tank shall be constructed of welded boiler plates and provided with external radiating tubes. The steel cover plate shall be bolted to the tank using gasket for perfect oil seal. The tank shall be anticorrosive painted and finished in grey colour.

The transformer core shall be built of non-aging, cold rolled, electrical silicon steel lamination and each lamination insulated to reduce eddy current losses. The core laminations shall be clamped and bolted effectively to reduce humming. The winding, coils shall be of high grade electrolytic copper conductor, flat or round, paper insulated thoroughly dried and impregnated as required.

The filling of oil shall be carried out at such a temperature that the pressure in the tank is at a minimum. The space above the oil shall be evacuated and filled with dry clean nitrogen. The pressure of nitrogen inside the top cover shall not exceed 0.35 kg/sq.cm.

Tank and terminal box joints shall be fitted with gaskets to prevent entry of water. Gaskets shall be of a suitable non-absorbent material. Joint faces shall fit properly and no additional thickness or jointing shall be used to make good irregularities.

The top cover shall have a substantial flange and adequate number of bolts fixing the cover to a similar substantial flange on the transformer tank. The gasket provided at this joint shall be of synthetic rubber bonded cork. Conservator tank shall be provided with Silica gel breather to allow for expansion of oil.

3.3 Installation

Transformers shall be installed at location shown on the drawings. It is responsibility of the Contractor to check the provisions in civil works, related to transformer installation.

The installation of the transformer shall be carried out in accordance with specifications and the manufacturer's recommendations. The accessories shall be assembled, installed and connected in place so as to form a complete transformer assembly. The transformers roller wheels shall be locked after placing it in position so that the wheels do not move on the channel due to vibrations.

The HV cable connections shall be made on the HV terminal, provided on the transformer, by the Contractor as per manufacturer's recommendations. The cable compound and all other jointing / termination materials shall be provided by the Contractor without any additional cost. The neutral on the LV side shall be effectively

connected to earth.

The control wires for Buchholz relay connections to alarm and trip contacts of the HT circuit breaker at distribution stations shall be installed in a heavy gauge steel conduit with transformer station and also it shall be run along the cable trench.

3.4 Testing and Commissioning

The contractor shall submit a detailed list of manufacturers recommended tests along with test procedures and intended results, for approval by the Consultant. Any additional test recommended by the Consultant shall be made part of the list of tests to be carried out on the transformers. The manufacturers recommended test list shall be submitted at least 2 weeks prior to the planned testing activities.

Testing of the transformer shall be carried out at the manufacturer's facility as well as at the client substation. All test procedures shall comply with the manufacturer's specified procedures and as per IEC standards. All testing procedures shall be carried out in the presence of the Consultant / Client. All expenses for witnessing the test procedures shall be deemed to have been included in the quoted prices. The quoted prices shall be inclusive of transportation of the transformer to and from the manufacturer's / approved testing agent's facility.

In case any test fails to comply with standards, manufacturers recommendations, the cause of failure shall be determined and removed. The equipment shall then be retested for compliance. Any material (transformer oil, silica gel etc.) found to be inadequate or failing the required test procedures shall be replaced within the cost quoted

Upon complete installation of the transformer in its position, a thorough check shall be made for the proper fixing of accessories, protective relays, neutral connection, oil quality and level etc. The transformer shall be tested before energizing as per the Engineer's instruction. The transformer will be commissioned in the presence of the Engineer to satisfy its complete effectiveness and compliance with specifications. After installation, all tests as recommended by the manufacturer including connectivity of control equipment shall be carried out. In addition, the following shall be adjusted prior and subsequent to connection with the load;

(i) Tappings

Transformer tapping shall be adjusted for no load and full load operation providing the desired output at any tapping. Adequate protection shall be ensured to prevent risk of damage from short circuits

and having all contact surfaces of ample area for satisfactory operation during overloads.

The mechanism shall be manually operated and shall come to rest only when the switch is making full contact. At all times, clear indication shall be given of the ratio at which the transformer is operating. Means shall be provided for locking the tapping switch mechanism in the position corresponding to each voltage ratio.

All test values obtained during the test on the transformer shall be recorded. Triplicate copies of all such test datasheet (for both passed and failed tests) shall be submitted to the Engineer for necessary approval

4. 11 KV SWITCHGEAR

4.1 Specifications

The MV switchboard shall be sheet steel fabricated, cubicle type, totally enclosed, dust tight and vermin proof to IP 4X classification. It shall be floor mounting, free standing of 3mm sheet steel, de-rusted, degreased, primed with two coats of zinc-chromate and painted with two coats of enamel. It shall be of draw-out trolley design and have anti-condensate heaters thermostatically controlled in each cubicle. Provision for manual operation of the heater shall be provided. The switchboard shall be one panel incoming / outgoing with cable box for termination of both incoming and outgoing cables.

The circuit breakers shall be triple pole, withdraw able, vacuum type. They shall have manually operated drive mechanism. For manual operation a handle shall be provided. Interlocking device shall be provided such that the breaker can be closed only when it is in fully plugged in or fully withdrawn position, and withdrawal of circuit breaker is only possible in the open or isolated position, Safety shutters shall be provided to automatically cover the live contacts as the circuit breaker is withdrawn. A triple pole grounding switch shall be provided for cable and bus bars earthing. The circuit breakers shall be provided with ON-OFF push buttons. Luminous indications shall be provided for 'ON', 'OFF' 'TRIPPED' positions.

The circuit breaker shall have anti pumping capabilities to prevent immediate closing of breaker after opening due to any reason.

Each 11 KV circuit breaker shall comply with IEC 56 and shall comprise of the following accessories and meet the following requirements.

- Rated current : 630A or as shown in drawing
- Rated nominal voltage : 11 KV

- Rated maximum voltage : 12 KV
- Withstand voltage : 27 KV for 1 minute.
- Rated short circuit capacity: 350 MVA at 11 KV for one second.

- High conductivity electrolytic copper tin plated bus bars completely isolated and mechanically braced to withstand stresses under fault conditions and colour coded to BS 3245.
- High tension CTs class 0.5 for metering and protection of appropriate ratings to IEC 185
- High tension PTs class 0.5 rating 11 KV/1 110V to IEC/86

KWH meter class 1.0 with maximum demand indicator.

- KVA rh meter.
- Protective relays for over current protection

Protective relay for earth fault protection.

- Ammeters
- Voltmeter
- Voltmeter selector switch
- Indicating lamps
- Cable box of appropriate size for termination of both incoming and outgoing cables.
- Bucholz / temperature alarm/trip circuits with alarm hooter.
- Earth bar

Insulation mat shall be placed in front of the MV Panels all along the length. It shall be 200mm wide and 6mm thick and suitable for providing insulation for 11 KV working.

Danger Boards / Signs and Shock / First Aid charts shall be provided as per the requirements of the local Electricity Rules.

Contractor shall be responsible to ensure the size of cubicle can be accommodated as per site conditions, with adequate clearances available for physical inspection of the panel from all sides.

The design of panel should be such that it does not create any objection / hindrance in getting NOC / Approval from the electrical inspector.

4.2 Installation

The contractor shall provide all labor and materials, tools and equipment required to install, connection, test and commission the switchgear. All installation materials such as foundation bolts leveling, clamps, cable sockets, lugs, solder, wall plugs, steel raw bolts, washer units etc, are to be supplied by the Contractor.

Manufacturer's recommendations for installations are to be followed and therefore the shop drawings are to be approved by the Engineer before installation. The contractor shall work out in advance the position of holes, channels. For any departure from the working drawing that are deemed necessary by the Contractor due to the site condition, he shall submit the details of such departure and obtain the Engineer's instructions in writing before starting such work.

4.3 Testing and Commissioning

Upon complete installation of the switchgear in its position the Contractor shall perform tests, in the presence of the Engineer, to show the effectiveness and correctness of its components. The Contractor shall provide all labor, materials, equipment, instruments and power needed to perform the test required.

The complete assembled panels shall be checked for proper clearance, alignment fitness of all joints and earthing system. All protective relay functions shall be checked by means of primary injection tests and functional tests shall be carried out for protective alarm and interlock functions. The Contractor shall record all test values obtained during the tests on the switchgear. Triplicate copies of such test data shall be submitted by the Engineer.

5. POWER CABLE XLPE

5.1 Specifications

The MV Cable shall be XLPE insulated, 15 KV grade to IEC 502. The Conductors shall be of high conductivity stranded electrolytic copper. The insulation shall be cross-linked polyethylene extruded over the conductor. Each core shall be shielded by a semi-conducting material applied directly over the insulation. The semi-conducting material shall be covered by bare copper tape applied with suitable overlapping. Phase identification tape of red, yellow and blue shall be wrapped over the copper shield. The three insulated conductors shall be assembled with PVC filler and bound with tape. The tape binder shall then be covered with extruded PVC jacket. The PVC jacket shall be padded with a suitable material before application of armour. Armouring shall be provided with single layer of galvanized steel wire. The armouring shall be covered with binder tape. The armour shall be of appropriate size to carry the system fault current.

The entire cable assembly shall be covered with a PVC jacket of thickness not less than 2.5mm. The size of cable and voltage grade shall be given on the over-sheath at every 3 metres interval.

System voltage and rated voltage shall be 15 KV (phase to phase).

Continuous operating temperature of conductor shall be 90 degrees C.

Cable terminator kits shall be used for termination of HT cables as per manufacturer's recommendations. Cable joints where required are to be as per IEC/BS standards. Cable termination kits and cable joints are deemed to be included in the contractor's price.

5.2 INSTALLATION

Cables Laid Direct in the Ground

Cables

Cables of 1,000 volts grade and upto 15,000 volts grad laid direct in the ground shall be at a minimum depth of 900 mm measured from the top of the cables to the general ground level. For this purpose a trench shall be excavated, cleaned and the floor of the trench shall be covered with a minimum of 100 mm of clean sand or sifted soil before laying the cable. After laying the cables they shall be covered with additional clean sand or sifted soil, well punned over and around the cables to a level of 100 mm above the uppermost cable. Protective cable tiles shall be carefully placed over each cable. As per requirements of site conditions the buried depth may be changed with due approval of the Engineer.

Warning Tapes

In addition to the proactive cable tiles all cables buried direct shall be marked throughout their length by polyethylene cable warning tape colored yellow. Such tape shall be laid 300 mm above the cable tiles during the backfilling of the trenches and where required two or more tapes shall be laid side by side to ensure full width cover.

The tapes shall read "Danger – 400 volts or Danger – 11,000 volts" as the case may be.

6. L.V. SWITCHGEAR

Main, Submain Distribution Boards and DBs shall be of the totally enclosed type, dust proof, damp proof and be suitable for floor/surface/flush mounting, and comply with IEC 157, IEC 158, IEC 439, BS 4752.

They shall be suitable for 400/230 volts 3 phase, 4 wires, 50 Hz system and shall have all components rated for insulation class 600 volts minimum.

All main, sub main and MCB distribution boards shall be factory assembled. Main and Sub-main distribution boards shall be fabricated with 14SWG and MCB DBs with 16 SWG sheet steel, de-rusted, degreased, primed with two base coats of anti-corrosive paint and painted with two coats of heavy enamel paint in approved colour or powder coated. Indoor distribution boards shall have enclosures of IP-54 grade. Where powder coated switchboards have been specified, all metal work of the distribution board

shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns. Indoor distribution boards shall have enclosures of IP-42 grade.

All distribution boards shall be complete with adequately rated electrolytic tinned copper phase, neutral and earth bus bars and be complete with incoming and outgoing cable terminations arrangement, terminal block/line up terminals and shall be suitable for flush mounting of all instruments. The cabling inside the panels shall be suitably numbered and harnessed by means of straps or cords.

All components shall be installed on mounting brackets inside the enclosure and protected from the front with, screwed sheet steel safety plate. The enclosure shall be provided with rubber gasketing and a lockable hinged door with cam fastener. All distribution boards shall be front access type.

The front side of the distribution boards shall be provided with a name plate designating the board. The inside of the door shall have a chart clearly indicating the circuits with their designations. The door is to be grounded by flexible copper cable. This also applies to the common and front plate.

Suitably rated CTs shall be provided as required CTs shall be of class 0.5 for metering and 1.5 for protection.

Miniature circuit breakers (m.c.b's) and moulded case circuit breakers (MCCBs) shall be of the moulded pattern and their switching levers shall be such that they are accessible through the safety plate for operation. The short circuit rating of the circuit breakers shall be as indicated on the drawing. They shall comply with IEC Standards 947-2 and 898.

Load Break Switches and contractors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminum plate shall be provided for cable entry to ACBs / MCCBs cubicles of 630A and above rating.

Outdoor feeder pillar shall be housed in weather proof sheet steel cabinets to IP54 grade fabricated with 14 SWG sheet steel, derusted, degreased, rust-proofed with two coats of anticorrosive paint or powder coated. They shall be floor mounted on concrete bases of required dimensions.

All components of feeder pillars shall be on mounting brackets inside the enclosure. They shall be equipped with adequately rated electrolytic copper phase, neutral and earth bus bars and be complete with cable terminations arrangement, terminal block/line up terminals.

6.1 Power Factor Improvement Plant

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall have automatic as well as manual operation capability.

The power factor improvement plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts, 50 Hz system and shall be self-cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12, 8, 6 and 4 stages. Each capacitor bank unit shall be either 50 KVAR or 25 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

1 No. Multi stage power factor correction relay for automatic/manual control.

1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.

1 No. Auto-off-Manual selector switch

1 No. Current transformer with 5 amps secondary current, having suitable output burden and accuracy.

3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 50 KVAR capacitor bank:

1 No. 125 amps, triple pole 415 volts air break contractor with auxiliary contacts (2 NO+2 NC) Contractor shall be suitable for AC 3 duty.

1 Set of 2 Nos 125 Amps H RC back-up fuses with base and carrier.

1 Set of ON and OFF push buttons.

1 No. Red lamp for "On" indication of the contractor.

Requirement of Capacitor Banks

According to IEC-83 1 -1 and 831-2.

Fully insulated, terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminium coating vacuum metalized.

Safety features: Self healing. Over pressure tear-off fuse.

Withstand switching operations safely.

Maximum in rush current 200 times rated current.

Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.

Overloading capacity 1.5 times rated output at delta max.

Acceptable tolerances - 5/+ 10% of rated output at rated frequency.

Static life expectancy > 100,000 operating hours.

Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

SECTION – E – 20 ROAD LIGHTING FIXTURES

1. GENERAL

The work under this section consists of supply, storage, installation, testing & commissioning of Road lighting system read together with drawings & bill of quantity. The Contractor shall furnish all labour, materials, services, and skilled supervision necessary for the construction, erection, installation and connection of all equipment. The extent of work specified herein and/or shown on the drawings represents the minimum requirements.

Electrical Work Generally is to be in accordance with the requirements of the Specification Road lighting including luminaries, columns, related power distribution and control, protective earthing and related works including column foundations and cables etc.

The design criteria for road lighting are based on the following parameters;

Luminance (L) cd/ m ²	1.5 cd/m ²
Overall Uniformity (U _o) = (U _o + L min./L avg)	0.4
Uniformity of each lane (U _l) = (U _l + L min./ Lmax.)	0.5-0.7
Threshold increment not exceeding	<10 %

The contractor shall be responsible and confirm in writing that his selection of equipment will ensure on the road surfaces luminance level and uniformities equal or better than those defined in the lighting design criteria as mentioned above.

The contractor shall submit the technical details of the luminaries and other equipment and having obtained conditional approval thereof; submit in duplicate, full detail of the calculated results for the level and uniformity of luminance and illumination on all road surface. These details should be submitted after initial approval by the Engineer.

2. TECHNICAL REQUIREMENTS:

Minor deviations from the Drawings may be considered for improvement in construction details, but no changes are to be made without the written approval of the client/Engineer.

3.0 AMBIENT CONDITIONS:

Unless otherwise specified, equipment is to be designed and derated for continuous and trouble-free service at 50 °C ambient temperature and 100% relative humidity, with temperature reaching 70 °C in direct sunlight and with high content of ultra-violet rays. Equipment is to withstand full load operation whilst exposed to sun.

4. SHOP AND CONSTRUCTION DRAWINGS:

Contractor shall submit drawings for approval including, but not limited to, the following:

- a) Layout of equipment in exact positions with mounting and construction details, concrete foundation dimensions and reinforcement, routing and sections of duct- banks and trenches, backfill and packing material, earthing rods etc.

- b) Cabling and wiring diagrams, single line drawings, loads, phase distribution, protection and control, earthing.
- c) Calculations of illumination levels and glare, based on CIE methods.

5. LED STREET LIGHTING SYSTEM

The Road light operates from **Dusk to Dawn** i.e., the lamp automatically switches ON after the sunset and switches OFF after sunrise. The LED light should have programmable driver.

The light fixture shall be posted on single or double arm pole as shown in drawings. The luminaire shall be fixed on to the Pole and are interconnected through the cables. The street light operates in the stand alone mode.

The Street Lighting system components consist of:

- a) LED Luminaire
- b) Pole
- c) Interconnecting cables
- d) Terminal box & Circuit Breaker

6. LUMINAIRES DESCRIPTION

6.1 Housing

The fixture shall have a full die cast aluminum housing providing adequate rigidity, strength and heat dissipation.

The housing shall have integrated driver and LED lamp compartments for better heat dissipation and convenience in maintenance at the site, and shall feature highly reflective components and films to increase light output.

The optical LED compartment shall have thermally hardened glass cover and high quality silicon gaskets. The glass shall be extra-white for maximum light transmission. The glass cover shall be tightly secured with housing.

The complete fixture shall be rated for ingress protection class IP 66.

6.2 Optics

The fixtures shall have flexible optical systems for various wattage range. The fixture shall use high efficiency LED and optics system.

The Light output Ratio (LOR) shall not be less than 85%.

The fixture shall offer a composite system efficiency of more than 120 lumen / watt.

The lens system design and high efficiency LED shall facilitate maximum spacing between the road lighting poles and coverage of wider roads.

The multilayer optics design shall ensure adequate luminance uniformity in the unlikely event of individual LED failure.

The fixture shall offer choice of narrow, medium and wide beam light distribution.

The optics lens system shall have choice of narrow, medium and wide beam light reflectivity for maximum light output.

6.3 Surge Protection

The lighting fixture shall have surge protection to protect the electronic driver and LED system. Minimum surge protection rating shall be 10 KV.

SPD should comply to IEC 61347-2-11 and should be listed in Luminaires IEC 60598-2-3

6.4 IP Protection / Impact Resistance

The complete fixture including lamp and gear compartments shall have ingress protection class IP66 for Road Lights and IP65 for Flood Lights long reliable performance and minimal maintenance requirement and an impact Resistance of IK08 or above. No chemical glue shall be used as that may cause breakdown of water-proof and dust-proof seal.

6.5 Maintenance

Both the driver and LED lamp compartments shall be designed to be easily accessible for maintenance.

6.6 Mounting

The mounting of the fixture shall be in axial orientation through suitable sized sidearm. The means for attaching the luminaire or external part to its support shall be appropriate to the weight of luminaire or external part. The connection shall be designed to withstand wind speeds of 160 Km/hr on the project surface of the assembly without undue deflection.

6.7 Future Compatibility

The fixture shall be fully compatible with future LED upgrades when they become available. It shall have a modular design to upgrade/replace with new LED modules or LED drivers at site conveniently with minimum effort. All electronic components/drivers shall be mounted on a separate tool-less gear-tray. Lamp compartment shall have easy access for opening the glass cover.

7.0 LED Driver/Electronic Control Gear for LED Modules

The LED driver shall be designed to operate large array of high powered LEDs through current controlled output. The driver shall be suitable for 230V, + 10%, - 15%, 50Hz, single phase mains AC supply.

The LED driver shall have an efficiency of at least 85%.

The LED driver shall be manufactured Harvard, TCL, Philips, Lumotech, BOSSLOH Schwabe, Lightech.

7.1 LED

The LED chip shall be Philips, Lumild, Cree Nichla or Osram make.

The LEDs shall:

- Be designed for lumen maintenance of L_{70} or 70% at the end of useful life at ambient temperature of 35° C.
- Have a useful life of 50,000 burning hours.
- Have a minimum color rendering index (CRI) of $70 \pm 10 \%$ and a color temperature above 5000K.

7.2 Thermal Management

Managing thermal properties in LED fixtures is most critical to ensure optimum performance of LEDs and reliability of the system. The housing under the circuit board shall be specially designed to ensure perfect contact between the board and the fixture housing for efficient heat dissipation.

Only metal core PCBs shall be used to maximize heat transfer process PCB shall be mounted on the housing using a highly efficient thermal interface material. Use of silicon glue is not acceptable.

The housing over the driver chamber shall have additional ribs to ensure direct contact with the drivers. The housing shall have adequate surface area to ensure fast heat dissipation.

7.3 Photometrics

Fixtures shall have Illumination Engineering society (IES) Type II or III distribution pattern, with short or medium longitudinal distribution.

LM-80 LED and photometric test reports and IES files from a third party testing laboratory shall be available.

7.4 Warranties

The complete fixture including all accessories shall have at least three (3) year warranty (after one year of defect liability period) against defects and failures.

7.5 Applicable Standards and Codes

The fixtures shall conform to the following latest standards and codes

- IEC 60598-1
- IEC60598-2-2
- IEC60598-2-3 (Road & Tunnel Lights)
- IEC 60598-2-5 (Flood Lights)
- IEC6247-1 (For the complete fixtures being offered as well as for the LED Chips)

- LM-79 (for the Luminaries being offered (Model/Wattage specific)
- LM-80 (for LED chips being used)
- LM-82-12 (Approved method of measuring LPW @ 50°C (Model/Wattage specific)
- UL-1598 (For thermal management test, Model/ Wattage specific)
- EN 55015 : 2006 and 2007 – Limits and method of measuring radio disturbance characteristics of electrical lighting)
- EN 61547 : 1995 / +A1 : 2000 – Equipment for general lighting purpose EMC immunity requirements
- EN 61000-3-2 : 2006 – Limitation of harmonic current emission
- EN 61000-3-3 : 2006 – Limitaion of voltage fluctuation and flicker
- EN 62493 Assessment of lighting equipment related to human exposure to electromegnatic field (Environmental friendly)

The LED driver shall conform to following latest standards and codes:

- EN61347-1: Gerneral and Safety requirements
- EN61347-2-13: particular requirements for DC or AC supplied electronic control gear for LED modules
- EN61384: DC or AC supplied electronic control gear for LED modules performance requirements
- EN 61548 : 1995 / +A1 : 2000 – Equipment for general lighting purpose EMC immunity requirments
- En 62384: AC or DC supplied electronic control gear for LED modules performance requirements
- Technical and descriptive data and drawings.

7.6 Technical and Descriptive Data and Drawings

Technical and descriptive data and drawing to be submitted shall inculde but not limited to the following :

- i. Technical data of fixtures and driver
- ii. IES Photometric file (absolute photometric data)
- iii. LM-79 test report for each of the fixture type/ wattage being offered.
- iv. LM-80 test report of LED used
- v. LM-82-12 approved method of measuring LPW @ 50°C (test report of the fixture type / wattage being offered.
- vi. Thermal manegement test report (UL 1598) of the fixture type/wattage being offered.
- vii. EN 62493 test report
- viii. IK rating test report
- ix. Lumen depreciation test report at 1000, 2000, 3000 and 6000 burning hrs.
- x. 3rd party IEC 60598 test reports
- xi. Vibration test reports
- xii. EMC test reports
- xiii. Salt spray test report
- xiv. Photo- biological safety test report

- xv. Customers testimonials
- xvi. Factory ISO certificate
- xvii. Report of other type tests stipulated in the respective standards/codes.
- xviii. Country of origin, Manufacturing works / factory details, premises & QA & QC procedure, in house testing procedure, routine testing procedures and test reports, testing equipment details are also being provided in order to ensure proper traceability and quality assurance on each piece of the product being delivered.

7.7 International Independent Laboratories

For the specified requirements of type tests and type test reports by an independent authority/independent laboratory, the following laboratories shall be considered as independent laboratories:

- i) KEMA Labs, Holland.
- ii) CESI Labs Italy
- iii) CRIEPI Labs, Japan.
- iv) Any laboratory accredited by EA (European Co-Operation for Accreditation) or a member thereof.
- v) Any laboratory accredited by ILAC (International Laboratory Accreditation Cooperation) or member of thereof
- vi) Any laboratory accredited by IAF (International Accreditation Forum) or a member thereof.
- vii) Any laboratory accredited by STL (short-circuit Testing liaison) or a member thereof.

Installation Details

When cables cross road, paved area or other services, they shall be laid in protective pipes of required size. The pipe end after installation of cable shall be plugged to make them water tight by means of bituminized hessian or equivalent material.

Standards For PVC Pipe/Accessories

The pipe/accessories shall be manufacture according to the standards as below.

PS 4607 Part-1:	PVC CONDUITS AND ACCESSORIES (metric units)
BS3505:	PVC pipes and accessories
BS6099:	PVC conduits and accessories

8.0 SCHEDULE OF TECHNICAL DATA TO BE FILLED IN FOR EVERY TYPE/MODEL & WATTAGE OF LED ROAD LIGHTING FIXTURE AND SEALED BY THE MANUFACTURER-(MANDATORY)

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
Make	
Model	
Country of Origin	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
Main applications	
Wattage	
Max. power consumption	
IES Photometric File (Yes/No)	
Materials and finishing	
-Housing	
-Gaskets type & characteristics	
-Optics	
-Glass Type	
Dimensions (LxBxH)	
Weight	
Windage area	
Classification code	
-IP Rating for fixture	
-IP Rating for Gear compartment	
-IK Classification	
-Class	
Color & material	
- Frame	
-Hinge	
- Clip	
-Canopy	
Installation	
Maintenance	
LED Chip Make, model & country of origin	
CREE (Yes/No)	
NICHIA (Yes/No)	
OSRAM (Yes/No)	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
PHILIPS LUMILED (Yes/No)	
OR EQUIVALENT (Duly type tested as specified and in full conformance to the technical requirements/specifications).	
LED Color consistency (SDCM) Limits in %	
Optic	
Narrow Beam	
Medium Beam	
Wide Beam	
LED Driver/Electronic Control Gear Make, model & country of origin	
Harvard (Yes/No)	
TCI (Yes/No)	
Philips(Yes/No)	
Lumotech (Yes/No)	
Vossloh schwabe (Yes/No)	
Lightech (Yes/No)	
OR EQUIVALENT (Duly type tested as specified and in full conformance to the technical requirements/specifications).	
Optical cover	
Line Voltage	
Mains voltage performance (AC)	
Min. Mains voltage operational	
Power Factor	
- At Normal Power	
- At Dim levels	
Surge protection	
- Differential Mode	
- Common Mode	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
Earth leakage current [Max.]	
Light source	
LED driving currents	
System efficacy	
System lumen output	
Optics LOR (Light Output Ratio)	
CRI (Color Rendering Index)	
Color temperature as per ANSI C78.377A	
Ta	
Lifetime: Ta = 35°C @LM70	
Connector type & make	
Cable gland types & make	
Wire isolation (All wires are to be isolated singly)	
Energy Saving Options	
Dimming options	
-Programmable	
-No of Dimming levels	
-Wattage @ different Dimming Levels	
Warranty	
- Fixture	
-Driver	
- LED	
Future Upgrades and compatibility	
Certifications and Type Test reports	
FACTORY ISO CERTIFICATIONS	
ISO 9000	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
Type Test Enclosed (Yes/No)	
ISO 14000	
Type Test Enclosed (Yes/No)	
ISO 18000	
Type Test Enclosed (Yes/No)	
Fixture	
IEC 60588-1-2-3	
Type Test Enclosed (Yes/No)	
Type Testing Agency	
Photo biological Safety tests-IEC 62471	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
General & Safety Requirements - EN 61347-1	
Type Test Enclosed (Yes/No)	
Type Testing Agency	
LED Modules-Requirements of AC or DC supplied electronic control gear – EN 61347-2-13	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
LED Modules performance requirements- AC or DC supplied electronic control gear - EN 62384	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
Limits and methods of radio disturbance characteristics of electrical lighting EN 55015 : 2006 and 2007	
Type Testing Agency	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
Equipment for general lighting purpose EMC immunity requirements EN 61547 : 1995 / +A1 : 2000	
Type Testing Agency	
Limitation of harmonic current emission EN 61000-3-2 : 2006 – Limitation of harmonic current emission	
Type Testing Agency	
Limitation of voltage fluctuation and flicker EN 61000-3-3 : 2008	
Type Testing Agency	
LM-79 test report for each of the fixture type/wattage being offered.	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
LM-80 test report of LED used	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
LM-82-12- Approved method of measuring LPW @ 50°C (test report) of the fixture type/wattage being offered	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
Thermal management test report (UL 1598) of the fixture type/wattage being offered	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
EN 62493- Test report	
Type Testing Agency	
Type Test Enclosed (Yes/No)	

DESCRIPTION	DATA/PARAMETERS/VALUES TO BE FILLED IN BY THE BIDDER/MANUFACTURER
IK rating test report	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
Lumen depreciation test report at 1000, 2000, 3000, and 6000 burning hrs	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
Vibration test report	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
EMC test report	
Type Testing Agency	
Type Test Enclosed (Yes/No)	
Salt spray test report	
Type Testing Agency	
Type Test Enclosed (Yes/No)	

SECTION - E - 21 PHYSICAL SECURITY SYSTEM

1. SCOPE OF WORK

This document shall contain following systems:

1. Road Blocker
2. Tire Killer
3. Walk Through Gate

1. ROAD BLOCKER

Electromechanical road blocker shall be used as effective access control for vehicles. It shall come with control cabinet which is powder coated steel.

Road Blocker (W x D x H)	2510 mm x 1770 mm x 1000 mm
Cabinet	640/940mm W x 670mm D x 1300mm H
Basic Power Requirements	3-Phase 415v AC, 50Hz,
Control Voltage	S.E.L.V 24V
Speed of operation	6 seconds to raise or lower
Operation	The supporting framework is constructed from fully welded, heavy gauge, high strength, structural steels completely encased with steel sheets to provide a self-shuttered module. Sub-surface fixing points ensure the blocker is completely secured to its foundation.

2. TIRE KILLER

Tire killers shall be placed on exit gates to avoid unauthorized access of vehicles. They shall be available in width up to 4 meters.

3. WALK THROUGH GATE

1.0 GENERAL

1.0.1 STANDARDS:

It shall comply with following standard.
International Protection Marking - IEC 60529

It shall confirm to safety standards and has been tested against and complies with applicable magnetic field standards concerning human exposure and pacemaker safety.

It shall confirm to applicable international standards for electrical safety and Electromagnetic compatibility.

1.0.2 SYSTEM DESCRIPTION:

A multi zone walk through metal detector used primarily for weapons detection. It can be used for applications including passenger screening at airports and seaports, visitor screening at courthouse, public buildings, sporting, educational institutions and other special events.

Independent zones are provided for superior discrimination, reliable detection of threat items, high traffic throughput and reliable location of threats.

It shall have automated sensitivity and floor sensitivity functions make the calibration process easy, eliminating time and error method.

It shall have random alarm function that enables security personnel to randomly choose individuals for an additional security check.

1.0.3 TESTING

Contractor shall provide and test the complete walk through metal detector system.

2. PRODUCTS:

2.1 SYSTEM REQUIREMENTS:

Ambient Operating Temperature: The range of operating temperature shall be from -20°C to 60°C.

Humidity: 0 to 95%, no condensation

Ingress Protection: It shall have ingress protection of IP 55 as compliance with code.

Alarm: It shall have audible and visible alarm feature.

Display: It shall have alphanumeric display and zone display and relay contact for remote alarm (SPDT)

Sensitivity: 100 sensitivity steps shall be available in each program. Separate vertical zones with independently adjustable sensitivity from 0 to 200%

Calibration: Automatic or manually set.

Interference Suppression: System shall have feature of digital filtering by signal processor. Several operating frequencies to suppress local electrical noise.

Weight: The weight should be approx. 63 Kg (139 lbs.)

LIST OF APPROVED MANUFACTURER*** All Equipment shall be procured from Principal Authorized agents / distributors / resellers**

The Bidder shall fill name of only one manufacturer for each equipment/material on which the tender is based. He shall be bound to supply the equipment from the same manufacturer. In case, the Bidder gives names of more than one manufacturer against any equipment, the Engineer / Owner can ask the Bidder supply the equipment from any one of them.

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choice manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. Any deviation from the BoQ / Specification shall be listed in a separate sheet containing the details of the deviation including the deviating BoQ item number.

Bidder is required to mark the proposed Manufacturer / supplier and country of origin for each item below

S.No	Equipment	Manufacturer	Country of Origin	✓
1.	Oil Filled Transformer / PMU	Pak Elektron Limited (PEL)	Pakistan	
		Siemens	Pakistan	
		M-Tech	Pakistan	
2.	MV Cables	Pakistan Cables	Pakistan	
		Newage Cables	Pakistan	
		Pioneer Cables	Pakistan	
3.	MV Cables Accessories (Jointing & Termination Kits)	3M	USA	
		Raychem	USA	
4.	HT – CT / PT	Revalco	Italy	
		Schneider Electric	France	
		ABB	Italy	
		Siemens	Germany	
5.	MV Switchgear	Siemens	Germany	
		Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	France	
		ABB	Italy	
6.	LV Switchgear, PFI Panels	Pak Elektron Limited (PEL)	Pakistan	
		Schneider Electric	Pakistan	
		Siemens	Pakistan	
		ABB	Pakistan	
		Hussain & Co.	Pakistan	
		Bilal Switchgear	Pakistan	
		Engineers & Engineering	Pakistan	
7.	Power Factor Plant, Capacitor, Relay, controller	Nokian	Finland	
		RTR	Spain	
		Lovato	Italy	
		Technologic	Italy	
8.	LV Circuit Breakers	Schneider Electric	France	
		Terasaki	Japan	
		Siemens	Germany	
		ABB	Italy	
9.	C.T, Relays & instruments	Schneider Electric.	France	
		Siemens	Germany	
		Revalco	Italy	
		ABB	Italy	

S.No	Equipment	Manufacturer	Country of Origin	✓
10	LV Cables and Wires/ Earthing Cable	Pakistan Cables	Pakistan	
		Pioneer Cables	Pakistan	
		Newage Cables	Pakistan	
		Allied Cables	Pakistan	
		Universal Cables	Pakistan	
		Fast Cables	Pakistan	
11	Load Break Switches, Isolator, Change Over Switches	Gewiss	Italy	
		Kraus & Naimer	New Zealand	
		Legrand	Italy	
		Clipsal	Australia	
12	uPVC Conduits / Pipes and Accessories	Galco	Pakistan	
		Dadex	Pakistan	
		Jeddah Polymer	Pakistan	
		Beta	Pakistan	
		Civic	Pakistan	
13	Back Box / Pull Boxes / Junction Boxes	Hussain & Co.	Pakistan	
		Hensel	Germany	
		Jeddah Polymer	Pakistan	
		Premier Engineering	Pakistan	
14	Switch & Socket Outlets / Floor Boxes	Clipsal (Schneider Electric)	Australia	
		MK Electric	UK	
		Legrand	France	
		ABB	Italy	
15	Cable Glands, Lugs, Terminals and Accessories	Cembre	UK	
		Hubbell / Hawke	UK	
		Hensel	Germany	
16	Cable Tray / Trunking	EZZI Engineering	Pakistan	
		Premier Engineering	Pakistan	
		Hussain & Co.	Pakistan	
		M-Tech	Pakistan	
17	Contactors	Telemecanique	France	
		National	Japan	
		ABB	Italy	
18	Fans and Accessories	Pak Fan	Pakistan	
		GFC Fan	Pakistan	
		Millat Fan	Pakistan	
		Royal Fan	Pakistan	

S.No	Equipment	Manufacturer	Country of Origin	✓
19	Light Fixture	Philips	Netherlands	
		Pierlite	Australia	
		Osram	Germany	
		ConxCorp	Canada	
		EAE	Turkey	
20	Diesel Generator, Fully Imported (Assembled in USA, Europe or Japan) Alternator	Engine		
		Caterpillar	USA	
		Cummins	UK	
		Volvo	UK	
		Perkins	UK	
		John Deere	USA	
		Mitsubishi	Japan	
		Alternator		
		Caterpillar	USA	
		Mecc Alte	Italy	
		Stamford	UK	
		Leroy Somer	France	
		Mitsubishi	Japan	
21	Lightning Protection & Earthing	Indelec	France	
		LPI	Australia	
		Erico	UK/USA	
		Furse	UK	
		Dehn	Germany	
		Wallis	UK	
22	UPS	Emerson-Liebert	USA	
		Eaton	UK	
		APC	USA	
		Schneider	France	
		ABB	Italy	
23	Data Communication System and IPTV (Passive Only)	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
24	Telephone Cable	Clipsal (Schneider Electric)	Australia	
		3M/Corning	USA	
		Panduit	Singapore	
25	Fire Alarm System	Gent by Honeywell (EN)	UK	
		Esser by Honeywell (EN)	UK	
		Hochiki	UK	
26	Closed Circuit Television	DAHUA	KOREA	

S.No	Equipment	Manufacturer	Country of Origin	✓
	(CCTV) System	Hikvision	China	
		Kedacom	Singapore	
27	Public Address System	TOA	Japan	
		Bosch	UK / USA	
28	Exit & Emergency Lighting Fixtures	Menvier	UK	
		Technoware	Finland	
		Emergilite	Italy	
29	Communication Racks & PDU	3M /Corning	USA	
		Schneider	France	
		APC	France	
30	Fire Resistance Cable	Prysmian FP 200 Flex /Gold	UK	
		Draka	UK	
31	Access Control System	HID	UK	
		Honeywell	UK	
		Virdi	Korea	
32	Speaker Cables	Firekas	Turkey	
		Draka	UK	

PLUMBING
SPECIFICATION
FOR
SMIU – MALIR
CAMPUS
LOT – 04 & 05

(Sect. 15140) -	DOMESTIC WATER PIPING
(Sect. 15145) -	DOMESTIC WATER PIPING SPECIALTIES
(Sect. 15150) -	SANITARY WASTE, VENT AND STORM PIPING
(Sect. 15155) -	DRAINAGE PIPING SPECIALTIES
(Sect. 15410) -	PLUMBING FIXTURES
(Sect. 15441) -	PLUMBING PUMPS

Sect.15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUMMARY

- A. This Section includes domestic water piping inside the building.

1.03 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PEX: Crosslinked polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. PPR: Poly propylene Random

1.04 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa) unless otherwise indicated.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples:
- C. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components

- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Refer Approved List of Manufacturers.

2.02 PIPING MATERIALS

- A. The pipe materials shall as stated below.

2.03 DOMESTIC COLD WATER BELOW AND ABOVE GRADE

- 1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
- 2. uPVC pipes to BS 3505 with Class E with solvent welded fittings to BS 4346 for pipe sizes above 110mm dia.

2.04 DOMESTIC HOT WATER PIPING

- 1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
- 2. cPVC Sch 80 pipes with solvent welded fittings for pipe sizes above 110mm dia.

2.05 IRRIGATION PIPES

- 1. uPVC pipes to BS 3505 with Class E with solvent welded fittings to BS 4346 for all pipe sizes.

2.06 VALVES

- A. Generally, all valves of the same type shall be of the same manufacturer. All gate, globe, angle, and swing check valves as a group shall be of the same manufacturer. All valves 50 mm and smaller shall be threaded and have bronze bodies.
- B. All valves 65 mm and larger shall be Cast iron type and shall be flanged (or grooved for grooved coupling joints).

- C. For PPR piping use PPR Coated valves of the same piping material and manufacturer.
- D. Each valve shall be marked (engraved, stamped, or cast on each valve or metal tag, permanently attached to the valve) at the factory with the following minimum information
 - 1. Manufacturer's Name.
 - 2. Catalogue or Figure No.
 - 3. Size and Pressure Class.
- E. Arrows to indicate direction of flow on check, globe, angle, non-return, and eccentric plug valves.

2.07 GATE VALVES

- A. [Size 50 mm and Smaller]. Furnish bronze valves with screwed-in bonnet, non-rising stem, solid wedge disc, and threaded ends. Pressure rating PN20.
- B. [Size 65 mm and Larger]. Furnish Iron Body Bronze Mounted (IBBM) valves, i.e. cast iron body bronze trim valves, with bolted bonnet, non-rising stem, solid wedge disc, flanged ends, and renewable seat rings.

2.08 GLOBE VALVES.

- A. [Size 50mm and Smaller]. Furnish valves designed for minimum PN20 working pressures.
- B. [Size 65 mm and Larger]. Furnish valves designed for minimum PN16 working pressure.

2.09 CHECK VALVES

- A. [50 mm and smaller]. Furnish swing valves designed for minimum PN20 non-shock working pressures. Valves shall have renewable discs and side plugs, integral seats.
- B. [Size 65 mm and Larger Water Check Valves]. Valves shall be silent type spring loaded of the double door or wafer style. Valves shall be designed for minimum PN16 non shock water working pressure.

2.010 RELIEF VALVES.

Domestic Water Temperature and Pressure Relief Valve.

- A. On hot water storage tanks provide an ASME rated thermostatic, self-closing, temperature and pressure relief valve, located in the relief valve openings of tanks. Valve shall have a minimum thermal discharge capacity equal to the input capacity of the heater standard pressure setting of 600 kPa and standard temperature setting of 100 - 140 degrees C. Relief valve pipe to discharge to floor drain.

2.011 BALL VALVES.

- A. [Size 50 mm and Smaller]. Valves shall be standard port, 2-piece construction with screwed ends. Valves shall be designed for minimum PN25. Valves shall have bronze or brass body, stainless steel ball, steel handle with vinyl grip.
- B. [Size 65 mm and Larger]. Valves shall be standard port, BS 5159 with flanged ends. Valves shall be designed for minimum PN16 working pressure. Valves shall have steel body, chrome or nickel plated steel or stainless steel ball.

2.012 Float Valves

- A. Float valves shall be installed as indicated in the drawings to provide consistent level control in reserve supply water storage tanks. The valve shall meet the requirements of the Water Byelaws for air gaps and shall be constructed throughout in approved materials and shall prevent back siphoning. Bronze equilibrium float valves 80 and above shall be flanged end, flat faced and drilled to suit BS4504 PN16.
- B. Bronze equilibrium float valves upto 50 shall be screwed end BS2779 parallel and shall be provided complete with back nut.
- C. Floats for valve sizes 80mm and above shall be of copper.

2.013 Solenoid Valves

- A. Electrically operated solenoid valves shall be single phase 220V and shall be rated for the system pressure

2.014 Bib Taps

- A. Bib-cocks shall be in accordance with BS 1010: 1973. They shall be provided with hose union nosepiece and hand wheel operated.

2.015 Automatic Air Valves

- A. Automatic air valves shall have a bronze body with bolted cover and a 9mm top outlet.

2.016 Strainers

- A. Up to and including DN50 strainers shall be manufactured from bronze and shall be of the 'Y' type with bolted cap, PN25 temperature/pressure rating.
- B. Strainers above DN50 shall be manufactured from cast iron and shall be of the 'Y' type with bolted cap, PN16 temperature/pressure rating and shall be complete with drilled and tapped caps complete with drain cocks.

- C. Strainers shall be provided with a medium grade screen sized such that in their clean condition the maximum pressure drop at the design flow rate shall not exceed 6kPa.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Section "Earthwork."

3.02 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.

3.03 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 - 2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 3. Drain Duty: Hose-end drain valves.
- B. PPR Coated PN-25 rated ball, butterfly, and check valves may be used in matching piping materials.

3.04 PIPING INSTALLATION

- A. Install domestic water piping level without pitch and plumb.
- B. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Install supports according to Division 15 Section "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.

- C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for PVC/cPVC/PPR and PE piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- E. Install supports for vertical PVC/cPVC/PPR piping every 48 inches (1200 mm).

3.06 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to water pressure of 150 psi or 50 psi above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

END OF SECTION 15140

Sect.15145 - DOMESTIC WATER PIPING SPECIALTIES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following domestic water piping specialties:

1. Balancing valves.
2. Strainers.
3. Outlet boxes.
4. Hose stations.
5. Hose bibs.
6. Drain valves.
7. Water hammer arresters.
8. Air vents.
9. Flexible connectors
10. Flow Sensing Devices
11. Puddle flanges

1.03 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS**2.01 BALANCING VALVES**

- A. Refer Section 15140

2.02 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers :

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
 - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm)
6. Drain: Factory-installed, hose-end drain valve.

2.03 HOSE BIBBS

A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
8. Finish for Service Areas: Rough bronze, or chrome or nickel plated.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Include operating key with each operating-key hose bibb.

2.04 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-80 for gate valves.

2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves :

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.05 WATER HAMMER ARRESTERS

A. Water Hammer Arresters :

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows / Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.06 AIR VENTS

A. Bolted-Construction Automatic Air Vents :

1. Body: Bronze.
2. Pressure Rating: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 (DN 15) minimum inlet.
6. Air vents shall be installed on all coils and all other high points required for efficient operation and venting of system.
7. Air vents shall be provided at all high points in the pipework, whether indicated on the drawings or not.
8. Large diameter automatic air vents shall be provided at all primary venting positions, such as plant rooms and at the head of vertical risers.
9. Air bottles shall be provided at all venting points.
10. The Sub CONTRACTOR shall be responsible for the design and positioning of all air vents.

2.07 PUDDLE FLANGES

- A. Where pipework passes through the external walls of the buildings or trenches below ground level, the CONTRACTOR shall supply and cast or built puddle flanges into the structure.
- B. Puddle flanges are to be manufactured from the same material as the pipework of which they form a part.

- C. Each puddle flange shall comprise a length of pipe, flanged or screwed at end according to diameter with an undrilled slip on flange welded on the outside at a point where it will be located mid way in the thickness of the wall. The puddle flange is to be painted externally with two coats of bituminous paint before being built into the structure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install Y-pattern strainers for water on supply side of each pump.
- D. Install water hammer arresters in water piping according to PDI-WH 201.
- E. Install air vents at high points of water piping. [Install drain piping and discharge onto floor drain.]

END OF SECTION 15145

Sect.15150 - SANITARY WASTE, VENT AND STORM PIPING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.04 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa) .
 - 2. Sanitary Sewer, Force-Main Piping: 150 psig (1035 kPa).
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
 - 2. Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Piping materials shall be as under.

2.02 ABOVE GROUND SOIL, WASTE AND VENT PIPE

- A. All horizontal soil, waste pipes and rain water shall be Poly Propylene (PP) sound proof drainage pipes as per DIN 4109 and Din 4102 and fittings made of mineral-reinforced polypropylene homopolymer and copolymer. The typical density of the mineral filler shall be between 1.65 to 2.03 g/cm³ according to DIN 53479.
- B. The sound isolation shall be 13 DB for 4.0 l/s flow rate in accordance with DIN 52379 and DIN 4109
- C. The sound proof pipes & fittings shall be fire resistant class B2 to DIN 4102.
- D. The sound proof pipes & fittings shall be fungus and bacteria resistant, and shall have smooth surface, corrosion resistant.
- E. Soundproof drainage pipe system shall comply with following standards:
 - 1. DIN 4109m sound proof, absorption standards.
 - 2. DIN 4102, B2. Self-extinguishing flameless.
 - 3. DIN 19560 / DIN EN 1451. Hot water resistance, 95°C (Long term), 95°C (short term).

4. Physical Characteristics

Density	1.65 g/cm ³ DIN 53479
Elongation at break	50%
Tensile strength E-modulus Linear expansion	20N / mm ²
E-modulus	3800 N / mm ²
Linear expansion	0.04 mm / mk

5. The floor trap shall also be of sound proof material to DIN 4109.

2.03 BELOW GROUND SOIL AND WASTE PIPE

- A. uPVC conforming to the following British Standards:
1. Pipes 110mm and 300mm diameter: uPVC pipe with solvent weld fitting as per BS 4660 (BS EN 1401)
 2. Pipes larger than 300mm diameter: to BS 3506.

2.04 STORM WATER PIPE

- A. Plastic pipes shall be extruded un-plasticized PVC (UPVC) conforming to the following British Standards:
1. uPVC pipe with solvent joints (as approved by consultant) as per DIN 8061/8062 and ISO 3633 Type B

2.05 CONTENSATE DRAIN PIPING (ABOVE AND BELOW GRADE)

- A. uPVC conforming to the following British Standards:
1. Pipes 20mm and 300mm diameter: Upvc class 'E' pipe with solvent weld fitting as per BS 3505 (EN 1401).

2.06 PRESSURE PIPING FROM PUMPS (ABOVE AND BELOW GRADE)

- A. uPVC conforming to the following British Standards:

1. Pipes 20mm and 300mm diameter: Upvc class 'E' pipe with solvent weld fitting as per BS 3505 (EN 1401).

B. Alternatively (Kite Mark) pipes are acceptable only if approved by consultant.

2.07 SPECIAL PIPE FITTINGS

2.08 ENCASEMENT FOR UNDERGROUND PIPING CROSSING DRIVEWAYS

- A. All Drainage pipes crossing driveways and subjected to heavy traffic shall be provided in concrete encasement.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Refer to "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 DN 50 and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 75) and larger.
 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction or Consultant.

3.03 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
- B. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- C. Install supports for vertical PVC piping every 48 inches (1200 mm).

3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated.

3.05 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.06 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

Sect.15155 - DRAINAGE PIPING SPECIALTIES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUMMARY

- A. This Section includes the following drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Trench drains.
 - 4. Channel drainage systems.
 - 5. Roof drains.
 - 6. Manhole Covers
 - 7. Miscellaneous drainage piping specialties.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated above.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS**2.01 CLEANOUTS**

- A. Plastic Floor Cleanouts:
 - 1. Size: Same as connected branch.
 - 2. Body: PVC.
 - 3. Closure Plug: PVC.
 - 4. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.
 - 5. Finish: Stainless steel cap

2.02 FLOOR DRAINS

- A. Plastic Floor Drains:
 - 1. Material: PP Soundproof as per piping material
 - 2. Outlet: Side
 - 3. Sediment Bucket: Not required.
 - 4. Top or Strainer Material: Stainless steel <Refer Architect finishes schedule>.
 - 5. Top of Body and Strainer Finish: Stainless steel.
 - 6. Top Shape: Square. <Refer Architect finishes schedule>.
 - 7. Trap Material: Plastic drainage piping.
 - 8. Trap Pattern: Standard Multi Floor Trap with Multiple inlets and one outlet.
- B. Funnel floor drain where specified on drawings shall include a nickel bronze funnel secured to the grating

2.03 TRENCH DRAINS

- A. Trench Drains :
 - 1. Standard: ASME A112.6.3 for trench drains.
 - 2. Outlet: Side.
 - 3. Grate Material: Cast Iron/PVC. <Refer Architect finishes schedule>.
 - 4. Grate Finish: Epoxy coated for cast iron <Refer Architect finishes schedule>.
 - 5. Dimensions of Frame and Grate: Refer drawings
 - 6. Top Loading Classification: As mentioned on MEP drawings and BOQ.

2.04 ROOF DRAINS**A. Plastic Roof Drains:**

1. Standard: ASME A112.21.2M.
2. Pattern: Balcony/ Roof drain.
3. Body Material: PVC.
4. Dimensions of Body: Refer Drawings
5. Outlet: Bottom.
6. Dome Material: PVC/Stainless Steel <<Refer Architect finishes schedule>.

2.05 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES**A. Vent Caps:**

1. Description: PVC of same brand as of piping.
2. Size: Same as connected stack vent or vent stack.

B. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

C. Manholes/gully traps covers

1. All covers shall be Cast Iron with black bitumen coating. Manhole covers shall have clear opening of 600 x 600 mm.
2. All manholes and gully traps shall be vented as per drainage department requirements.
3. Gully trap covers shall have clear opening of 300 x 300 mm.
4. All manhole covers and frames shall comply with BS 497:1976 (BS EN 124:1994)
5. Covers in paved areas shall be medium duty type having weight as per Table 1
6. Covers in plinth protection shall be light duty having weight as per Table-1
7. Covers in Driveways shall be Heavy duty having weight as per Table-1

CAST IRON MULTI DUTY MANHOLE COVER & FRAME

Features :

Single Seal
Closed Key Holes
Coating Cold Applied

Option :

Ductile Iron
Epoxy Coated
Lockable

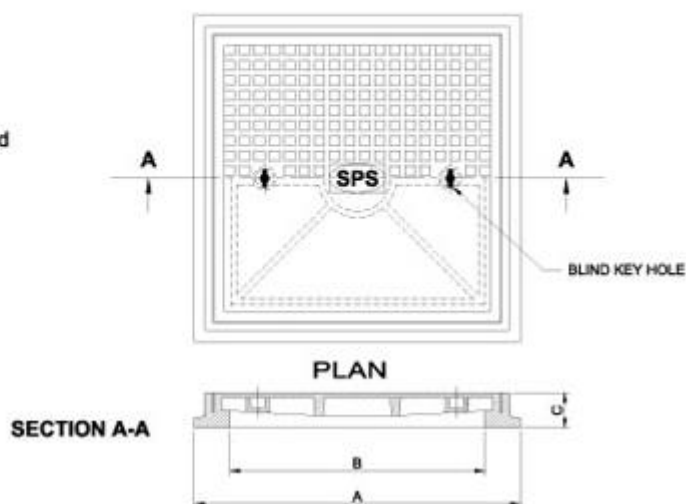


Table 1-1 (Manhole Covers Weights)

S.no	Cover material	Clean Opening	Type	Weight	Standard	Remarks
1	Cast Iron	600 x 600	Light duty	45 Kg	BS EN 124:1994	
2	Cast Iron	600 x 600	Medium duty	67 Kg	BS EN 124:1994	
3	Cast Iron	600 x 600	Heavy duty	90 Kg	BS EN 124:1994	

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- F. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- G. Install fixture air-admittance valves on fixture drain piping.
- H. Install stack air-admittance valves at top of stack vent and vent stack piping.
- I. Install air-admittance-valve wall boxes recessed in wall.
- J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- K. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.
- L. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain **1-inch (25-mm)** clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- Q. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.
- R. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- S. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- 3.02 CONNECTIONS
- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- C. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.
- 3.03 LABELING AND IDENTIFYING
- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Grease interceptors.
 2. Oil interceptors.
 3. Solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
- 3.04 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and grease

removal devices and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems and grease removal devices.

END OF SECTION 15155

Sect.15410 - PLUMBING FIXTURES**1.01 QUALITY ASSURANCE**

- A. Quality Standard: NSF 61 for fixture materials in contact with potable water.

1.02 WARRANTY

- A. Materials and Workmanship:
1. Commercial Applications: One year.

1.03 FAUCETS

- A. Lavatory Faucets, <Refer Architecture fixture selection and Specifications>:
1. Two-handle mixing non-pressure type valve.
 - a. Body Material: Commercial, solid brass (with non-metallic coatings or Chrome finish as required by the architect).
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: Maximum [2.5 gpm (9.46 L/min.)],
 - d. Mounting: [Deck, exposed] [Deck, concealed] [Back/wall, exposed] [Back/wall, concealed].
 - e. Spout: [Rigid, gooseneck] type.
 - f. Spout Outlet: Aerator/ Spray
- B. Sink Faucets, <Refer Architecture fixture selection and Specifications>:
1. [Kitchen faucet with spray, three-hole fixture].
 - a. Body Material: [Commercial, solid brass] (with non-metallic coatings or Chrome finish as required by the architect).
 - b. Finish: Polished chrome plate]
 - c. Maximum Flow Rate: 2.5 gpm (9.46 L/min.), unless otherwise indicated.
 - d. Mixing Valve: Two-lever handle.
 - e. Backflow Protection Device for Hose Outlet: Not required.
 - f. Mounting: Deck, Back/wall as recommended by the architect.
 - g. Spout Outlet: Aerator/ Spray
 - h. Drain: Stopper with chain.

1.04 TOILET SEATS

- A. Toilet Seats :
1. Toilet seat for water-closet-type fixture.

- a. Material: Molded, solid plastic.
- b. Configuration: front with cover.
- c. Size: Regular.
- d. Class: Standard commercial.

1.05 FIXTURE SUPPORTS

A. Water-Closet Supports :

- 1. Combination carrier designed for standard mounting height of wall-mounting, water-closet-type fixture.

B. Lavatory Supports:

- 1. Type [lavatory carrier with exposed arms and tie rods] or [lavatory carrier with concealed arms and tie rod] for wall-mounting, lavatory-type fixture.

C. Sink Supports:

- 1. Type [sink carrier with exposed arms and tie rods] or [II, sink carrier with hanger plate, bearing studs, and tie rod] for sink-type fixture.

1.06 WATER CLOSETS (WESTREN)

A. Water Closets, <Refer Architecture fixture selection and Specifications> :

- 1. Floor-mounting, floor-outlet, vitreous-china fixture designed for [gravity-type tank] operation.
 - a. Style: [Close coupled] [One piece].
 - 1) Bowl Type: Round front design. Include bolt caps matching fixture.
 - 2) Height: Standard.
 - 3) Design Consumption: Dual Flush Design with Major (6.0 L/flush) Minor (4 L/flush)].
 - 4) Tank: Gravity type. Include cover.
 - b. Supply: [NPS 3/8 (DN 10)] [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.
 - c. Toilet Seat: Included

1.07 WATER CLOSETS (EASTREN)

A. Squatting WC, <Refer Architecture fixture selection and Specifications> :

- 1. Flat Bowl, vitreous-china fixture designed for [gravity-type tank] operation.
 - 1) Type: Flat and Shallow design
 - 2) Flush Tank : Yes (check drawings for installation height)

- 3) Design Consumption: Single Flush Design with Major (6.0 L/flush).
- 4) Tank: Gravity type.
- 5) Color (Refer Architecture fixture selection and Specifications)
- b. Supply: [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.
- c. DN50 supply pipe from Flush tank to WC. Pipe shall be concealed.

END OF SECTION

Sect.15441 – PLUMBING PUMPS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.05 COORDINATION

- A. Coordinate size and location of concrete bases.

PART 2 - PRODUCTS

2.01 BOOSTER AND TRANSFER PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Grundfos Pumps Corp.
3. Wilo Pumps
4. Refer Approved list of manufacturers

B. Description: Factory-assembled and -tested, Multistage stage

1. Supply and install transfer and Booster water Set designed for a total system capacity as shown on Pump Schedule. The systems shall be tested and calibrated, and shipped to the job site as an integral unit ready to receive suction and discharge piping and incoming power supply.
2. The unit shall be a packaged factory assembled and tested unit complete with duty/stand by pump, interconnecting pipework in copper, bronze, valves, safety devices and prewired control panel.
3. Pumps shall be constant speed:
4. Pump shall be bronze fitted centrifugal, single stage, end suction type
5. Pump shall be rated for a minimum of 175 PSIG working pressure.
6. Casings shall be cast iron with gauge ports, vent and drain ports at top and bottom of casing.
7. Shaft impeller shall be stainless steel 316.
8. The pumps shall be complete with temperature control, gate valves, check valves, pressure gauges, thermal bleed circuits, wiring, conduit and interconnecting pipe work, mounted on anti-vibration mountings and neatly arranged and firmly supported by the framework of the unit. Suction connection shall be horizontal, as close to the base as possible to connect to inlet pipe from the water storage tank.
9. Mechanical seals shall be with carbon rotating ring, stainless steel spring, ceramic seat and flexible bellows and gaskets. Grease lubricated ball type bearings shall be provided.
10. Pump and Motor Assembly: Hermetically sealed, replaceable type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.

C. Capacities and Characteristics:

1. Capacity: Refer Equipment Schedule
2. Total Dynamic Head: Refer Equipment Schedule
3. Maximum Continuous Operating Temperature: 220 deg F (104 deg C).
4. Impeller Size: As per Manufacturer Recommendation
5. Inlet and Outlet Size: As per Manufacturer Recommendation
6. Speed: As per Manufacturer Recommendation
7. Motor Horsepower: Refer Schedule
8. Brand used for design selection : Grundfos

2.02 CONTROLS

1. The pump set control panel shall be in a NEMA I enclosure which includes motor starters, time delays, protected control circuit, transformer, current relays, hand-off-automatic switches for each pump, minimum run timers, and low suction pressure cut out etc.
2. Transfer pump shall be controlled by float switch.

2.03 SUMP PUMPS

1. Pump casing shall be Stainless steel.
2. Impeller shall be stainless steel wear resistant, semi shrouded, multi vane with adjustable diffusers. Minimum particle size shall be 20mm
3. Shaft shall be Stainless Steel 316SS.
4. Motor shall be squirrel cage induction type, class F insulation capable of a maximum of 15 starts/hour.
5. Motor casings shall be with integral cooling ribs for maximum heat dissipation.
6. Pumps shall be fitted with two mechanical seals with silicon carbide rotating & seat stainless steel spring, flexible bellows and gaskets. The chamber between the shaft seal to be oil filled.
7. Shaft shall be mounted on pregreased rolling element bearings.
8. Cable junction chamber shall be a sealed terminal chamber with separate gland assemblies incorporating strain relief clamps.
9. Pumps shall be suitable for a maximum depth of submersion with the flanged outlet directed vertical upwards.
10. Pumps shall be selected to match the duties indicated on drawings.
11. Pumps shall be supplied with control panel complete with integrated fuse elements, handoff automatic switch, motor contactor, duty pump selector switch, run/trip lamps for individual pumps etc. Pumps shall be controlled by a unit mounted float control. The pumps shall operate at high level and stop at low level of water in the sump pit.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.03 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

3.04 CONNECTIONS

- A. Install piping adjacent to pumps to allow service and maintenance.
- B. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of pumps:
 - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps
 - 3. Install pressure gages at suction and discharge of pumps.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.

3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.
8. Adjust timer settings.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 15441

**DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY
(SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI LOT
NO.4 FACULTY STAFF RESIDENCES, BACHELOR FACULTY
MALE / FEMALE HOSTELS (REMAINING WORKS)**

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1 EXCAVATION

1.1 EXCAVATION – GENERAL

The Contractor shall remove the whole of the vegetation, top soil, concrete, flagging, paving, and curbing, road metalling and other materials from the site of any excavation and shall keep separately and preserve the same for reuse where applicable. The ground shall be excavated for the permanent and temporary works to the required depths, width and levels so that the dimensions of the permanent works shall not be less than as shown on the drawings or as may be directed by the Engineer.

All rubbish, filth and matter of an offensive nature taken out of any excavation shall be disposed of at once and not left on the surface within the site.

The major work for excavation involved in borrows pits indicated on drawings or otherwise proposed by the Contractor. The Contractor shall carryout the excavation in borrow areas for obtaining earth for construction of embankments. The Contractor shall provide necessary transport for excavated earth from the borrow areas to the site / location of embankment with means approved by the Engineer. The Contractor shall ensure that earth obtained from borrow areas is suitable for construction of embankments and shall not contain excess water. Excess water if any shall be removed by the Contractor through exposure to natural whether or through any other means approved by the Engineer. The borrow pits shall not be measured for accessing the quantity of earth required for excavation.

The Contractor is to examine the Site and to familiarize himself with the nature of the ground. Claims due to lack of knowledge of site condition will not be entertained. The Contractor shall not install pipelines, manholes or commence any permanent works until the Engineer has inspected and accepted the excavation, trenches and preparation of formation level. The Contractor shall submit for the Engineer's approval the proposed support of excavations where required and trenches at least 2 weeks prior to the commencement of any excavation work. The contractor shall excavate further if on reaching the specified levels, the inspected exposed ground, or part of the ground is considered naturally unstable by the Engineer or became unacceptable due to exposure to weather conditions or due to flooding or have become puddle, soft or loose during the progress of work.

Replace the further excavation with concrete or with such materials as the Engineer may direct.

1.2 EXCAVATION – PIPELINES

- 1.2.1 The excavation shall be carried out to the required alignment, levels, slopes or gradients as per drawings or described in the specifications and bill of quantities taking into account bedding required below pipes or to such other dimensions and slopes as the Engineer may direct in writing to facilitate laying of pipes. The Contractor shall provide masonry pillars of suitable size and fix temporary benchmarks at intervals to be determined by the Engineer or his representative. No trench excavations shall be commenced without prior approval of the Engineer.
- 1.2.2 The quantity of excavation shall be the volume of materials removed from below the original surface of the ground, or from the final level attained after cut, to the limits of excavation specified or shown on the drawings. For soft and unstable soils, the Contractor shall provide adequate side supports or may take any other measures to prevent soil from collapsing. The cost of supply of all material, plant and labor necessary for site clearance, excavation, side support, over break, refilling, watering and ramming etc. shall be included in the contract rates for excavation. In case sides or ends of any excavation collapse under self-weight or due to any other reason, the Contractor shall at his own cost remove all disturbed material. Sides of ends of any excavation give way, the Contractor shall, at his own cost remove all disturbed material. Any excavation outside the limits shown shall be treated as excess and shall not be paid for.
- 1.2.3 Any excavation done in excess of specified width due to any reason whatsoever shall not be paid.
- 1.2.4 Additional excavation will be necessary at all manholes/ valves chambers and pipe joints to facilitate the making of joints. Additional excavation for construction of manholes/ valve chambers and joint holes shall be of such dimensions as shown in the drawing, so as to give clear working space. The Contractor shall make allowance for the additional excavation required for the manholes and valve chambers in the price tendered for trench excavation. These shall not be separately measured or paid.

- 1.2.5 The length of the trench shall be measured along the centreline of the trench and the depth shall be measured vertically for original ground level, or level attained after Cut to the average bed level
- 1.2.6 Excavated material that is not required or is, in the opinion of the Engineer, unsuitable for re-use in the work shall be disposed to an approved location. The contractor shall give the Engineer adequate notice of his intention of spoil. Subject to any specific requirement of the contract the disposal of excavated material within the site shall be at the contractor's discretion but shall be so arranged as to be acceptable to the Engineer.
- 1.2.7 The contractor shall ensure that no excavated material, which is suitable for and is required for re-use in the works, is disposed of outside the site without written approval of the Engineer.
- 1.2.8 The Contractor shall stockpile materials on site as approved by the Engineer. Surface water shall be directed away from stockpile site to prevent erosion or deterioration of materials. Any excavated material stored on site for backfilling or any other purpose shall be deposited and compacted in such a manner that will avoid damage or inconvenience. Embankments and stockpiles shall be sloped to angle of repose or less until shored.

1.3 DEWATERING

Where dewatering is required, the Contractor shall provide qualified and experienced crew to perform the dewatering operation, or furnish the services of a dewatering subcontractor approved by the Engineer to design and operate the dewatering works.

The Contractor shall control the grading in the vicinity of site of work in order to prevent any water from running into the excavated areas. He shall keep dry all pits and trenches during construction and all de- watering and pumping out whether due to ground water seepage or otherwise, shall be included in the rates as quoted by the Contractor for dewatering. The method employed in all cases shall be approved and agreed by the Engineer or his Representative.

Any data if provided by soil reports are for the Contractor's guidance only and it shall be the Contractor's sole responsibility to obtain further details

required by him for preparing his tender. No claim shall be entertained for additional costs or extension of time that may result from lack of information.

The Contractor shall provide such drainage outlet ditches or canals as may be necessary to affect proper drainage before rain is expected. Such drainage ditches or canals for protection of work during construction and their maintenance and clearing to make them continuously effective during the work shall not be separately, but shall be deemed to be included in other items of work.

The Contractor shall also provide, fix maintain and operate such engines, pumps, hoses, chutes and other appliances as the necessary to keep the accumulated water at a level required and as directed by the Engineer. The Contractor shall not remove any dewatering systems without the Engineer's acceptance.

The measurement and payment of dewatering shall be made separately according to the units mentioned in bill of quantities.

1.4 PROTECTION OF UTILITY SERVICE

1.4.1 Damage to Surface

If carriage ways, verges or footways in roads whether paved or unpaved or gardens, plantations or other surfaces are damaged outside the limits of the excavations due to lack of proper traffic control or moving plant and equipment or other operations of the contractor then such surfaces shall be reinstated by the contractor at his own expenses. The surfaces shall be restored to their original condition using such materials as may be required whether obtained from the excavated materials or not. All trench excavation and other work carried out within the limits of any roadway shall be completed as rapidly as possible and not more than half the width of the carriage way shall be obstructed at one time. Cutting of asphalt or concrete paving shall be carried out by saw to achieve neat edge at the cut. Cutting by compressor and breakers is not permitted. The alignment of the cut shall be straight. In case deviations occur then the cutting shall be repeated until the edge of the cut is acceptable to the Engineer.

1.4.2 Maintenance of Traffic

When the excavation is in roads care shall be taken to cause the least inconvenience to traffic. When directed or necessary for the maintenance of traffic, the contractor shall remove from the site all materials as excavated

from the trenches and return the same as necessary for refilling after the structures have been completed or the pipes tested and approved.

1.4.3 Control of Traffic on Roads

The Contractor shall ensure that the flow of traffic over existing roads and access to properties is maintained at all times during the contract. The flow of traffic is to take place at all time over a reasonable surface that is to be segregated as far as possible from areas where work is progress.

1.5 MEASUREMENT AND PAYMENT

The measurement and payment for different categories of earth excavation inclusive of disposal of surplus earth shall be done in accordance with BOQ rates.

No payment shall be made to the Contractor for excavation from borrow areas for the purpose of construction of embankments. Payment for construction of embankments shall be made on the basis of actual measurement of embankment to be constructed as per drawings and specifications. The Contractor's rates shall be deemed to include for excavation in borrow areas, transport to the site / location of embankment and construction of embankment to correct size and slopes duly watered and compacted in layers as per requirements of the Contract including checking the moisture content and taking necessary measures for bringing the moisture content to the requirements of the specifications.

The rates for excavation quoted by the Contractor shall include for any trial pits or trial holes.

Payment for dewatering shall be made separately in accordance with BOQ.

1.5.1 Measurement

Measurement, for excavations of trenches, for pipelines, of specified purpose, will be made in the specified units, of theoretical volume of unclassified excavation, acceptably carried out, on the basis of the dimensions, for the neat excavation finish lines, in accordance with the Drawings or directions of the Engineer.

1. Any excavation carried out outside the limits, shown on Drawings or otherwise specified or directed by the Engineer, shall not be measured and shall not be paid for.

2. Maximum widths of trenches, allowed for measurement and payment, for disposal line, will be 2.1 meters.

1.5.2 Payment

Payment for excavations of trenches, for pipelines, of specified purpose, will be made for the respective quantities of these items, measured in according to the above measurement, at the unit rates, tendered in the priced Bill of Quantities.

Rate: The unit rates tendered, for excavations of trenches, for pipelines, of specified purpose, shall be deemed to be inclusive of, but not limited to the following:

- a. All operations related with transportation, involved in the process.
- b. All operations related with storage of materials.
- c. All sorts of wastages.
- d. All operations including:
 - i. Excavation
 - ii. Protection, preservation and maintenance of excavations
 - iii. Stock piling of excavated materials, suitable for backfilling
 - iv. Disposal of surplus and/or unsuitable excavated material and filth and garbage
 - v. Maintenance, protection and repairs, of the works
 - a) Design, provision, construction, maintenance and removal of all the requisite temporary works like bridges and detours for the traffic.
 - b) Design, provision, construction, maintenance and removal of the requisite public protection and warning works like suitable barricades, flood lights, warning lights, signs and similar items.
 - c) Protection of existing adjacent facilities like pavements, structures and utilities.
 - d) Making good all damages
 - e) Obtaining soil data and information
 - f) Carrying out all sampling and testing
 - g) All other operations, procedures and requirements necessary to complete the work in accordance with these specifications.

2 BACKFILLING

2.1 GENERAL BACKFILLING

The work covered by this section of the specifications consists of furnishing all plants, equipment, appliances, labour and materials in performing all operations in connection with filling and backfilling for all types of construction works including pipelines and other foundations complete in strict accordance with proper gradient, slope with top and bottom of trenches etc. as per specifications and drawings and subject to the terms and conditions of the Contract.

2.2 FILL, BACKFILLING AND RESTORING OF GROUND TO ORIGINAL CONDITION

Fill where required shall be clean unadulterated local river sand and shall be free from wood, stones and other debris. Excavated material shall only be used for fill if approved by the Engineer or his representative.

All fill, backfilling or earthwork in embankment shall be compacted by mechanical rammer, or other approved equipment in layers not more than 150 mm thick. Each layer shall be uniformly spread and fully compacted and shall have proper moisture content for the required degree of compaction that shall be done by mechanical rammers as approved by Engineer.

Backfill shall not be placed against walls etc., prior to the water proofing treatment if provided and approved by the Engineer. Backfill shall be brought up evenly on each side a wall as far as practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to tie wall than distance equal to the height of the backfill above the top of base slab footing. No back filling shall be done before the new structure has been cured for at least two weeks.

The Contractor shall verify that pipeline & chambers has been inspected. The Contractor shall identify and cut out soft areas of sub-grade not capable of compaction in place and shall backfill with approved fill and compact to density equal to or greater than requirements for sub sequent fill material.

The back filling of the trench shall be allowed after the effluent pipe has been laid and jointed over the specified bed, inspected, checked, tested and approved by the Engineer.

Backfilling of the trenches shall be carried out by filling half pipe level. The filling shall then be thoroughly rammed. More filling shall be carried out and

rammed again until the consolidated filling reaches pipe top level. Only selected dry materials free from stones or debris shall be used for backfilling that shall be spread and rammed evenly across the trench. Thereafter, the trench shall be filled in layers not exceeding 150 mm in depth, each layer being properly rammed before the next layer is placed so that 95-100% compaction is obtained as per AASHTO Standard.

On completion of backfilling, the Contractor shall level a grounds disturbed by him in the course of the work, spread the soil where necessary as directed by the Engineer.

2.3 Rough Grading

Necessary rough grading if required shall be carried out by the Contractor to establish the finish grade as specified in the drawings or construction requirements of the site, or otherwise indicated shall have uniform levels or slope between points on existing and finished grades. Abrupt changes in slopes shall be rounded.

2.4 COMPACTION

Fill and/or backfill shall be compacted to a density of not less than 95% of the maximum density at optimum moisture as determined by 110 AASHTO T-99.

Isolated boulders and rubble not exceeding 0.1 cubic meter in volume may be incorporated at the Engineer's discretion.

If any material after placing reaches a condition such that it cannot be thoroughly compacted the contractor shall either remove all of the material which is in unsuitable condition or improve the condition of the material by mechanical or chemical means.

2.5 REMOVAL OF EXCESS AND UNDESIRABLE MATERIALS

- Excess and undesirable material from excavation not require for fill or backfill shall be disposed of, removed and/or deposited and levelled on the site where directed by the Engineer. Earth suitable and meant for backfill if required shall be stored at site in a manner not to interfere with the progress of construction works in progress.
- The Contractor shall keep all excavated soil sprinkled with water during the excavation work so as to prevent any dust nuisance.

- All surplus soil arising out of the work shall be carried away to approved site within a week, deposited and spread as directed by the Engineer.
- The Contractor shall carry out the cutting of existing bituminous road as required for excavation for carrying out the work to the full depth of hard crust of any existing thickness. The stone metal soling etc. shall be separately stacked along the side of excavation for possible reuse.

2.6 EXECUTION

The Contractor shall commence backfilling of excavations as soon as practicable after the permanent works have been tested, inspected and accepted by the Engineer. Backfilling shall not be carried out without the consent of the Engineer. After compaction the surface shall be levelled longitudinally and transversely and rolled to achieve a uniformly compacted and even surface free from undulations, soft spots and depressions all within the accepted tolerances. Suitable material for backfilling shall be deposited and compacted in layers not exceeding 150mm thickness (measured before compaction) if compacted by hand. If compaction is carried out by mechanical means, the thickness of layers depends on the type of equipment employed and shall be approved by the Engineer. Supports if provided shall be carefully removed as the filling proceeds but the removal of such supports shall not relieve the Contractor of his responsibility for the safety and stability of the Works. Tranches shall be carefully backfilled and compact by hand the trench with selected excavated material free from large stones etc. to the following minimum levels above the crown of the pipe. Optimum moisture content of backfill materials shall be maintained to attain required compaction density.

2.7 MATERIAL

The soil material used for backfilling shall be as approved by the Engineer. The soil material shall be uniform, readily compactable soil and shall exclude material from swamps, marshes, vegetable matter, timber or similar material liable to decomposition, material susceptible to spontaneous combustion. Clay or soils having a plasticity index $>9\%$ or a liquid limit $> 49\%$ shall not be used. Proctor tests shall be carried out on the material to be used for backfilling prior to start of Backfill Operations in order to establish the Optimum Moisture Content and maximum compaction.

2.8 MEASUREMENT AND PAYMENT

2.8.1 Measurement

Measurement, for backfilling of trenches for pipe lines and inlet chamber will be made in the specified units, of theoretical volume of unclassified excavation, acceptably carried out, on the basis of the dimensions, for the neat excavation finish lines, in accordance with the Drawings or directions of the Engineer.

2.8.2 Payment

Payment for backfilling of trenches for pipe lines and inlet chamber will be made for the respective quantities of these items, measured in according to the above measurement, at the unit rates, tendered in the priced Bill of Quantities.

Rate: The unit rates tendered backfilling of trenches for pipe lines and; inlet chamber shall be deemed to be inclusive of, but not limited to the following:

- a. All operations related with transportation, involved in the process
- b. All operations related with storage of materials
- c. All sorts of wastages
- d. All operations including:
 - i) Back-filling including placing, watering and compaction, of the back-filling materials
 - ii) Final grading and levelling

3 PORTLAND CEMENT, AGGREGATES & WATER

3.1 PORTLAND CEMENT

3.1.1 General Requirements

- a. Portland Cement shall be indigenous stuff unless otherwise approved by the Engineer.
- b. Unless otherwise permitted, cement from not more than two plants shall be used and in general, the product of only one plant shall be used in any particular section of the work.

3.1.2 Specification

These specifications cover five types of Portland cement, as follows:

No .	Applicable Specifications		Application
	ASTM	BS	
a.	C150 (Type I)	BS 12	Ordinary Portland Cement: For use in general concrete construction when the special properties specified for Type II, III, IV and V are not required.
b.	C150 (Type II)	BS 1370	Moderate Heat Portland Cement: For use in general concrete construction exposed to moderate sulfate action, or when moderate heat of hydration is required.
c.	C150 (Type III)	BS 12	Rapid Hardening Portland Cement: For use when high early strength is required.
d.	C150 (Type IV)	BS 1370	Low Heat Portland Cement: For use when low heat of hydration is required.
e.	C150 (Type V)	BS 4027	Sulfate Resisting Portland Cement: For use when high sulfate resistance is required.

3.1.3 Packing and Marking

- a. Cement shall be furnished in sacks or in bulk form, as approved by the Engineer.

- b. Cement in sacks shall be delivered in strong, well made, paper or cloth bags, each plainly marked with the manufacturer's name, brand, type of cement and the weight of cement contained therein, except that, in the case of Type-I cement, the type need not be identified.
- c. A bag shall contain 50 Kg. net.
- d. When the cement is delivered in bulk; this information shall be contained in the shipping invoice, accompanying the shipment.

3.1.4 Inspection

The Contractor shall facilitate the Engineer, in all respects, for careful sampling and inspection, either at the mill or at the site of work, as may be specified by the Engineer. The following periods, in days, from the time of sampling shall be allowed for completion of testing.

- 1-day test 6
- 3-day test 8
- 7-day test 12
- 28-day test 33

3.1.5 Rejection

- a. Cement may be rejected if it fails to meet any of the requirements of these specifications.
- b. Cement remaining in bulk storage at the mill, prior to shipment, for a period greater than six months after completion to the tests, may be tested and may be rejected if it fails to conform to any of the requirements of these specifications.
- c. Packages varying more than 3% from the weight marked thereon may be rejected and if the average weight of packages in any consignment as determined by weighing fifty packages taken at random, is less than that marked on the packages, the entire consignment may be rejected.
- d. Packages received in broken or damaged condition shall be rejected or may be accepted only as fractional packages as determined by the Engineer.
- e. Cement that is found to be adversely affected by moisture, as determined by the Engineer, shall be rejected.

3.1.6 Method of Sampling and Testing

- a. The sampling and testing of Portland cement shall be in accordance with relevant BS or ASTM standard specifications.
- b. Contractor shall carry out all tests on Portland cement, at his own cost, if required by the Engineer.

3.1.7 Transportation of Cement

Transportation of the cement from the mill to the site stores and to the point of use shall be accomplished in such a manner that the cement is completely protected from exposure to moisture.

3.1.8 Storage

- a. Cement shall be stored in dry, weather tight and properly ventilated structures. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification of each consignment.
- b. The sacks should be stacked closely on a damp proof floor or on timber planks, raised by a minimum of 12" (300 mm), from the ground, with air space below. There should be similar air space between the stacks and walls.
- c. To avoid bursting of bags and setting under pressure, the height of the stacks shall be limited 8 bags.
- d. Adequate storage capacity shall be furnished to provide sufficient cement to meet the peak needs of the project.
- e. Cement storage facilities shall be emptied and cleaned by the Contractor when so directed, however, the interval between required cleaning normally will not be less than four months.

3.1.9 Usage

- a. The Contractor shall use cement in the approximate chronological order in which it is received at the site. All empty sacks shall be promptly disposed of as approved by the Engineer.
- b. No cement stored through a monsoon, or for a period of more than six months, should be used, unless tests have been applied and cement found up to the requisite standard.

- c. Suitable, accurate scales shall be provided by the Contractor for weighing the cement in stores and elsewhere on the work, if required, and he shall also furnish all necessary test weights.

3.1.10 Delivery and Usage Record

Accurate records of delivery of cement and its use in the works shall be kept by the Contractor. Copies of these records shall be supplied to the Engineer in such a form as he may require.

3.2 AGGREGATE

3.2.1 General Requirements

- a. Aggregates for normal concrete shall conform to the requirements of ASTM Designation C 33 "Specifications for Concrete Aggregates".
- b. In case the Contractor prefers to use aggregate from a source other than that approved by the Engineer; following tests shall be carried out, at the Contractor's cost, to determine suitability of the material for the intended use:
 - i. Mechanical properties
 - ii. Porosity
 - iii. Organic impurities
 - iv. Clay and Silt Contents
 - v. Abrasion and Soundness Tests
 - vi. Alkali Reactivity Potential
 - vii. Water soluble Chloride Contents
- c. The nominal maximum size of the aggregate shall not be larger than one fifth of the narrowest dimension of the finished wall or slab, or larger than three fourth of the minimum clear spacing between the reinforcing steel and embedment.

3.2.2 Nature of Aggregate

- a) Fine Aggregate: The use of natural sand or a combination of natural and manufactured sands may be permitted, provided that the fine aggregate meets the applicable requirements of the specifications herein, for particular use intended.

- b) Coarse Aggregate: Except where otherwise specified, coarse aggregate shall consist have crushed natural stone.

3.2.3 Source

The Contractor shall obtain concrete aggregate from deposits of natural sand and gravel or shall procure crushed aggregate from approved quarries, which produce aggregates meeting with the Specifications contained herein.

3.2.4 Sampling and Testing

- a. The Contractor shall provide facilities, as may be necessary, for the ready collection of representative test samples, of the aggregates, to determine compliance with specifications.
- b. The Engineer will obtain and test such samples, at the expense of the Contractor, using appropriate standard test methods, selected by the Engineer.
- c. Testing of concrete aggregates by the Engineer shall not relieve the Contractor of his responsibility to maintain, control and ensure the production, stockpiling and handling of both fine and coarse aggregates, in accordance with these Specifications.

3.2.5 Aggregate Processing

- a. General: All aggregates, as delivered to the mixer, shall consist of clean, hard, dense and durable and uncoated particles.
- b. Light Weight Elements: Light weight elements, like chalk, clay and organic matter shall be separated by vibro-floatation process. Where required, fines shall be removed from the coarse aggregate by adequate washing.
- c. Soft Particles
 - i. The Contractor in planning his aggregate processing operations shall make necessary provisions, as regards methods and equipment, to ensure effective elimination of soft particles from all aggregates.
 - ii. The percentage of soft particles present in the processed coarse aggregate shall not exceed 3 percent by weight, when determined in accordance with the applicable requirements of ASTM Designation C235 "Standard Method of Test for Scratch

Hardness of Coarse Aggregate Particles" or other standard test method, selected by the Engineer.

- iii. Test Samples shall be representative of the each size group of processed coarse aggregate, as specified in Article 5.6, obtained according to the ASTM Methods D 75.

3.2.6 Grading Requirements

Compliance with the aggregate grading and uniformity requirements will be determined at the mixer. The aggregates, as delivered to the mixers, shall conform to the following specific grading requirements:

3.2.6.1 Fine Aggregates

- The grading of fine aggregate shall conform to the following requirements:

U.S. Standard Sieve Mesh	Percent Passing
0.375" (9.50 mm)	100
No.4 (4.75 mm)	95-100
No.8 (2.37 mm)	80-100
No.16 (1.18 mm)	50-85
No.30 (0.60 mm)	25-60
No.50 (0.30 mm)	10-30
No.100 (0.15 mm)	2-10

- Fineness modulus shall range between 1.9 and 2.78.
- The sand equivalent value, as determined by ASTM Designation D 2419, "Standard Test Method for Sand Equivalence Value of Soils and Fine Aggregate", shall not be less than 75.

3.2.6.2 Coarse Aggregate:

- The grading of the coarse aggregate, within the separated size groups, shall conform to the following requirements:

US Standard	Percent by Weight Finer than Each Laboratory Sieve			
Sieve Size (Nominal Size)	1/4"(6.25 mm) to No. 4 Group	3/4"(19 mm) to No. 4 Group	1"(25 mm) to No. 4 Group	1.5"(37.5 mm) to No. 4 Group

2.00" (50.00 mm)	-	-	-	100
1.50" (37.50 mm)	-	-	100	95-100
1.00" (25.00 mm)	-	100	95-100	-
0.75" (19.00 mm)	100	90-100	-	35-70
0.50" (12.50 mm)	90-100	-	25-60	-
0.375" (9.50 mm)	40-70	20-55	-	10-30
No. 4 (4.75 mm)	0-15	0-10	0-10	0-5
No. 8 (2.37 mm)	0-5	0-5	0-5	-

3.2.6.3 Particle Shape

- A flat particle is one having a ratio of width to thickness greater than three. An elongated particle is one having a ratio of length to width greater than three.
- The shape of the particles shall generally be spherical or cubical.
- The quantity of flat and elongated particles, in the separated size groups of coarse aggregate, as defined and determined by standard tests, approved by the Engineer, shall not exceed 15% by weight in any size group.

3.2.7 Deleterious Substances

3.2.7.1 Fine Aggregate:

The maximum percentages of deleterious substances, in the fine aggregate, as delivered to the mixer, shall not exceed the following values, with sum of the percentages of all deleterious substances not to exceed 5 percent, by weight.

Substances	Percent of Weight
Material passing No. 200 sieve	3
Shale	1
Total of other deleterious substances including mica, chloride, coated grains and soft flaky particles	3

3.2.7.2 Coarse Aggregate:

The maximum percentages of deleterious substances, in any size of coarse aggregate, as delivered to the mixer, shall not exceed the following values, with the sum of the percentages of all deleterious substances not to exceed 3 percent by weight.

Deleterious Substances	Percent of Weight
Material passing No. 200 sieve	1
Shale	1
Clay lumps	0.5
Other deleterious substances	1

3.2.8 Storage

- Aggregate shall be stored, at the site, in such a manner as to prevent its deterioration or the inclusion of foreign matter.
- Aggregate, which has deteriorated or which has been contaminated, shall not be used for concrete.
- All methods employed by the Contractor for loading, unloading, handling and stock-piling aggregates shall be subject to the approval of the Engineer, at all times.

- d. Sufficient aggregate shall be maintained at the site, at all times, to assure continuous placement and completion of any lift of concrete started.

3.2.9 Moisture Control

- a. All fine aggregate and smallest size group of the coarse aggregate shall remain in free draining storage at the site for at least 72 hours, immediately prior to use.
- b. The free moisture content of the fine aggregate and of the smallest size group of coarse aggregate, as delivered to the mixer, shall be controlled so as not to exceed 4% and 1% respectively, expressed as percent by weight, of the dry aggregates; unless higher limits are allowed by the Engineer.
- c. In addition to the limits on the maximum amounts of free moisture in aggregate, the moisture content shall be controlled so that, for each size, the variation in the free moisture will not be more than 0.5 percent, during any one hour of mixing plant operation.
- d. Coarse aggregates, with other sizes, as delivered to the mixers, shall have the least amount and least variation, of the free moisture contents, practicable under the job conditions.
- e. Under no conditions shall the aggregate be delivered to the mixed plant being dripping wet.
- f. The Contractor shall carry out such tests, at his own expense, as the Engineer may deem necessary, to determine the free moisture content of aggregate.

3.3 WATER

Water for mixing mortar shall be clean and free of mud, oil and injurious amounts of organic materials or the deleterious substances. Potable water shall be used.

3.3.1 Source

Water, for all construction purposes, shall be obtained from an approved source.

3.3.2 Quality

- a) The water shall be clean and free from clay, silt and injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious

substance, likely to cause efflorescence or interfere with setting of mortars or otherwise be harmful to the work.

- b) Water fit for drinking purpose shall be accepted as suitable for all construction purposes.
- c) The water shall conform to the requirements of BS 3148, as to its suitability, for construction. It shall meet the following chemical requirements. All requisite water testing, in this regard, shall be carried out at the Contractor's Cost.

Substances	Permissible Levels
Chlorides	≤ 3000 mg/l
Sulfates	≤ 2000 mg/l
Impurities	≤ 2000 mg/l
pH Value	5 to 10

3.3.3 Storage

Water shall be stored in watertight tanks or containers, adequately protected from the admixture of dust and other foreign matter.

4 STEEL REINFORCEMENT

4.1 DESCRIPTION

The work, to be covered under this Section, shall include furnish, testing, cutting, bending and placing all steel reinforcement, as indicated on the Drawings or otherwise required.

4.2 MATERIALS REQUIREMENT

4.2.1 General

No steel shall be incorporated in the Work, without prior approval of the Engineer. All reinforcement shall be free from loose rust, scales and oil, grease or other coating, which might destroy or reduce its bond with the concrete.

4.2.2 Specifications

Concrete reinforcement bars shall be of following specifications, as shown in the Drawings and/or specified in Bill of Quantities:

- a. Cold worked steel bars, conforming to BS 4461.
- b. Grade 40 and Grade 60 steel bars, conforming to ASTM 615.
- c. Hot rolled mild steel round bars, complying with BS 4449, with guaranteed yield strength of not less than 36000 psi.

4.2.3 Testing

The Contractor shall provide all measuring and testing facilities to ascertain quality, weight and quantity of steel, at his own expense and shall furnish manufacturers certificate, stating chemical composition of steel, if so directed by the Engineer.

4.3 BAR BENDING SCHEDULE

Where instructed by the Engineer, bar bending schedules, for the concrete reinforcement, shall be prepared, from the Drawings, by the Contractor, at his expense, and submitted, to the Engineer, for approval.

4.4 CUTTING AND BENDING

- Steel reinforcement may be mill or field cut and bent.
- All bending shall be in accordance with standard approved practices and methods.

- When bending is required, it shall be performed prior to embedding the bars in the concrete. In all such cases, the bars shall be cold bend.
- Bending or straightening of bars, partially, embedded in set concrete, shall not be permitted, except in isolated cases, where corrective action or a field change is required and is specifically approved by the Engineer.
- Bending hot at a cherry-red heat (not exceeding 840 degree centigrade) will be allowed for mild steel bars. Bars bent hot should not be cooled by quenching.

4.5 PLACING AND POSITIONING

- Reinforcement shall be placed and maintained, within the specified tolerance of its position, as shown on the Drawings.
- Welding of bars shall not be permitted, for assembly of reinforcement, unless authorized by the Engineer.
- The use of reinforcement, for the transmission of current, for welding will not be permitted.
- Where tying wires or clips are used, care should be taken to ensure that the projecting ends do not encroach into the concrete cover.
- All reinforcement shall be secured in place by use of metal or concrete supports, spacers, or tiles, as approved by the Engineer. Such supports shall be of sufficient strength to maintain the reinforcement in place, throughout the concreting operation.
- The supports shall be used in such a manner that they will not be exposed or contribute, in any way, to the discoloration or deterioration of the concrete.
- Concrete supports shall be manufactured of the same concrete mix, as used in the structure to be concreted.

4.6 RELATION OF BARS TO CONSTRUCTION SURFACES

The cover of all main reinforcement shall be as specified or shown on the Drawings. The actual concrete cover, to all steel, at any point, shall not be less than the required nominal cover by more than 3mm (1/8 inches).

4.7 SPLICING

Except as otherwise shown on the Drawings or directed by the Engineer, all splices, lengths of laps, splice locations, placement and embedment of reinforcement shall conform to the applicable requirements of American Concrete Institute 318, "Building Code Requirements for Reinforced

Concrete". If welded splices are proposed, welder of approved qualification and experience shall be employed, after obtaining approval of Engineer. Sufficient number of butt welds shall be tested, to failure, in each lot, to maintain a check on the quality, at the cost of the Contractor.

4.8 TOLERANCES

Following tolerances shall be observed:

4.8.1 Fabricating Tolerances

i. Sheared length	+ 25 mm (1.00")
ii. Depth of truss bars	+ 13 mm (0.50")
iii. Outer dimensions of stirrups, ties, and spirals	+ 6 mm (0.25")
iv. All other bends	+ 25 mm (1.00")

4.8.2 Placing Tolerances

i. Clear distance to formed surface	+ 6 mm (0.25")
ii. Minimum spacing between bars	- 6 mm (0.25")
iii. Top bars in slabs and beams	
Members depth 200mm (8") or less	+ 6 mm (0.25")
Members depth 200 mm to 600 mm (8" to 24")	+ 13 mm (0.50")
iv. Lengthwise of Members	+ 50 mm (2.00")

Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items, subject to approval of the Engineer.

4.9 EMBEDMENT ITEMS

- Before placing concrete, care shall be taken to determine that all embedded items are properly placed and are firmly and securely fastened in place as indicated on the Drawings or as instructed by the Engineer.
- Embedded Items shall be free of oil and other foreign matter.

- The embedding of wood or other foreign materials in concrete is prohibited.
- All reinforcement, including dowels, remaining exposed in the work shall be suitably protected until embedded in concrete.

4.10 MEASUREMENT

- Measurement, for concrete reinforcement, will be made in the specified units of weight, of reinforcing steel, of specified quality, acceptably placed, on the basis of the lengths of bars, actually installed, in accordance with the Drawings or bar schedules or as directed.
- Following unit weights will be used for converting the length of bars, of different sizes, to determine the weight of concrete reinforcement, for the purpose of measurement:

Bar Designation	Unit Weight Kg/m (lb/ft.)	Bar Size (mm)	Unit Weight kg/m
# 2	0.249 (0.167)	8	0.395
# 3	0.560 (0.376)	10	0.616
# 4	0.994 (0.668)	12	0.888
# 5	1.553 (1.043)	16	1.579
# 6	2.236 (1.502)	20	2.467
# 7	3.043 (2.044)	22	2.984
# 8	3.975 (2.670)	25	3.854
# 9	5.061 (3.400)	28	4.834
# 10	6.406 (4.303)	32	6.313
# 11	7.909 (5.313)	36	7.990
# 14	11.388 (7.650)		
# 18	20.246 (13.60)		

- Overlaps, unless clearly shown in the Drawings or approved by Engineer, for the purpose of payment, shall not be measured and allowed.

4.11 RATE AND PAYMENT

- Payment for concrete reinforcement, of specified quality, will be made for the weight of reinforcement, computed in accordance with Article 10, at the unit rates, tendered in the priced Bill of Quantities.
- Contractor shall provide lengths of reinforcement, which are greater than those shown on the drawings or directed by the Engineer, no payment for extra lengths shall be made.
- The Contractor shall not claim for the difference in the actual weights of bars and their standard weights given in the Article 10.
- The unit rates tendered, for all items of reinforcement, shall be deemed to be inclusive of, but not limited to the following:
 - i. Providing reinforcement bars
 - ii. Providing M.S. binding wire and concrete, metal and plastic chairs, spacers and hangers, necessary to support the reinforcement.
 - iii. All sorts of transportation involved in the process
 - iv. All sorts of wastages
 - v. All operations including cleaning, cutting, bending, placing and fixing, in position, of reinforcement; binding with wire; and placing supports and spacers
 - vi. Preparing bar bending schedules
 - vii. Carrying out all sampling and testing
 - viii. All other operations, procedures and requirements necessary to complete the work in accordance with these specifications.

5 BEDDING AND PIPE LAYING

5.1 SCOPE OF WORK

The work covered by this section of the specifications consists of providing Pipes and laying including furnishing of all plants, equipment, appliances labor and materials in performing all operations in connection with construction of water works.

5.2 ALIGNMENT AND GRADE

The Contractor shall follow the alignment and grade as given in the drawings approved by the Engineer.

5.3 PIPE LAYING

- All pipes shall be examined for defects before lowering in the trench. Defective or damaged pipes shall not be used. Pipes shall be handled carefully so as not to damage them in any way. Wide slings shall be used. The pipe shall be laid as per instruction of the manufacture and directions given below.
- Each pipe immediately before being laid shall be carefully brushed out and tested for soundness. Each pipe shall be laid accurately to line and levels so that except where horizontal and vertical deflection is required as per drawings or directions of the Engineer, the finished pipeline shall be in a straight-line both in horizontal and vertical planes. Pipes shall be laid upon an even bed of well compacted bed of granular material as shown in the drawing and specified for the full length of each pipe, extending for the full width of the trench and with sufficient material at the sides to permit the pipes being marked on the bed and firmly supported to true line and level. Sufficient space should be left to enable the field joints, tested and inspected but the Contractor shall ensure that at least three quarters of the pipe length is fully supported. After the pipeline has been tested and approved by the Engineer or his representative, the space left out at the joints should be carefully filled with granular or concrete bedding. Each pipe shall be laid in such a manner as to prevent the in-grass of sand, mud or other deleterious materials. The open ends of pipes shall be suitably protected at the end of each day's work or whenever a pipe end is left unattended, to prevent any foreign matter gaining access to the pipes.

5.4 BEDDING FOR PIPELINES

5.4.1 DESCRIPTION

This work shall consist of furnishing and placing all types of bedding, of specified materials, under and around pipes, in water, wastewater and rainwater pipelines, in accordance with these specifications and to the lines, grades and cross-sections shown on the Drawings and/or as directed by the Engineer.

5.4.2 MATERIALS REQUIREMENTS

- Materials for bedding shall be from an approved source.
- The materials, for bedding, shall be free from clay, salt, alkali, organic matter, shale, loam, soft flaky particles and other deleterious substances.
- It shall be stacked at the place designated by the Engineer and kept free from the admixture of deleterious materials.

5.4.3 CONSTRUCTION REQUIREMENTS

The material for bedding shall be placed to the specified thickness and shape and compacted by rammers of approved weight.

5.5 MEASUREMENT & PAYMENT

5.5.1 Measurement

Except where otherwise specified in the Bill of Quantities, measurement of bedding, for pipelines, will be made in the specified units of volume, of these materials, of specified quality, acceptably placed, on the basis of the dimensions, for the neat finish lines, in accordance with the Drawings or directions of the Engineer.

5.5.2 Payment

Payment for various types of bedding, for pipelines, of specified materials and quality, will be made for their respective quantities, measured in accordance with Article 4, at the unit rates, tendered in the priced Bill of Quantities.

5.5.3 Rate

The unit rates tendered, for various types of bedding, for pipelines, shall be deemed to be inclusive of, but not limited to the following:

- a. Providing all materials
- b. All sorts of transportation involved in the process
- c. All sorts of wastages
- d. All operations including stacking, cleaning, laying and compacting of bedding materials; and maintenance, protection and repairs, of the work
- e. Carrying out all sampling and testing
- f. All other operations, procedures and requirements necessary to complete the work in accordance with these specifications.

6 CONCRETE SURROUND FOR PIPES

- The pipes shall be encased in reinforced cement concrete of nominal mix 1:2:4 at Nullah or road crossings as per directions of the Engineer. The minimum thickness for the concrete surround shall be as shown in the drawings.
- The pipes shall be laid on a reinforced cement concrete bed of nominal mix 1:2:4 at locations where directed by the Engineer. The concrete shall be laid on well-compacted and levelled bed.
- The material used in the concrete, method used in mixing, laying and curing etc. of the concrete shall be as described under the section 5 "Concrete". The reinforcement steel has confirmed to the requirements given to Section 6 of reinforcement steel.

6.1 CONCRETE THRUST BLOCKS / ANCHORAGES

- Concrete thrust blocks and cradles shall be constructed of 1:2:4 cement concrete with strength of 3000 psi or as directed by the Engineer. Concrete thrust blocks of adequate sizes shown in drawing or directed by the Engineer shall be provided at all tees and bends.
- Thrust blocks shall be poured against proper formwork or against undisturbed earth where possible and approved by the Engineer. The concrete shall be cured for minimum 7 days by keeping the surface wet. All forms shall be removed prior to backfilling.

6.2 MEASUREMENT

Pipes shall be measured in linear meter, their lengths the net length of the pipe as laid, after deduction of the length of overlap at any joint to be made

with the pipe. Plain ended pipe shall be measured and paid by effective length as laid.

6.3 PAYMENT

Payment shall be made for the acceptably completed pipeline, granular bedding, pipe encasement and concrete thrust block laid in accordance with the specifications, drawings and directions of the engineer including all costs for labour, materials, transportation, handling, testing and disinfection complete at the approved BOQ rates.

7 HYDROSTATIC TESTS (Water supply System)

Hydrostatic tests shall be performed as per AWWA C-200-80 according to PN rating of pipe provided in BOQ.

- a) The test pressure shall be held for not less than 15 Minutes

The test information shall be recorded on a suitable recording chart. The pipeline shall be manually cleaned of all debris, stones and sand prior to laying, jointing and hydraulic test. Pipeline and pipe work shall be subjected to hydraulic pressure tests in the presence of the Engineer. Such tests shall comply with BS 8010 or CP 312, unless otherwise specified. Testing shall be carried out in two stages.

- b) Test of sections as construction proceeds.
- c) A final test of the whole of the pipe work or pipeline on completion.

The Contractor shall provide all plant, equipment, and fittings etc. including water, necessary for the hydraulic test. He shall inform the Engineer, well in advance of the time for tests, details of his proposals including the supply of water, its source and method of conveyance. No connections to the pipeline or pipe work which would involve cutting, tapping or altering the Permanent Works, shall be allowed.

Test gauge shall be of approved manufacture having dials at least 200 mm diameter, graduated such that the test pressure is at least 75 % of the full scale reading. If necessary different gauges shall be supplied for different pipeline sections. Two gauges of each type shall be provide for the sole use of the Engineer and shall remain in the Engineer's possession for the duration of the Contract.

7.1 Test Procedure

Each section of the pipeline or pipe work to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces that will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Hydrants, washout valves and isolation valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test. The air valve manufacturer's confirmation shall be obtained that the valves are capable of withstanding the test pressure involved.

Proposals for testing where thrusts on structures are involved, even where thrust collars on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The Contractor's proposed method of filling the pipeline or pipework with water shall be approved by the Engineer. The sectional length under test shall be filled making certain that all air is displaced through an air valve installed at the high end of the line. The section shall then remain under constant pressure - 10 to 20 m head of water - for a period of several hours until the pressure can be maintained without additional pumping. Pipes of materials liable to absorb water, e.g. concrete lined pipes shall be allowed to become saturated under this moderate pressure for 24 hours.

The pressure shall then be slowly increased to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe section shall pass the test if the leakage is not more than 0.35 litre per mm of pipe diameter per kilometre per 24 hours for each 100 m head of pressure applied.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until and unless the leakage of any section of the pipeline tested is not more than the rate of leakage specified above and all sources of discernible leakage have been rectified.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by consideration other than those applying to the pipeline system.

7.2 Test Pressure

Test pressure is to be measured at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown

on the drawing all pipelines and pipe work shall be tested according to PN provided in BOQ or as determined by the Engineer.

The contractor shall submit a schedule of pipeline test pressures to the Engineer for approval prior to commencing testing.

7.3 Sectional Hydraulic Test

The Sectional Hydraulic Test shall be carried out after the pipeline or pipe work section to be tested has been laid, jointed and backfilled to a depth sufficient to prevent flotation of the pipeline, but leaving the joints exposed. The sections to be tested shall be to the approval of the Engineer and shall be no longer than 1,000 m or above, when either the pipeline is laid adjacent to or underneath the carriageway. The joints between each tested section shall be left exposed until the pipeline has passed the Test on Completion:

7.4 HYDRAULIC TEST ON COMPLETION

The test on completion shall be carried out after all the pipeline or pipe valve sections have been joined together on completion of sectional testing. The joints between sections shall be backfilled once the test is satisfactorily completed.

7.5 DISINFECTION & CLEANING OF PIPE

7.5.1 Disinfecting Water Mains

Applicable procedures for disinfecting new and repaired potable water mains are presented in standards such as ANSI/ AWWA C651, Disinfecting Water Mains.(8) ANSI/ AWWA C651 or equivalents uses liquid chlorine, sodium hypochlorite, or calcium hypochlorite to chemically disinfect the main. Disinfecting solutions containing chlorine should not exceed 12% active chlorine, because greater concentration can chemically attack and degrade pipes

7.5.2 Cleaning

Pipelines operating at low flow rates (around 2 ft. /sec or less) may allow solids to settle in the pipe invert. HDPE has a smooth, non-wetting surface that resists the adherence of sedimentation deposits. If the pipeline is occasionally subject to higher flow rates, much of the sedimentation will be flushed from the system during these peak flows. If cleaning is required, sedimentation deposits can usually be flushed from the system with high pressure water.

Pressure piping systems may be cleaned with the water-jet process, or may be pigged. Pigging involves forcing a resilient plastic plug (soft pig) through the pipeline. Usually, hydrostatic or pneumatic pressure is applied behind the pig to move it down the pipeline. Pigging should employ a pig launcher and a pig catcher.

7.6 Payment for Testing, Disinfection and Cleaning of Pipelines

No separate payment will be made for pressure and leakage testing of pipelines for the supply of clean water and all necessary testing apparatus, pumps, gauges and pipe-works, the cost of supervision and labour in testing and retesting, if necessary and all other work, materials and equipment in complying with the requirements of testing of pipelines.

7.7 Measurement and Payment

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications, and the contract payment schedules.

8 HDPE PIPES AND FITTINGS

8.1 HDPE PIPES FITTINGS AND ACCESSORIES

8.1.1 DESCRIPTION

The PS 3580:1984 PN-8, 10 & 12.5 & in trenches to correct alignment and grade, as indicated in the drawing and specifications including all other accessories and equipment.

8.1.2 SCOPE

This material specification details the minimum requirements for the design, manufacture, testing, inspection and supply of High Density Polyethylene (HDPE) or High Performance Polyethylene (HPPE) pipe material and fittings to be used for transport and potable water.

This specification is intended to be used for PN-08 and pipe series SDR 21. Contractor has to substantiate the reason when he is deviating from SDR 21 and has to get approval from the Engineer.

8.1.3 APPLICABLE STANDARDS AND CODES

The following codes and standards, to the extent specified herein, form a part of this specification. The latest edition of these codes and standards shall govern the work.

ISO 4427	Polyethylene (PE) pipes for water supply –specifications
ISO 161-1	Thermoplastic pipes for conveyance of fluids – nominal outside diameter and nominal pressure- part 1: Metric series
ISO 1167-1to4	Thermoplastic pipes, fittings and assemblies for the conveyance of fluids
ISO 3126	Plastic pipes – Measurement of dimensions
ISO 4065	Thermoplastic pipes – Universal wall thickness table
ISO 6964	Polyolefin pipes and fittings – Determination of carbon black content by calcination and pyrolysis – Test method and basic specification.
ISO 9080	Thermoplastic pipes for the transport of fluids – Method of extrapolation of hydrostatic stress rupture data to determine the long-term hydrostatic strength of thermoplastic pipe materials.
ISO 11922-1	Thermoplastic pipes for the conveyance of fluids – Dimensions and tolerances Part: 1: Metric series.
ISO 12162	Thermoplastic materials for pipes and fittings for pressure applications – Classification and designation – overall service (design) coefficient.
ISO 13761	Plastic pipes and fittings – pressure reduction factors for polyethylene pipeline systems for use at temperatures above 200 C.
ISO 7005 – 3	Metallic flanges – Part 3, Copper alloy and composite flanges
BS EN 12201	Plastic piping systems for water supply - polyethylene
ISO 974	Determination of the brittleness temperature by impact
ISO 2505	Thermoplastics pipes - Longitudinal reversion
ISO 6259	Determination of tensile properties

ISO 1133	Determination of the melt mass-flow rate (MFR) and the melt volume-flow
ISO 877	Methods of exposure to direct weathering

8.2 TECHNICAL REQUIREMENTS

8.2.1 MATERIAL

The CONTRACTOR shall identify the manufacturer of the resin, the resin type and classification. In addition, the CONTRACTOR shall provide evidence that the resin proposed is suitable for use at the design temperature and under the design pressures.

Any change in the material, the material specification, or the manufacturer's location shall be subject to prior approval of the ENGINEER.

Pipes and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, blisters, dents or other damaging defects.

Material shall be uniform in opacity, density, interior smoothness, and other physical properties.

It shall have adequate resistance to weathering and other ageing from storage for a minimum of two years after manufacture.

The material of the polyethylene pipes and fittings which is in contact with or likely to come in contact with drinking water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odour, cloudiness or discoloration of the water.

The concentration of substances, chemical and biological agents leached from materials in contact with drinking water, and measurement of the relevant organoleptic / physical parameters, shall not exceed the maximum values recommended by the World Health Organisation in its "Guidelines for Drinking Water Quality" or the EEC Council Directive on the "Quality of Water Intended for Human Consumption", whichever is more stringent in each case.

For the manufacturing of pipes & fittings new materials to be used only (Rework material is not acceptable).

Pipe manufacturer shall confirm that all fittings to be provided for the pipe systems shall meet the same quality requirements as for the pipes to ensure the same performance for design life cycle.

The pipes and fittings shall be manufactured from polyethylene containing only those antioxidants, UV stabilisers and pigments necessary for the manufacturing process to fulfil the requirements of the specification.

All pipes and fittings shall be suitable for butt fusion or electro fusion techniques.

Contractor shall provide PE manufacturers guideline for the applicability of the material used. If required PE manufacturers shall provide assistance and training.

8.2.2 PHYSICAL PROPERTIES

Pipes and fittings shall be made of high density polyethylene (HDPE) and shall comply with the requirements of ISO 4427 PE 100. The material shall be produced by a member of the PE 100 + Association.

The material used for the manufacturer of pipes and fittings shall be in accordance with Table 1 and Table 2 of clause 4.4 of ISO 4427-1

The minimum required strength (MRS) of the material compound shall be 10 MPa at 20 °C.

The design stress shall be 8 MPa.

Lifecycle durability of 80 years is to be confirmed.

For design calculation, pressure, reducing coefficients 4427-1, Annex A are applicable. The thermal stability of polyethylene material shall meet the requirements of ISO 4427.

8.2.3 PIPE DIMENSIONS (GEOMETRICAL CHARACTERISTICS)

The pipe dimensions for water systems shall be based on standard dimensions according to ISO 4427 and measured in accordance with ISO 3126.

Straight pipe shall be supplied in standard lengths measured at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$. unless otherwise specified; coil lengths shall not exceed 100 m (328 ft.).

Coiled pipes shall be coiled such that localized deformation is voided and the minimum internal diameter of the coil shall not be less than $18 d_n$.

8.2.4 PIPE APPEARANCE

When viewed without magnification the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects. The pipe ends shall be cut cleanly and square to the axis of the pipe.

All polyethylene pipes to be used for the transmission and distribution of potable water shall be black and have blue stripes.

The carbon black content in the compound shall be 2.25 ± 0.25 % by mass when measured in accordance with ISO 6964. The dispersion of carbon black when determined in accordance with ISO 11420 shall be equal to or less than grade 3.

8.2.5 FITTINGS

The fittings shall be injection moulded or formed from material compatible to that of the pipe and shall be as resistant to the external and internal environments as the other demands' of the pipe system.

At locations where HDPE to metal connections are specified, Nylon based polyamide 11 coating system complying with the requirement of AWWC224 or epoxy coated backing rings shall be used, or special restrained transition fittings subject to approval by the ENGINEER. The flanges shall be drilled to ISO 7005-2, as per the design requirements.

8.2.5.1 FITTINGS APPEARANCE

When viewed without magnification the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects. The fitting shall be blue or black.

8.2.5.2 FITTINGS DIMENSIONS

The dimensions shall be measured in accordance with EN/ISO 3126

8.2.5.3 WALL THICKNESS OF FITTINGS

The wall thickness of the body of the fitting at any point shall be equal to or greater than the minimum wall thickness of the corresponding pipe.

8.3 PIPE INSTALLATION

- a) Trench excavation shall be carried out in accordance with Excavation of the specification.

- b) Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
 - Provide qualification details of the manufacturer's technical expert to be assigned to the Contract. The technical expert shall have expertise, experience and skills necessary for advising and monitoring all aspects of transport, storage, handling, installation and testing of pipes as appropriate.
 - The technical expert shall provide comprehensive technical assistance to the Contractor throughout
 - Contract and regularly monitor the Contractor's activities and report on shortcomings.
- c) The pipeline shall be within 1 inch of the specified line and the invert level shall be within 6mm of the specified value and shall be such that there is no back fall at any point on a gravity pipeline.
- d) Install bedding, surround and backfill in accordance with the pipe manufacturer's requirements.
- e) Install appurtenant facilities on the pipeline such as manholes, valve chambers as specified of the specification.
- f) Lay pipes from downstream to upstream unless agreed otherwise with the Engineer.
- g) HDPE pipelines can accommodate gradual changes of direction in the vertical and horizontal plane. However the pipe should not normally be bent to a radius less than 25 times the outside diameter of the pipe.
- h) When cut pipe is required, ensure that the cutting is done by a machine, leaving a smooth cut at right angles to the axis of the pipe.
 - Ensure that all pipes and fittings are sound and clean before laying. When pipe lying is not in progress, ensure that the pipe ends are at all times fitted with watertight plugs or caps. The plugs or caps shall only be removed for the purposes of making a connection of the pipe end or testing the pipeline. The plugs or cap shall be replaced immediately on completion of the test.

8.3.1 BUTT FUSION JOINTING

- a) Butt fusion jointing shall only be used to join pipes of the same PE material with compatible MFR and with the same nominal wall thickness and outside diameter. The following procedures shall serve as a general guide only. The Contractor shall obtain detailed jointing instructions from the

manufacturer who shall have a technical representative available at the Engineer's request during the jointing process.

- i. The butt fusion machine should be sited within a shelter and the ends of the pipe being joined should be covered or plugged to prevent through drafts.
- ii. Each component that is to be fused should be held in position in the purpose built clamping jig. The lengths of pipe hanging outside the jig should be supported by means of roller cradles.
- iii. The pipe ends should be faced so that the finished surfaces are perfectly smooth free of visible ridges, valleys or other surface imperfections.
- iv. The outside diameters of the pipe ends should match closely without the offset exceeding 10%
- v. The pipe ends should be heated to the pipe manufacturer's recommended temperature and interfacial pressure. The Contractor should use a pyrometer or other surface temperature measuring device to confirm and record the actual surface temperature for each weld. Temperature indicating crayons should not come into contact with the surface to be welded.
- vi. After the pipe ends have been properly melted, the heater tool should be removed within the specified time. The molten pipe ends should be brought together and allowed to cool without disturbance to form the permanent weld. The proper bead size and geometry specified for the pipe being welded should be formed.

8.3.2 SADDLES/SIDEWALL JOINTING

Saddle /sidewall fusion jointing shall be accomplished by using a mechanical saddle fusion machine that has been designed for this purpose to ensure proper alignment, temperature and force control. The following procedures shall serve as a general guide only. The Contractor shall obtain detailed jointing instructions from the manufacturer who shall have a technical representative available at the Engineer's request during the jointing process.

- i. Any dirt or coating that might interfere with the proper operation of the saddle fusion machine should be removed from the pipe and the surfaces of the pipe and saddle roughened to expose fresh material and any residue brushed away.
- ii. Test fit the saddle fusion machine to ensure that alignment and contact are as they should be.

- iii. Commence the fusion process and periodically verify the surface temperature using a pyrometer or other surface temperature measuring device. If temperature indicating crayons are used, they should not be used on a surface which comes into contact with the surfaces to be welded.
- iv. After the heating period, remove the heater plate and check for the correct melt pattern on both the fitting and the pipe. Join the fitting to the pipe with the prescribed fusion force.
- v. Cool the joint without disturbance until the melt has formed a permanent weld. The joint should not be subjected to any external stresses until the fusion joint has cooled.

8.3.3 ELECTRO FUSION JOINTING

- a) Electro fusion jointing involves heating the electro fusion joint internally, either by a wire coil at the interface of the joint or by a conductive polymer. Heat is created by an electric current passed to the conductive material in the fitting.
 - i. Ensure that the fitting is dimensionally appropriate for welding to the pipe. Clean the pipe surface in the joint area. Cut the end of the pipe square. Mark on the pipe surface the proper position of the fitting to be installed. Scrape the surface of pipe area to be joined, removing all surface degradation and contamination. Avoid contamination of the scraped pipe surfaces.
 - ii. Place the pipe and fitting in the clamping fixture to prevent movement of the pipe or fitting.
 - iii. Connect the electro fusion control box to the fitting and to the power source. Apply electric current to the fitting as specified in the manufacturer's instructions. Turn off the current when the proper time has elapsed to heat the joint properly.
 - iv. Allow the joint to cool for the recommended time and remove the clamping fixtures. Do not remove prematurely from the clamps as any strain on a joint that has not fully cooled can be detrimental to joint performance.

8.3.4 MECHANICAL JOINTS AND FITTINGS

- a) Many types of mechanical connection styles and methods exist. The Contractor shall submit suitable mechanical joints. All such joints shall be recommended and acceptance tested by the manufacturer of the

pipe. Where marked on the drawings end-load resistant fittings of an approved type shall be used.

- b) When tightening polyethylene flanges care shall be taken to produce an equal torque load to the limits given by the manufacturer. A torque wrench shall be used. Since polyethylene creeps under load it is essential that the bolts are re-tightened several times prior to commissioning to minimize the risk of leakage.
- c) All joint materials and gaskets shall be suitable for use in the prevailing climate, soil, ground water, and potable water and irrigation water conditions.

8.4 INSPECTION AND TESTING

8.4.1 CERTIFICATION AND DOCUMENTATION

CONTRACTOR shall supply the ENGINEER with copies of certificate and test documents. Such documentation shall be subject to the Engineers' approval prior to shipping.

8.4.2 TEST RESULTS AND FREQUENCIES

The MANUFACTURER shall establish and maintain a current record of test results according to the requirements of the applicable standards and this specification. The MANUFACTURER shall perform all the tests required by ISO 4427 to demonstrate the characteristics and quality of the resin material and the dimensional tolerances of the pipe. The MANUFACTURER shall document all the tests, with frequencies and results as indicated in ISO 4427. The records shall

8.4.3 INSPECTION AND AUDIT REQUIREMENTS

Pipe shall comply fully with ISO 4427, the requirements of the PE 100 + Association and all the additional requirements of this specification.

To verify compliance with this specification, the ENGINEER shall reserve the right to appoint an independent third party inspector to witness the applicable qualification tests, review production records, and inspect general handling and shipping procedures. The third party inspector shall have full access to the testing and production facilities and will be a fully authorized representative of the ENGINEER.

8.4.4 ACCEPTANCE CRITERIA

The order shall meet the following criteria:

A copy of the raw material MANUFACTURER's "Certificate of Quality Control Testing" covering each batch of raw material used for pipes purchased under this specification, shall be available for inspection by the ENGINEER on request.

Pipe wall thickness shall be controlled by continuous scanning using ultrasound or other qualified devices. These devices shall be regularly calibrated for accuracy by certificated agency.

Successful test performance and acceptable results for the testing program outlined in this specification.

An acceptable inspection report from an independent third party inspection company according in the manufacturer's country.

When performed, acceptable results from an independent test audit of any portion of the tests noted in ISO 4427 and this specification.

8.4.5 DEFECTS

When the rejected item is a length or coil of pipe, the lengths or coils manufactured immediately before and after the defective lengths or coils shall be carefully examined. If further defects are found, this is sufficient cause for rejecting the entire batch. This will not apply to local damage that did not occur during manufacture, such as gouges or cuts during handling or transit.

8.4.5.1 QUALITY ASSURANCE/QUALITY CONTROL

A copy of the MANUFACTURER's QA/QC plan shall be submitted to the ENGINEER with its quotation for review and concurrence prior to award. If MANUFACTURER's facility is ISO certified, QA audit requirements shall be waived in favour of ISO 9000 registrar audits, unless the ENGINEER'S trend analysis program indicates areas of concern

8.4.5.2 PACKING, MARKING AND VENDOR DOCUMENTATION

8.4.5.3 Pipe Identification and Packing

The marking information and sequence shall comply with ISO 4427. All pipes and fittings, including test samples shall be clearly and permanently marked using indent printing in a colour that contrasts with the pipe.

All pipes shall be indelibly marked at maximum intervals of 1m

The marking shall indicate at least the following information:

- The manufacturer's name and/or trademark
- The dimensions (nominal outside diameter x nominal wall thickness)
- Material and designation
- The nominal pressure (PN) in bar
- The pipe series (S or SDR) (optional)
- The production period (date or code)
- The number of this International Standard.

The word "water" shall also be included if the pipe is intended for potable water.

- The maximum quantity of pipe to have the same coil/length number is one silo (coiled pipe) or one bundle (straight lengths). The maximum combined length of pipe in the silo or bundle with the same coil/length number shall not exceed the maximum allowable coil length as specified.
- When pipe material is boxed, the coil number shall be clearly marked on the outside edge of the box or silo. Invoices and packing lists shall include the date of manufacture and coil/length numbers for all material in the shipment.
- The fittings shall be packaged in bulk or individually protected where necessary in order to prevent deterioration and contamination. The package shall have at least one label with manufacturer name, type and dimension of the fittings and number of units.

8.4.5.4 Packaging and Transportation

The CONTRACTOR/SUPPLIER shall provide packing and transportation procedures for approval by the ENGINEER and shall comply with the following requirements.

8.4.5.5 Delivery

Delivery of the plastic pipes and fittings to site, shall be no later than six months after the stamped manufacture date.

8.4.5.6 Weathering

A certificate from the pipe/fitting manufacturers shall be provided, confirming that the products may be stored in the open for minimum of 2 years without any adverse effect.

8.4.5.7 Tie-downs

Tie-downs shall be at least 100 mm (4.0 inch) wide and be clean and free from sand, gravel and other such materials. For straight length pipe (up to 12 m (39 ft.)), a minimum of 6 tie-downs are required.

8.4.5.8 Pallets

The pallets shall be suitable for transporting the material from the place of manufacture to the designated receiving location without causing any damage to the pipe. The pallets shall not contain any broken planks or extremities that may damage the coiled pipe or straight lengths. They shall be durable enough to prevent loose pallet nails from gouging the bottom coil/straight length.

8.4.5.9 Overhang

Pipe shall not overhang at either end of the trailer.

8.4.5.10 Stacking

The CONTRACTOR/MANUFACTURER shall not ship small coils stacked inside silos of larger coils. Frames manufactured for the containment of straight lengths of polyethylene pipe during transport and storage shall not contain nails or other fastening devices that may damage the pipe.

8.5 TRUCKING

Where pipes are transported by vehicles, the vehicles should have a flat bed and be free from sharp edges or projections. During transport, polyethylene pipes shall be protected from diesel fumes and be continuously supported to prevent movement between the material and its support.

8.6 SILO'S

Silo packs of coiled pipes shall be squarely stacked and well supported on pallets. Coils shall not overhang the pallets and, shall not be stacked higher than 2.3 m (8.0 ft.)

8.7 MEASUREMENT AND PAYMENT

8.7.1 MEASUREMENT

The quantities to be paid for shall be the number of linear feet of pipe placed, completed and accepted.

8.7.2 PAYMENT

The quantities, as measured above, shall be paid for at the contract unit price respectively, for each of the particular pay items listed in the BOQ. Payment shall be full compensation for laying, jointing and all accessories used.

9 UPVC PIPE

uPVC pipes shall be approved manufacture and confirm to the standard as specified in General section

9.1 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all the operations in connection with laying, jointing, testing, disinfection and commissioning of upvc pipe work complete in strict accordance with the specifications herein and the applicable drawings and subject to the terms and conditions of the contract.

9.2 STANDARDS AND SPECIFICATION

For sampling testing and tolerance limit, specification BS3505:1968 and PS 3051 1991 shall be followed. The upvc pipes jointing shall be cement solvent joint or Z- joint. The contractor should provide the Technical Detail and Boucher to the Engineer or Engineer's representative for approval.

9.3 PHYSICAL PROPERTIES

The physical properties of UPVC pipes shall fall within the following limits

Properties	Value	Unit
Specific Gravity	1.42 - 1.46	-
MECHANICAL		
Tensile strength at 23 °C	450 – 600	kgf/cm ²
Modulus of elasticity at 20°C	30,000	kgf/cm ²
Elongation at break	> 80	%
Impact strength at 0°C	0.5 – 1	Ft lb / in of notch
Impact strength at 20°C	1 – 2	Ft lb / in of notch
Compressive strength	600 – 700	Kgf/cm ²
Bending Strength	1000	Kgf/cm ²
THERMAL		
Specific heat at 20°C	0.24	Cal/gm/°C
Vacate softening point	85	°C

Heat distortion temperature at 18.5 kgf/cm ²	75	°C
Thermal conductivity	0.12 – 0.14	W/m °C
Coefficient of linear thermal expansion	0.08	Mm/mm °C
ELECTRICAL		
Dielectric constant (800 cycle)	3	-
Dielectric strength	425	Volts/mil
Inflammability	Will not support combustion	-
Water absorption (24 hrs at ambient temp.)	0.07	%

9.4 ABBREVIATIONS

uPVC	Unplasticized polyvinyl chloride
PVC	polyvinyl chloride
BS	British Standard
PS	Pakistan Standard
OD	Outside diameter
PN	Nominal Pressure

9.5 Nominal Pressure (PN)

The following class/pressure shall be followed

Class B (PN=6 bars),

Class C (PN= 9 bars)

Class D (PN=12 bars),

Class E (PN= 15 bars)

9.6 THICKNESS AND DIAMETER

The diameter and thickness shall be as followed

Nominal size Inch	Mean Outside Diameter	Wall Thickness			
		Class B 6 bar	Class C 9 bar	Class D 12 bar	Class E 15 bar
	max	min	min	min	min
	mm	mm	mm	mm	mm
3"	89.1	2.9	3.5	4.6	5.7

4"	114.5	3.4	4.5	6.0	7.3
5"	140.4	3.8	5.5	7.3	9.0
6"	168.5	4.5	6.6	8.8	10.8

9.7 uPVC FITTINGS

uPVC fittings shall be approved manufacture and shall be confirm to the standard as specified in General section I For sampling testing and tolerance limit, BS and PS pecification shall be followed.

Metal fittings (cast iron and ductile iron fittings) can be used for diameter ranging 10 inches and above. The metal fittings are connected with the pipe using rubber ring Z-joint system.

9.8 JOINTING

9.8.1 Solvent Cement joint

Jointing is done by applying a uniform layer of solvent cement to spigot and socket ends of pipes to be jointed together and assembling them with a quick action. Right after jointing, the surplus cement shall be removed and a period of 24 hours should be allowed to elapse before pressure testing. It may be noted that completion.

9.8.2 GUIDE TO THE CONSUMPTION OF LUBRICANT, CLEANER AND SOLVENT CEMENT PER 100 JOINTS

Range of pipe and fittings diameter (mm)

Aprox.	32 – 40	50 – 63	75 - 90	110 – 125	140 - 160
	1" – ¼"	1" – ½"	2 ½" – 3"	4"	5" – 6"
Lubricant (kg)	-	2.0	3.50 – 4.00	4.00 – 5.00	5.0 – 6.5
Cleaner (liter)	0.35 – 0.50	0.65 – 0.90	1.00 – 2.00	3.00 – 5.00	6.5 – 9.0
Solvent Cement (Liter)	0.78 – 1.00	1.30 – 1.800	2.00 – 4.00	6.00 – 10.00	13.0 – 18.0

9.8.3 Z-JOINT

Z – Joint is also commonly known as “rubber ring” joint. These joints contain an electrometric sealing component which is automatically compressed to

form an effective seal when the spigot end of upvc pipes inserted into the socket.

These joints are not designed to resist end thrust. Therefore, particular care should be taken to ensure that the pipeline is properly anchored. Anchor blocks should be designed to withstand the thrust resulting from the maximum pressure to which the pipe is likely to be subjected, normally the test pressure. It is desirable to insulate the uPVC pipe from direct contact with the anchor block by means of a suitable flexible membrane.

9.8.4 FLANGED JOINT

Flanged joints can be used to connect uPVC pipes with metal pipes, valves and fittings provided with flanges. Joints are made by the compression of the gasket or a ring seal set in the adaptor of the flange. Flanged joints are also preferable, where there is a need to dismantle pipeline from time to time. Care should be taken while selecting flange accessories their flange should be compatible with the uPVC flange adaptor.

9.9 INSTALLATION OF uPVC PRESSURE PIPES

9.9.1 INSTALLATION OF BURIED PIPE

Unplasticized PVC pipes must be laid onto a trimmed trench bottom, where soil is uniform, fine grained and free from sharp objects. The trench width must be sufficient to enable the lying and jointing of the pipes and proper compaction around the pipe. The minimum recommended trench width (W) is equal to pipe OD plus 600 mm or as specified in the Drawings.

The minimum depth of cover required for water mains is 1000mm from finished surface level to the crown of the pipe. Thus, the minimum excavated depth (D) of the trench for water mains is pipe OD + 1000mm + Bedding.

The normal thickness of bedding is a min of 100mm. for pipe sizes greater than 8 inches; the bedding thickness should be increased to a minimum of 150mm and or specified in the Bill of Quantities.

Because of the flexible nature of the material the pipe should be suitably anchored at all changes of direction and at fixed points. The anchors

should be designed to withstand the maximum thrust developed during hydrostatic pressure testing.

Un plasticized PVC pipes should not be installed in direct sunlight or near any heat source. The liner expansion of uPVC is about six to seven times that of steel, so precaution is to be taken to compensate for it. The pipe line should be installed in such a way as to minimize the stress. The best way of doing this is to arrange piping so that bends occur between anchor points. Along walls pipe rack, hangers, clamps, straps or u-bolt can be used.

9.9.2 Support Spacing

Recommended horizontal and vertical support spacing is given in the table.

*Pipe Outside Diameter	Water Temperature °C				Vertical spacing
	20 °C	30 °C	40 °C	50 °C	
OD	Horizontal Spacing				
mm	cm	cm	cm	cm	cm
16	75	60	40	-	80
20	85	70	50	-	90
25	90	75	55	45	100
32	100	85	65	50	120

9.9.3 MEASUREMENT

All UPVC pipes shall be measured according to the work actually done and no allowance will be made for any waste in cutting to the exact length required. The measurement for pipes shall be in running fee nearest to a inch. Of length along the centre line of pipe as actually laid at work sites.

The rate for providing, laying and jointing of UPVC pipes shall be deemed to include the cost of collars/rubber rings, jointing material, testing and extra excavation required for ordinary bedding of pipes and also for collars and pipe sockets, if any.

If any damage is caused to the pipe line during the execution of work or while cleaning/testing, the pipe line as specified. The contractor shall be held responsible for the same and shall replace the damage pipe line and retest the same at his own cost to the full satisfaction of Engineer.

Water for testing of pipeline shall be arranged by Contractor at his own cost.

Pipes shall be brought on site proportionate to the required progress for Thirty days only.

10 RCC PIPES.

Pipes for sewers shall be of RCC manufactured in SR cement from approved pipe factory. The pipes shall conform in all respects to ASTM C-76/ BS 5911. The thickness of barrel of sewer pipe shall be 30% more than the thickness proposed in ASTM C-76 for the same internal diameter of pipe. The pipes shall be socketed for push on rubber joints. The Contractor shall submit with his tender a detailed sketch of R.C.C. pipe with statement indicating details of socketed joints and also details of reinforcement including numbers and diameter of horizontal and spiral bars for each diameter of pipe. Conforming the requirements All R.C.C. pipes shall be manufactured with S.R cement.

The Contractor shall supply the required number of rubber rings of size and dimension suitable for the diameter of pipe provided for making a fully watertight joint. The rubber ring shall comply in all respect with BS 2494 or equivalent, approved by the engineer.

11 MS PIPES AND SPECIALS

11.1 Mild Steel Section Specifications

The pipes shall be made of Steel plate / coil X-42 of API standard No. 5 D Grade or PSS-0014-84.

11.2 Chemical Properties and Tests

The chemical composition of the steel shall fall within the following limits:

Carbon - 0.28% max.

Manganese - 1.25% max.

Phosphorous - 0.04% max.

Sulphur - 0.05% max.

11.3 Mechanical Properties and Tests

- Yield Stress - 42000 psi (min. psi)
- Ultimate Tensile Strength - 60000 psi (min. psi)
- Elongation on Gauge - 27 (min. %)

11.4 Standard Specifications

For sampling testing & tolerances limits, specifications No. AWWAC-200-80 shall be followed.

11.5 Thickness of Plates / Coil

Thickness of plate / coil shall be as specified in the respective items in the BOQ. All plates used shall be free of surface defects.

11.6 Pipe

The term pipe signifies a hollow cylinder made of M.S. Steel plate / coil of uniform internal dia

11.7 Diameter

The internal diameter of the pipes shall correspond to the net specified diameter after protective lining.

The outside diameter of the body of the pipe as measured by taping the circumference shall be uniform.

11.8 LENGTHS

Pipes shall be finished in uniform lengths.

11.9 STRAIGHTNESS

The pipe shall be straight.

11.10 ENDS

The ends of the pipe shall be so formed that when pipes of the same class and diameter are welded or jointed together to form a continuous straight conduit with a smooth & uniform interior surface.

11.11 JOINTS

Joints shall be welded as per AWWA specifications.

11.12 MANUFACTURE OF PIPES

Before starting production of M.S. pipes the contractor shall furnish the following manufacturing procedure. This procedure shall include but not limited to the following information.

- i) Material quality, full details and checks analysis including residual elements.
- ii) Material manufacturing details.
- iii) Method of plate / coil forming.
- iv) Welding procedures, including procedures for skelp welding.
- v) Method & degree of coil expansion where applicable.
- vi) Method of straightening, sizing and hydrostatic testing.
- vii) Inside diameter.
- viii) Quality control and Inspection procedures. The submitted procedures and any agreed modifications shall be strictly followed in the production of pipes. The pipes shall be spirally welded with at least two welding passes, one of which shall be on the inside. The Contractor may propose straight welding for pipe manufacturing. This should be clearly mentioned in the tender submitted by the Contractor.

The Contractor shall submit all manufacturing procedures and qualification tests result to the Engineer for approval before the total production has exceeded 20 pipes. In the event test results are not available before production has exceeded 20 pipes, the contractor shall stop production and not restart until all test results have been approved by the Engineer.

The Engineer shall witness the manufacture and testing operation of desired quantity of pipes to verify compliance with the agreed procedure.

11.13 INTERNAL PROTECTION OF PIPES – CEMENT MORTAR LINING

The internal cement mortar lining shall be applied in-situ of cement, sand, mortar 1:3 after completion of laying and backfilling of pipeline in trench, in continuity, in one course or more, by electronically driven lining machine traveling through pipe and centrifugally distributing the mortar uniformly across the pipe. The discharge shall be from the rear of the machine so that machine will be continuously fed with mortar by train of intermediate loading machine fed by Power Loader and high speed electric mixers, to achieve desired standard of lining.

The rate of travel of machine and rate of mortar discharge shall be mechanically regulated to produce a smooth surface and uniform thickness throughout. The lining machine shall have electronically controlled rotary trowels for smoothing of the lining so as to obtain William Hazel Coefficient in range 130-140. The mortar shall be densely packed and adhere wherever applied, there shall be no injurious rebound.

11.14 LINING MATERIAL

11.14.1 SAND

Sand shall consist of inert granular material. The grains shall be strong, durable and uncoated. The sand shall be well graded and shall pass a No. 16 mesh screen, with not more than five 5 percent passing a No. 100 Sieve.

Graded sand will be bagged to ensure 1:1 mix while feeding the mixer.

Sand shall be clean and free from injurious amount of dust, clay, lumps, shale, soft or flaky particles, mica, loam, oil, alkali and other deleterious substances. The total weight of such substances shall not exceed three percent of the combined weight of the substances and the sand that contains them.

11.14.2 PORTLAND CEMENT

Portland cement shall confirm to type I or type II of ASTM C150 or shall be as otherwise specified by the Engineer.

11.14.3 WATER

Water for mixing mortar shall be clean and free of mud, oil and injurious amounts of organic materials or the deleterious substances. Potable water shall be used.

11.14.4 MIX FOR LINING

11.14.4.1 COMPOSITION

Mortar for lining shall be composed of cement, sand and water that have been well mixed by the concrete mixer and shall be such consistency as to produce a dense, homogeneous lining.

11.14.4.2 PROPORTIONS

The approximate proportions of cement and sand in the mortar for the lining shall be 1 part of Portland cement to 1 part of sand by volume. The exact proportions shall be determined by the characteristics of the sand used as approved by the Engineer.

11.14.4.3 WATER CONTENT

The water content shall be the minimum that produces a workable mixture, with full allowance made for moisture collecting on the interior of the pipe surface.

11.14.4.4 MIXING

Mortar shall be mixed long enough to obtain maximum plasticity. The mortar shall be used well before initial set.

11.15 THICKNESS OF LINING

The lining shall be uniform in thickness within the allowable tolerance, except at joints or deformations in the pipeline, at which places also the thickness shall be as uniform as possible to the satisfaction of the Engineer. Cement Mortar Lining thickness shall be as specified by AWWA C602-83 and approved by the Engineer.

11.16 CURING

Curing operations shall begin immediately following completion of the machine placement of the mortar lining in a section of pipeline. The selection of pipe shall be closed with airtight cover over all openings and shall be maintained in a moist condition.

When a section of pipeline has been completed, the Contractor shall be responsible for careful curing of the mortar lining until the Engineer fills the

section with water, or until the lining work has been accepted by the Engineer, but in no case for less than seven days.

11.17 CLEANING OF PIPE FOR LINING

The interior surface of pipe to be lined shall be cleaned to remove corrosion products, chemicals or other deposits, loose and deteriorated remains of old coating materials, oil, grease and accumulations of water, dirt and debris. Shot or sand blasting is not required to prepare surface for lining.

11.18 MACHINE APPLICATION OF MORTAR LINING

The lining shall be applied in one course or more by machine traveling through the pipe and distributing the mortar uniformly across the pipe. The discharge shall be from the rear of the machine so that the newly applied mortar is not marked. The rate of travel of the machine and the rate of mortar discharge shall be mechanically regulated to produce a smooth surface and uniform thickness throughout to the satisfaction of the Engineer. The mortar is density packed and adheres wherever applied; there shall be no injurious rebound.

11.19 GUARANTEE AND PERFORMANCE CRITERIA

Internal Cement Mortar Lining should be got done by an approved and specified firm, who must have proven past experience in machine application of cement mortar lining. During the warranty period if any damage occurs because of lining defect it shall be got rectified by the specialist company at no cost to the Employer. 15 years written warranty would be required to be provided by the specialist company with proven record. The Contractor will be allowed cement lining for individual pipes and specials in case of inclined or vertical length or for start length of pipes.

11.20 PAYMENT

Payment for the internal cement lining and external protection of the MS pipeline shall be made for the acceptably completed work as per specifications at the approved tender rates, which shall include all costs for labor, material and equipment etc.

11.21 MILD STEEL SPECIALS

11.21.1 GENERAL

The specials like bends; tees etc. to be used shall be manufactured with MS plates of specified thickness. Internal diameters shall be as given on the drawings or as directed by the Engineer. The Contractor shall submit shop drawing for all special before the manufacturing of special

11.21.2 QUALITY OF STEEL

- CHEMICAL PROPERTIES

All collars and specials shall be made from steel, the analysis of which shows not more than 0.06% of sulphur or phosphorous.

- PHYSICAL PROPERTIES

The steel shall comply with the requirements as described for M.S. Pipes.

11.21.3 DIAMETER

The internal diameter of the specials and collars shall be as specified for pipes or as approved and directed by the Engineer.

11.21.4 JOINTS

The specials shall have standard flanges with holes at both ends and nuts and bolts with matching flanges provided with pipes. Plain ended bends shall be provided where specified for making weld joints or as approved and directed by the Engineer.

11.21.5 LENGTH / WIDTH

Length of each special and the width of the collar shall be as shown in drawing or approved and directed by the Engineer.

11.21.6 COATING

The internal and external coating for specials for rising main shall be same as provided for M.S. Pipes.

11.22 TESTS

The specials and the pipes shall withstand a pressure of 61 meters.

11.23 PAYMENT

The rates quoted for M.S. specials shall include cost of providing for material, labour, equipment including cost of cutting, rolling, levelling, chamfering, welding, drilling holes in flanges etc. complete including internal and external protection similar to M.S. Pipes mentioned in these specification cement lining. Payment shall be made as per tendered rates.

12 VALVES

12.1 Valves

12.1.1 General

All the valves and penstocks shall be made of ductile iron with stainless steel lining of approved quality obtained from approved manufacturer. The metal of casting shall be strong tough, even grains, smooth surfaced and free from all defects without plugging or filling. All valves shall be flanged conforming to the flange dimensions of specials, fittings and pipes to be supplied and installed by the same contractor. All valves shall be designed for a working pressure of not less than 10.55 Kg/Sq.cm and tested Hydro statistically to a pressure of 21.10 Kg/Sq.cm. The markings cast on the body of the valve shall indicate manufacturer's name, size of valve and designated working water pressure. Asphalt or/and varnish as directed by the Engineer shall be applied to the ferrous parts of the valve except bearing surfaces. Jointing material including nuts, bolts, washers and rubber packing shall be supplied in quantities of approved quality required plus 10 packing extra. The material of all type of valves & penstocks including appurtenances such as nuts bolt and flanges etc. shall be resistant to saline water up to the design life. The Contractor shall submit along with his tender a statement showing the name of manufacturer or alternate manufacturers along with cost details, type, pressure rating and weights of each type a valve and pipes if required so in the form as approved by the Engineer.

12.1.2 Valve Identification

All valves shall be identified by permanently fixed trifoliate labels/brass plates which shall identify the valve number and function, and be attached by stainless steel cable ties to an integral part of the valve - not the hand wheel or lever. Information on the tags shall be:

NO - Normally Opened

NC - Normally Closed

NT - Normally Throttled

NA - Normally Automatic

SOC - Set On Commissioning

12.2 GATE VALVES

Gate valves shall generally comply with BS 5163. Valves shall be of the non-rising stem type with flanged ends to BS 4504 PN 16. The body, wedge, bonnet, stuffing box, gland and thrust bridge shall be of best quality cast iron to BS 1452 Grade 14, the seats, nut, faces and guides of gunmetal to BS 1400 Grade LG2-C and the stem of forged bronze to BS 2872 Grade CZ114. Each valve shall have a drain plug fitted at the bottom of its seating along with proper arrangement of disposal of drain water. Stuffing boxes shall be designed to have soft packing fitted. Valves shall be rated for 150 PSI maximum working pressure with the bodies capable or with standing a test pressure of 300 PSI without leakage.

12.3 Washout Valves

The washout valves shall be in general conform to the requirements of BS 5163. The spindle shall be non-rising and shall be of solid forged bronze with a tensile strength of 4.34 to 4.65 Tons per Sq. Cm. shaped properly and machined all over with strong square threads suit valve nut. The stuffing box shall be deep large and liberal and capable of packing under pressure. The stuffing box shall be properly packed and ready for service when delivered. The stuffing box packing shall be made of Asbestos Hemp or jute packing shall not be used. The valve shall be provided with cast iron wheel for manual operation of the valve. The valve shall open anticlockwise and close in clockwise direction. Washout valve shall be locally manufactured confirming to the standards described herein.

12.4 Double Acting Air Valves

Air valves shall be of float type having cast iron body and bolted cover, bottom inlet, a ball float and valve operating mechanism. The air valve float chamber and float chamber cover shall be of ductile iron with stainless steel lining with all other parts of non-corrodible materials. All orifices shall be located well clear of the liquid level in the float chambers, and designed to prevent sedimentation of floating solids. Valve bases shall be as specified. Air valves shall be provided with separate isolating valves and drain plugs. Air valves with 'built in' isolation facility are not permitted. The installation of air valves utilizing solid cylindrical control floats is acceptable. Air valves shall be imported, procured from manufacturer of international repute and as approved by the Engineer.

12.5 Non-Return Valve

Non-return valves shall be of the free-acting type capable of withstanding and reducing shock following rapid flow reversal in a pipeline. They shall be suitable for pumps and delivery system provided. Valve bodies shall be of two part construction in best quality cast iron with detachable cover plates to facilitate inspection of the bearing and door. Doors shall be of best quality cast iron with renewable seats of gunmetal to BS 1400. Hinges pins shall be of stainless steel totally enclosed within the valve body. The doors shall be arranged such that they do not swing through an angle of more than 45 degree. Valve shall be rated for 20 bars maximum working pressure with the body capable of withstanding a test pressure of 30 bars and the seat 20 bars without leakage. The maximum velocity through any check valve shall not exceed 3.5m / sec. without the written approval of the Engineer

12.6 VALVE CHAMBERS

Valves shall be housed in R.C.C. chambers to be constructed by the Contractor. These valve chambers and method of assembly shall be as shown in the drawings or as directed and approved by the Engineer. All Chamber covers and frames in the slab of chambers of appropriate sizes (As per drawing) shall be of cast iron of robust construction and suitable for heavy duties and provided with locking arrangements.

12.6.1 PAYMENT

Payment shall be made for the acceptably completed valves, fittings, valve chambers in accordance with the specifications, drawings and directions of the Engineer including all costs for labour, materials, equipment, transportation, handling, testing and disinfection complete at the approved BOQ rates.

13 CAST IRON COVERS WITH FRAMES

13.1 SCOPE OF WORK

The work to be done under this section of the specifications consists of furnishing all plant, labour, equipment, appliances, materials and performing all operations required in connection with the installation of C.I. cover with frame, gratings and ladder rungs, complete as specified herein, as shown on the drawings and or as directed by the Engineer.

13.2 CAST IRON COVERS WITH FRAME

Cast iron cover and frame shall be of the sizes and duty as specified on the drawings. The specified size means the clear opening. The cover shall be complete with frame. Top of cover shall be roughened in an approved pattern. Locking and latching arrangement shall also be provided. The frame shall be well set in place at the time of pouring of concrete. The cover shall tightly fit in the frame. It shall be airtight and water-tight.

The duty, weight, test and working load for 600mm circular or square C.I. cover and frame shall be as follows: -

Class/Duty of Cover and Frame	Gross* Weight (Approx.)	Peak or Test Load	Services Working Load
Extra Heavy Duty	-----	900 KN	300 KN
Heavy Duty	225-285 Kg	400 KN	135 KN
Medium Duty	130-140 Kg	50 KN	17 KN
Light Duty	70-80 Kg	10 KN	3.5 KN

* The column of gross weight is indicative only for the duty of Chambers. The Contractor shall ensure that the chamber is rated for above mentioned test load irrespective of the weight.

13.3 Measurement

Measurement of acceptably completed work of cast iron will be made on the basis of actual number of cover with frame provided and installed in position as shown on the drawings or as directed by the Engineer.

13.4 Payment

Payment for the acceptable measured number of Cast Iron shall be made on the basis of unit rate per number quoted in the bills of quantities and shall constitute full compensation for all the works related to the item.

13.5 STEEL LADDER

Steel ladder shall consist of specified size of M.S. flats in strings and 1" (25, mm) diameter M.S. steel bars in rungs. The M.S. rungs shall be riveted and welded in 25 mm diameter holes in flats. The ends of each climb of the ladder shall be embedded in the concrete.

All components of ladder shall first be painted with two coats of approved red oxide primer and then with three coats of black enamel paint. The steel ladder shall be fabricated installed as per drawing or as directed by Engineer.

Payment shall be made on the basis of approved tender rates for each item of accepted work as per contract.

14 CONSTRUCTION, DEVELOPMENT AND TESTING OF TUBEWELL

14.1 Scope

The work covered in these specifications consists in furnishing all plant, labor, equipment, appliances, and materials required for performing all operations in connection with the construction of Tube-well in accordance with these specifications and drawings.

14.2 Drilling of Tube wells

Drilling of tube wells shall include, moving in, setting up, preparing the site, drilling the bore hole, collecting data and removing temporary casing, dismantling, moving out and cleaning up. Measurement for drilling of tube-wells will be made of the actual depth of borehole drilled, measured from the original ground surface. No measurement will be made of over drilling required because of sloughing, caving ground or for the Contractor's fault in casing; for tube well abandoned due to jammed tools, caving ground, or negligence on the part of the Contractor; or for tube wells not constructed in accordance with all of the requirements of these specifications.

- The Contractor shall drill bore hole at the location shown on the drawings and as directed by engineer. The diameter of the borehole will be specified in BOQ. The Contractor shall prepare the site for the construction of the tube wells and shall arrange for the disposal of water, cuttings, and bore soils away from the tube well.
- The bore hole shall be drilled by the Reverse Circulation Rotary Method. Bore hole shall be drilled to a depth as specified by the Engineer In charge. It is anticipated that the depth of tube wells may vary; however, no minimum depth for tube well or average depth is guaranteed. The bore holes shall be drilled sufficiently straight and plumb so that the pump and tube well casing may be installed concentric with the hole and within the tolerance specified for plumpness of the casing that is from ground level to a depth specified in BOQ and drawings, the bore hole shall be absolutely, vertical, straight and in plumb, and for the remaining depths, deviation should not exceed ½% (half per cent).
- The Contractor shall be responsible for protecting the tube wells from contamination by foreign material until the completed tube well and appurtenant facilities are the completed tube well and appurtenant facilities are accepted by the Engineer In charge. The Contractor shall

bear any expense needed to make good damage to tube well, tools, or equipment that may be caused by caving, washing, or other disturbance within the tube-well.

- If unstable material is encountered in drilling, the Contractor shall stabilize the material. The use of drilling fluid additives or other suitable materials may be employed in stabilizing the borehole with the approval of the Engineer In charge. If necessary, temporary casing shall be furnished and installed by the contractor to hold the walls of the hole during drilling operations and until the gravel shrouding has been placed. All temporary casing shall be removed by the contractor in stages as the gravel shrouding is placed. The temporary casing may be new or used and will remain the property of the Contractor.
- If, in opinion of the Engineer In charge, it is necessary to discontinue work on any bore because it is out of line more than the amount specified or on account of jammed tools, caving ground, or because of negligence on the part of the contractor; the contractor shall drill another bore hole at an alternative location. The Contractor will not be entitled to payment for any work done or materials furnished for bore holes abandoned as a result of his negligence.

14.3 Data and Records

- The Contractor shall keep an accurate drilling log of bore hole, including a description of all materials encountered and their location in the borehole. In the case of defective or incomplete records, the contractor shall complete the records of his own expense. All records and data shall be kept by the Contractor on approved forms. The Contractor shall deliver to the Engineer In charge the original of all records.
- Representative whole samples or cuttings of the material penetrated shall be taken at each lithology encountered and from each 10 feet depth of the borehole. Special care shall be exercised to determine the thickness and location of each change in material encountered and to obtain satisfactory samples. Immediately upon taking each sample, the sample shall be placed in Polythene bag, partitioned wooden box or other approved container, properly marked for identification and plainly labelled with the depth of the top and bottom of the section of the bore hole represented. The Containers shall be furnished by the Contractor. The method of obtaining,

processing, and storing the samples shall be subject to approval by the Engineer In charge. The Contractor shall deliver all samples to the field headquarters of the Engineer in charge on completion of boring work.

14.4 Tube-well Piping

Tube well piping shall consists of all works required in connection with the installation of Pump housing, blind pipes, strainers, Bail plug, centralizer etc. Concentric reducers will be considered as casing of the larger size to which the reducers are directly connected.

14.4.1 Reducer

The bottom end of the pump housing pipe shall be connected to mild steel tapered reducer, by means of coupling. The other end of the reducer shall be connected to the top end of the blind pipe.

14.4.2 Pump Housing and Blind Pipe

Mild steel welded pipe 3/164 thick (or as directed by the engineer in charge) shall be provided as per drawings or as directed by the Engineer In charge for pump housing and blind pipes.

14.4.3 Strainer

Brass strainer should be provided as per the manufacturer's manual.

14.4.4 Brass Strainer:

Brass Strainer shall be of the type suitable for installation in the tube wells. It shall by the product of a manufacturer currently engaged in the commercial production of brass strainers for tube wells. Workmanship shall be of the highest grade and in accordance with the best modern practice. Material not definitely specified shall be of the quality regularly sold by the manufacturer in the Market.

14.4.5 Quality of Strainer:

The strainer shall be of the non- continuous slot type. The strainer shall be designed to produce a minimum loss of head or draw down between the water bearing strata and the well with 1/84 wall thickness.

14.4.6 Openings:

Strainer openings shall be machine cut openings 3/35 inch in width. The area of openings shall be minimum 15 percent in case of 8 inch well screen. The number and area of opening shall be such that the expected yield of the well may be developed with minimum of openings or slots and shall be so designed as to prevent clogging and shall be free from jagged edges, irregularities, etc., that will accelerate clogging.

14.4.6.1 Strength:

The strainer shall have adequate strength to resist the external forces that will be applied after it is installed and to minimize the likelihood of damage during the installation. The strainer shall not be liable of change of alignment at any of its joints after installation.

14.4.6.2 Fittings:

The strainer and blind pipe shall be provided with suitable couplings. All fittings including couplings, where required for joining sections of the strainer, shall be constructed of the same material as the strainer.

14.4.7 Bail Plug

The bottom of the tube well shall be provided with the bail plug of suitable size of M.S. welded pipe approved by the Engineer In charge.

14.4.7.1 Centralizer

Centralizer shall be provided at 2F ft. interval along the depth of tube well. No measurement shall be made of Centralizers, bail plugs or other accessories required for the complete installation.

14.4.7.2 Lengths

The lengths, diameter and material of all kinds of pipes strainers shall be got approved from the Engineer In charge before installation by the Contractor.

14.5 Fabrication:

- The depth of pump housing pipe of mild steel shall be established by the Engineer In charge for each tube well depending on local sanitary conditions of shallow ground water and depth of pump setting.
- Adjoining sections of pump housing pipe shall be assembled by field welding, with butt welding straps.

All fields welding shall be performed by the electric arc method.

14.6 INSTALLATION

- The Contractor shall install the entire pump housing assembly straight, plumb, and concentric in the drilled hole, to permit the installation of the pump in such a manner that it will operate satisfactorily and without damage. The methods employed by the Contractor in the installation of the casing and in obtaining or correcting the verticality and straightness of the pump housing casing, shall be subject to approval of the Engineer In charge.
- Centralizer shall be attached to the pump house casing so that it will be centred in the drill hole throughout its entire length and held in such position while gravel shrouding is being placed. Centralizer will be placed at 25' intervals throughout the length of the tube well.
- Measurements for determining the deviation of the pump housing casing from the vertical shall be made by the use of a circular plumb having a minimum outside diameter of 1/5 inch less than the inside diameter of the pump housing casing. When the plumb is lowered to the bottom of the pump housing casing, the line from which the plumb is suspended shall not deviate from the centre of the pump housing casing at the top, by more than 1/5 inch at the bottom of the pump housing casing. All deviations shall refer to a vertical line passing though the centre of the pump housing casing at the top of the pump housing casing.
- Straightness shall be determined by lowering a section of pipe 4E feet long or a dummy of the same length to the bottom of the pump housing casing. The minimum outside diameter of the pipe or dummy shall be 1/5 inch less than inside diameter of the pump housing casing.
- If a dummy issued, it shall consist of a rigid spindle with three cylindrical rings, each ring having a height of at least 15 inches. The rings shall be true cylinders and shall be located at each end in the centre of the dummy.
- The central shaft of the dummy shall be rigid so that it will maintain the alignment of the existing of cylindrical rings. The pump housing casing

shall be sufficiently straight so the pipe or dummy can be passed freely throughout the entire length of the pump housing casing.

- Any tube well failing to meet the specified requirements for straightness, verticality and concentricity shall be abandoned, and the contractor shall construct a new well at his own expense at an alternative site designed by the Engineer In charge.

14.7 GROUTING

The annular space outside of the pump housing pipe shall be sealed with cement grout. Grout shall consist of one part of cement to one part of sand by volume and not more than 1/5 gallons of water per cubic foot. The annular space shall be flushed with water prior to grouting to ensure that the space is open and to remove foreign material. The grout shall be placed through a minimum 3/4 inch diameter grout pipe extending to the bottom of the annular space initially and shall remain submerged into the grout during the entire time the grout is being placed to ensure complete filling of the annular space. The grout shall be pumped into the pipe or applied continuously by gravity. The pipe may be left in place or it shall be gradually removed. In the event of interruption in the grouting operations, the bottom of the pipe shall be raised above the grout level and shall not be re-submerged until all air and water have been displaced from the grout pipe. The grout shall be allowed to set a minimum of 3 days after a placement prior to resuming work on the well.

14.8 GRAVEL SHROUDING

Gravel shrouding shall consist of all work required in connection with supplying and installing gravel shrouding in the annular space between the strainer and the walls of the bore hole, from the bottom of the strainer to top of the strainer and from top of the strainer to 3E ft. above, after developing and testing, stock-piling, grading, washing, storing, and installing gravel shrouding in the tube well. Measurement for gravel shrouding will be made of the depth of the gravel shrouding actually furnished and placed in the tube well.

14.8.1 Material

All gravel used for shrouding shall be clean, hard, well rounded, washed, carbonate free, and water worn, without thin, flat particles and with the following gradations:

British Standard Screen/Sieve	Percent passing
3/8 inch	100
No. 4	60 - 80
No. 7	20 - 40
No. 14	0 - 5

14.8.2 Installation

The specified spaces shall be gravel surrounded by the Contractor from the bottom to 3E ft. above the top of the Strainer in such a manner that there will be no voids other than granular space between the gravel particles. Water shall be circulated in the tube-well, has the gravel is being placed, by lowering the drill pipe inside the casing and operating the circulation pump. The gravel shall be placed to the top of the tube-well and shall be finally settled by bailing after all gravel had been placed temporary casing, if used, shall be carefully withdrawn in 5 to 10 feet stages during placement of the gravel shrouding and the gravel shall be introduced so that each stage of the hole above the bottom of the casing is completely filled before the casing is with drawn to the next stage.

14.9 DEVELOPMENT TESTING

Development and testing shall consist of all work required in connection with the development of tube well to produce the design capacity of relatively sand water with a minimum draw down, and the testing of tube-well to determine the effectiveness of the development operations as specified herein.

Development and testing shall include, but not limited to surging, back washing, and pumping and tube well at higher than rated capacity; testing the tube well for specified capacity, and sand content and degree of development; and disinfections and sealing tube well.

14.9.1 Development

The tube well will be developed either by compressed air or by piston type's slugger. The development will be carried out in the presence of the Engineer

In charge or his representative. The Contractor shall maintain a complete record of the development operation and shall make regular periodic measurements of discharge rates, sand content and water level measurements. The procedures used shall include back washing and pumping at higher than rated capacity and may include surging or similar procedures determined by the Contractor. The development of the tube well shall be performed for a minimum of six hours by step pumping, back washing and surging the tube-well with a vertical turbine pump. The Contractor shall notify the Engineer In charge following the completion of the six hours pumping period that the tube well is ready for testing.

14.10 TESTING

The Contractor shall test tube-well under the direction of the Engineer In charge as described herein upon completion of the development operations the tube-wells shall be permitted to recover for a minimum period of one hour. During this recovery period, the tube-well shall be sounded. If the comparison of the depth by sounding and length of the casing string indicates that there is more than six feet of materials in the tube-well, it shall be cleaned to within feet of the bottom of the bail plumb.

- Following the recovery period, the tube-well shall be pumped at 150 percent of rated capacity for a period of one hour. At the end of the first five minutes of pumping the sand content of the water shall be determined by using a 1000 S millimetre. In off cone or other device approved by the Engineer In charge. The sand content of the water shall be less than 100 ppm. A second sand content determination shall be made 10 minutes after the start of pumping. The sand content at this time shall be less than 30 ppm. If the sand content tolerances are exceeded at this time, or at any subsequent time up to the time of final acceptance of the installation, while pumping at the rate of 150 per cent of design capacity or less, the development of the tube-well shall be considered incomplete and the Contractor shall resume development of the tube-well will produce water meeting the sand content tolerances. Sand content determinations, water level, and discharge measurements during the remainder of the one-hour sand test period shall be made as directed by the Engineer In charge.
- When the sand test has been satisfactorily completed, the tube-well shall be further developed for one hours at 150 per cent of the rated capacity of the tube well by surging and back washing with the test pump at five

to ten minute intervals. Following the development period, the tube well shall again be pumped for a period of one hour at 150 percent of design capacity during which time the sand test shall be repeated. The specific capacity of the tube well shall be determined from the water level measurements and flow rates obtained during the pumping periods. If the specific capacity obtained from the second pump test is found to be more than 10 per cent greater than that obtained in the first pump test, the development shall be considered to be incomplete and the contractor shall resume development, at his own expense, until the tube-well is development sufficiently to meet this requirement.

- Upon satisfactory completion of the above 1 hour pumping period the tube-well shall be permitted to recover for a period of one hour. Upon the completion of this recovery period, a four hour multiple step pump test shall be performed by pumping the tube-well for one hour at each of approximately four equal increments. The last increment shall be at 15E percent of rated capacity. Following this last increment of the step test, the tube-well shall be pumped at a rate of 15E percent of design capacity for a period of two hours.

14.10.1 SUMMARY

The following is a short summary of the development and testing procedure:

14.10.2 Development

Development Time 6 hours (Minimum) Recovery 1 hour (Minimum)

14.10.3 Testing

- Pumping period 1 hour
- Development 4 hours
- Pumping period 1 hour
- Recovery 1 hour (Minimum)
- Step Pumping 4 hours
- Pumping period 2 hours

14.10.4 EQUIPMENT

The Contractor shall furnish all necessary equipment for testing the tube-well, including a water-lubricated or oil lubricated test pump capable of delivering at least 150 percent of the tube-well rate capacity at all stages of the tests, a valve for fine adjustment of the discharge, an electric measuring device to

determine the draw down during each stage of the test and In off cones to measures and content. If oil-lubricated test pups are used, the contractor shall exercise all reasonably precautions to keep the leakage of lubricating oil into the tube-well at a minimum and shall promptly remove all oil, which collects on the water surface in the tube-well by the addition of detergent or other suitable chemicals and pumping the emulsified oil from the tube-well.

14.10.5 MEASUREMENTS AND DATA

The Contractor shall take draw down and discharge measurements and other pertinent data during each test at intervals as specified by the Engineer In charge. All such data shall be recorded on forms approved by the Engineer In charge, and the original of such forms shall be delivered to the Engineer In charge at the completion of the development and testing operations.

14.10.6 DISINFECTIONS

After development and testing of the tube-well has been satisfactorily completed, and when approved by the Engineering in charge, the Contractor shall disinfect the tube-well by dispersing Chlorine solution throughout the entire depth of the well to obtain minimum chlorine content of 50 ppm (parts per million). The procedure and equipment used to introduce and disperse the chlorine in the tube-well shall be at the option of the Contractor, and shall subject to approval by the Engineer In charge.

14.10.7 SEALING

Upon completion of disinfections of the tube-well the Contractor shall seal the tube-well by tack welding providing 1/4 inch thick steel plate cap to the pump housing pipe around its circumference. Compliance with this requirement will not relieve the Contractor of his responsibility for safeguarding any part of the tube-well completed until the Certificate of Acceptance is issued for the entire tube-well installation.

14.10.8 PAYMENT

Payment shall be made on the basis of completed job of tube well drilled or material supplied and installed dully approved and measured by the Engineer In charge as per Bill of Quantities.

15 PUMPING MACHINERY

15.1 SCOPE

The work to be done under this section of the specifications includes furnishing all plant, labour, equipment, appliances and materials and in performing all operations required in connection with the installation of pumping machinery including all accessories as specified herein or shown on the Drawings or as directed by the Project Manager.

15.2 MATERIALS AND PRODUCTS

Materials and machinery shall conform to the latest referenced specifications and other provisions specified herein and shall be new and unused. In case where manufacturers are specified, materials and equipment will be of the same manufacturers. In all other cases the Contractor shall submit the names and addresses of the Manufacturers and trade names of the materials and equipment that he intends to buy. Other information such as diagram, drawing and descriptive data will be supplied if so desired by the Project Manager. Approval of materials and all the machinery under this provision shall not be construed as authorising any deviations from the specifications. The approval of machinery of manufacturer other than that specified will be purely on the discretion of the Project Manager. The Project Manager will fully ascertain the facts and satisfy himself as to the performance of the machinery offered by the Contractor.

15.3 SPECIAL REQUIREMENTS OF PUMPS

The Contractor shall furnish with each pump properly identified characteristic curves prepared and certified by the manufacturer showing capacity, head, efficiency and brake horsepower throughout the entire range of the pump.

The pumps shall have stable throttling curves and be suitable for unrestricted parallel operation.

All pumps shall be electric driven.

The pumps and their drives shall not overload or trip when operating against zero pressure.

The design, construction and materials shall be such that damage as a result of cavitation is completely eliminated.

Pumps shall have bearings and be suitable for continuous as well as intermittent operation without external sealing or cooling water. The pumps shall be such that they shall come into operation at once after a prolonged shutdown period without having to take special measures. Pumps shall be capable of delivering specified quantity of water at the specified pressure.

Pumps shall be tested at site before their final acceptance.

Pumps shall be installed at positions shown on the Drawings and/or as directed by the Project Manager.

Pumps and their drives shall be in perfect alignment when installed in position.

Pump set shall be provided with reducer/enlarger if necessary on pump discharge pipe, and suction piece on the suction end.

Motors shall run on 3-phase, 400 volts + 10%, 50 c/s A/C power. Motors shall be protected from low voltage, overload, over- heating and phase failure.

15.4 PUMP AND MOTOR

15.4.1 Horizontal Centrifugal Pump & Motor

The pump sets will consist of horizontal centrifugal pump and motor of specified capacity and head and duty and shall be horizontal, totally enclosed, fan cooled, squirrel cage induction motors of specified power.

Pump materials shall be as under:

Body : Fine grained grey cast iron

Impeller : Stainless Steel or Bronze

Pump Shaft : Stainless Steel

Shaft Sleeve : Stainless steel or Bronze

Pumps shall have mechanical seal. The suction and discharge flanges shall be rated for working pressure of 16 bars. The flanges shall be drilled to BS 10 (Table 'D' or 'E') or BS 4504.

15.4.2 Submersible Pump & Motor (for Tube Well)

The pump shall consist of submersible pump and motor of the specified capacity and head and shall be integral sealed but with strainer.

The pump material shall be as under:

Inlet body	:	Grey cast iron/steel
Intermediate body	:	Grey cast iron
Discharge bearing		
Body / bowl	:	Grey cast iron
Impeller	:	Tin bronze (radial type)
Bearing	:	Tin bronze
Pumps lift	:	Gr. Steel
Fastness	:	SS (A2)

15.4.3 PUMP ACCESSORIES

Pumps shall be provided inclusive of the following accessories:

- i) Pressure gauge, pressure switches, flow switches etc.
- ii) Strainer on pump suction pipe.
- iii) Reducer/enlarger is necessary if the pump discharge size is different from discharge piping.

15.4.4 MOTOR PROTECTION

Motors of 3kw or less power shall be started direct on line. Larger motors shall be started by star-delta starter.

Motor shall be protected against under voltage over voltage, overload, over-heating and phase failure.

Motor shall be rated for normal operation against a voltage fluctuation of + 10% and frequency fluctuation of + 2Hz.

15.4.5 CONTROL

15.4.5.1 Potable Water Pump and Motor

For potable water pumps, two pumps shall be duty and one shall be standby. Duty shall however change between the pumps on each start/stop cycle of the pump.

Operation of potable water pumps shall be controlled by water level switches in the water

15.4.6 Submersible Pump & Motor (Tube Well)

Operation of tube well pumps shall be manual.

15.4.6.1 PRESSURE GAUGE

Pressure gauge shall be of copper alloy, bourdon tube type with 100mm diameter dial face. The dial shall be englaved in black on white background from zero to 16 bars or 1.5 times the working pressure whichever is larger. Gauge shall be installed to socket welded to the pipeline with an isolating plug/ball valve. If the pipeline installation is such that the above requirement cannot be met pressure gauge of remote reading type shall be installed.

15.4.6.2 BRASS STRAINER

Brass strainers shall be of bucket type with flanged end. They shall be installed at the end of pump suction pipe. The wall thickness of the strainer shall not be less 1/8 inch. The diameter of the holes or the width of the slots shall not be greater than 1/4 inch. The open area of the strainer shall not be less than 1.5 times the cross-sectional area of the suction pipe on which it is installed.

15.4.6.3 PRESSURE SWITCH

Pressure switch shall be electric actuating device, which will close/open the circuit at preset lower/higher pressures. The device shall be housed in die cast aluminium casing with enamel finish. The switch shall be adjustable. The pressure switch shall be rated for a working pressure of 16 Bar. The switch shall be wired to control panel.

15.4.6.4 WATER LEVEL INDICATOR

The water level indicator for high and low water level cut off shall operate on 230 Volt AC, 50 Hz and supplied complete with float, float chains, counter-weights, chain clamps, steel mounting brackets, chain guide roller and any other equipment and material necessary for installation and satisfactory operation.

The level indicator shall have at least 5 switch-contacts or as required for sensing the required water levels within the specified range. The level indicator shall be suitable to match with the specific gravity of the fluid in which it is intended to be installed. All operational, constructional and installation details shall be furnished by Contractor for approval.

The bidder may quote for non-mechanical type of water level indicator to give equivalent performance. Technical literature and data of the indicator to be furnished along with the bid documents.

15.4.7 MAINTENANCE MANUALS AND TOOLS

14.1 A book or books containing the complete information in connection with the assembly, operation, lubrication, adjustment and repair of the pumping equipment, electric motor, together with detailed parts list with drawings or photographs shall be furnished in duplicate.

14.2 For the pump room, special tools necessary for maintenance and repair of the pumps and electric motors including tools kits, grease guns etc. with accessories shall be furnished.

14.3 The manufacturer's recommended list of spare parts to be stocked by the CLIENT shall be submitted by the Contractor to the Project Manager for approval. Such spare parts will also be furnished by the Contractor.

14.4 All the maintenance manuals, tools, spare parts etc., shall be supplied by the Contractor at no cost of the CLIENT and all cost shall be deemed to be included by the Contractor in his bid against item of pumping set.

15.5 MEASUREMENT AND PAYMENT

15.5.1 Pumping Machinery

15.5.1.1 Measurement

Measurement for payment of pumping machinery pressure gauge, brass strainer, pressure switch shall be the actual number acceptably provided and installed in position; the Contractor's bid against these item shall include cost of providing and installing the pumping machinery including the pumps, electric motors, all accessories, manuals, tools, spare parts, etc., as shown on the Drawings, as specified herein or as directed by the Project Manager.

15.5.1.2 Payment

Payment will be made for acceptable measured quantity of pumping machinery pressure gauge, brass strainer, pressure switch and water level indicator on the basis of unit rate per number quoted in the Bill of Quantities. The amount bid shall be full payment for the work specified.

15.5.1.3 Payment

Payment will be made for acceptable measured quantity of chain pulley and block on the basis of unit rate per number quoted in the Bill of Quantities. Payment will constitute full compensation for the complete works including all specified works related to the item.

15.5.2 Level Indicator

15.5.2.1 Measurement

Measurement of acceptably completed works of level indicator will be made on the basis of actual number installed in positions, tested, flushed, and commissioned as specified herein, in bill of quantities, as shown on the drawings and/or as directed by the Project Manager.

Measurement of acceptably completed works of level indicator will be made on the basis of actual numbers as specified herein, in bill of quantities, as shown on the drawings and/or as directed by the Project Manager.

15.5.2.2 Payment

Payment for acceptable measured quantity of level indicator will be made on the basis of unit rate per number quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the items.

Payment for acceptably measured quantity of level indicator will be made on the basis of unit rate per number quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the items.

16 POLYVINYLCHLORIDE WATER STOPPER

16.1 DESCRIPTION

The work shall comprise providing and installing of all types of polyvinylchloride (PVC) water stops and expansion joints, in concrete structures and elsewhere, in accordance with these specifications and to the location, lines, grades and cross-sections shown on the Drawings and/or as directed by the Engineer.

16.2 MATERIAL REQUIREMENTS

- PVC water stops shall be extruded from an elastomeric plastic compound, having basic resin of polyvinylchloride (PVC).
- The compound shall contain such additive resins, plasticizers, stabilizers or other materials, needed to ensure following physical characteristics when tested by the US Corps of Engineers Test Methods, as specified below:

Characteristics	Minimum Requirement[†]	Test Method
Tensile strength, using die III	123 kg/cm ² (1750 psi)	568
Ultimate elongation, using die III	350%	573
Low temperature brittleness with no sign of failure such as cracking or chipping	- 35° F	570
Stiffness in flexure, 1/2" span	28 kg/cm ² (400 psi)	571

16.3 CONSTRUCTION REQUIREMENTS

- i. All the operations of installing, jointing and splicing the water stops shall be carried out in accordance with the recommendations and instructions of the Manufacturer and the directions of the Engineer.
- ii. All embedment in concrete, lapping, turning and sealing shall ensure absolute water tightness.
- iii. No holes shall be made through any water stops.

- iv. The water stops, wherever indicated on drawings or directed by the Engineer, shall be cast integrally with the in-situ concrete, with separate junction and intersection pieces, placed and jointed at Site.
- v. The water stops shall be installed, in such a way that they are held securely, in their correct position, during the placement of concrete.
- vi. The concrete shall be fully and properly compacted around the water stops to ensure that no voids or porous areas remain.
- vii. Where reinforcement is present; adequate clearance shall be left, between water stops and the reinforcement, to permit proper compaction of concrete.
- viii. Splices, in the continuity, or at the intersections of runs of PVC water stops, shall be performed by heat-sealing the adjacent surfaces.
- ix. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material used but should be sufficient to melt but not char the plastic.
- x. After splicing, a remoulding iron, with ribs and corrugations to match the pattern of the water stop, shall be used to reform the ribs at the splice. The continuity, of the characteristic components of the cross-section, of the water stop design (ribs, tabular centre axis, protrusions, and the like) shall be maintained across the splice.

16.3.1 MEASUREMENT

- Measurement, for PVC water stops, will be made in the specified units of length, of the water stops, of specified type and size, acceptably placed, on the basis of the dimensions, in accordance with the Drawings or directions of the Engineer.
- No allowance will be made, in the above computed lengths, for the laps and splices.

16.3.2 RATE AND PAYMENT

- Payment for, PVC water stops, of specified type and size, will be made for the quantity of water stops, measured in accordance with Article 4, at the unit rates, tendered in the priced Bill of Quantities.
- The unit rates tendered, for all items of concrete, shall be deemed to be inclusive of, but not limited to the following:
 - i. Providing all materials including splicing, sealing, jointing and filler materials

- ii. All operations related with transportation, involved in the process
- iii. All operations related with storage of materials
- iv. All sorts of wastages
- v. All operations including installing, splicing, sealing, jointing and securing water stops; laying of sealants and fillers in expansion joints; and protection, maintenance and repairs, of the water stops
- vi. Carrying out all sampling and testing
- vii. All other operations, procedures and requirements necessary to complete the work in accordance with these specifications.

17 BITUMEN COATING

17.1 SCOPE

The work under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations for bitumen coating treatment to foundations, complete in strict accordance with this section of this section of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

17.2 SUBMITTAL

Samples of all materials proposed for use under this section, shall be submitted to the Engineer for approval.

17.3 MATERIALS

Bitumen 10/20 grade.

17.4 DELIVERY STORAGE AND HANDLING

Materials shall be protected from damage during loading shipment delivery and storage Non-staining materials shall be used for blocking and packing.

17.5 PREPARATORY WORK

All surfaces, to be treated shall be dust free and dry. Application shall not start unless the preparatory work has been inspected and approved by the Engineer.

17.6 WATER PROOFING TREATMENT IN FOUNDATION / SUB-STRUCTURES

All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc. by scraping, wire brushing or as directed by the Engineer. The surface shall be primed with a coat of asphalt oil used at the rate of not less than 1 gallon /100 square feet. Two coats of hot bitumen paint shall be applied at the rate of 40 lbs/100 sft. Each coat. The first coat shall be allowed to dry for about 6 hours before applying the second coat. During operation of painting great care shall be taken to avoid air bubbles. The manufacturer's advice/ recommendations shall be taken to avoid air bubbles. The manufacturer's instructions and Engineer's directions shall be followed.

17.7 MEASUREMENT AND PAYMENT

17.7.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the

17.8 Bills of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

All preparatory work, scrapping, scratching and cleaning.

17.9 Measurement

Measurement of acceptably completed works of bitumen coating will be made on the basis of net actual area in square feet as shown on the Drawings or as directed by the Engineer.

17.10 Payment

Payment will be made for acceptable measured quantity of bitumen coating on the basis of unit rate per square feet quoted in the Bills of Quantities. The unit rate shall include all cost of surface preparation and shall constitute full compensation for all the works related to the item.

18 QUALITY ASSURANCE & QUALITY CONTROL REGIMEN

18.1 GENERAL

The objective of Quality Assurance (QA) and Quality Control (QC) activities is to ensure the quality of the construction of the Project. The quality of the construction activities are interlinked to both the materials used in the construction and the way of performing the construction by a systematic, schematic and effective usage of men and material.

In order to provide assurance to the Gwadar Development Authority, the Contractor shall comply scrupulously with the following procedural points during the execution of the Project.

18.2 TOOLS OF QA AND QC

- The submittal of any material shall be given to the Engineer/ Department in advance of at least one month for approval.
- All the inspection reports, testing reports, approvals submitted and sought from the Engineer/ Department and the relevant records shall be safely maintained and properly filed in liaison with and in a manner agreed with the Department to facilitate checking at any time by the Department during the Contract.
- Materials approval statement report shall be prepared in liaison with and in a manner agreed with the Department and in the approved format and programme of the Department.
- Submittal Action Summary (SAS) spreadsheets for materials shall be prepared in liaison with and in a format agreed with the Department.
- All references to BS, AASHTO, ASTM, AWWA, DIN, EN, ISO etc. or any other standards given in the Specification (in this Section or the rest of the Specification) shall mean the latest versions of these Standards. The latest version may also mean a completely new Standard that has superseded the Standard mentioned in the Specification.
- The approval of materials should be obtained in the standard forms whose specimen copies "Form P" is bound in this volume of the Specification.
- No two Suppliers/ Manufacturers shall be allowed to supply the same material for the Contract, unless the first one failed in quality or supplies schedule. This should be documented properly in record. This measure is to prevent the mixing of material and to facilitate the traceability in future.

- In case of imported materials, no payment shall be made unless the Contractor/ Engineer sign the bill of lading. However, the responsibility of authenticity always lies solely with the Contractor. The bill of lading shall be made available to the Department on demand.
- All the Engineering materials/equipment/instruments or any other items used 'in the permanent works of the Contract shall be compulsorily and legibly marked with the manufacturer's name, casting or making references and all other specified relevant requirements. In the absence of the above, the products will not be considered genuine.
- All the materials that are brought from the manufacturers located outside the PAKISTAN shall preferably be registered in their respective countries with their respective standard institutions For example,

The registration means the acquisition of their logo, i.e." Kite mark "or "French mark", etc. No deviation from this is allowed.

- All properties/characteristics mentioned in the technical data of the submitted material shall authenticate by test results preferably from an independent laboratory.
- All the type tests or the approved tests carried out on the pipes or any other material shall be performed in the worst conditions of loading as per the standards and specification, corrosion, strain, etc. Subsequently the material supplied thereafter shall be quality better than or at least equal to the tested one.
- All the records of tests conducted in the factory shall be maintained by the factory for the inspection by the Engineer/Department at any time.
- The Engineer/Client shall have free and unhindered access to the manufacturing company at any time to check for compliance. Failure to provide such access shall lead to the withdrawal of the approval.
- Raw material that is being used to fabricate the product shall be approved first and then its use shall be continued for that whole Project unless permitted in writing to change.
- All electromechanical related tests on material will have to be performed before and during handing over. Test certificates shall be submitted to the Engineer.
- All products shall be designed to achieve a minimum service life of 50 years in accordance with AWWA M45, under all applicable loads,

environmental, installation and operating conditions. Manufacturer will provide certificate of the minimum service life of 50 years.

All the suppliers have to give the definite guarantees of performance and materials in PAKISTAN environment. No material will be accepted without the guarantees.

Any material (small or big) will not be accepted, even if it complies with specifications and standards, unless it is accompanied by guarantee letter for a definite period, the minimum of which shall be 10 years. Guarantee shall cover the likely wear and tear due to handling/installation/service etc.

Guarantee means at the end of the specified guarantee period the product shall retain 90% of its original properties.

Guarantee letter shall be in the name of the Client and it shall be comprehensive and straightforward and shall not have any hidden meaning or objective. In any case, whatever guarantee is given; it does not mean that this guarantee is enough and relieves from any QA/QC tests as and when laid down by the Department.

The guarantee is meant for the period starting from the issue of the Preliminary Acceptance Certificate of the Contract.

- If a factory's approval is suspended /withdrawn then the manufacturer will not be allowed to continue the supply of that failed /passed item from the date of suspension.
- The Contractor/Engineer/Department may be requested to have an amalgamated filing system
- Standards are binding for the Contractor unless modified/changed/alterd by the Engineer/Department for betterment.
- If any discrepancy is brought to light in specifications, standards, Engineer's instructions, comments on general approval letter, comments of approval forms, it shall immediately be brought to the notice of the Department.

18.3 FLOW DIAGRAM

The Contractor shall comply with the procedures of materials approval as outlined below. The Department reserves the right to modify the procedure as it sees fit.

- Flow Diagram for Previously Approved Material
- The Contractor shall comply with the Conditions of the general approval of the factory as mentioned in the general approval letter issued by The Client for various materials.
- In case of any discrepancy regarding the quality requirements of the materials and works in the different contract documents the highest standard will be applicable.
- The complete procedure with forms and flow chart for the materials approval is given below

18.3.1 PURPOSE:

To submit the organized transmittal for the approval of material in a contract.

18.3.2 SCOPE

The procedures applicable to all Contractual approval of any materials

18.3.3 RESPONSIBILITY

Main: contractor, consultant, project management, if any, and manufacturer.

18.3.4 PROCEDURE

This form is to be filled whenever the contractor asks for the approval of an item/material to be used in the works. Be this material be civil, electro-mechanical, structural, chemical, small/big, etc. for their work.

Form "P" shall be used for any material that has been previously approved by Gwadar Development Authority.

This Materials approval form is divided into 5 Sections.

Contractor's Section: Which is to be filled by contractor only

Consultant's Section: Which is to be filled by consultant only

Project Management Section: Which is to be filled by Project Management only, if any

Client Section: To be filled by Client personnel only

Attachments: Which is to be filled by contractor only, he will have to check mark the box beside that attachment which he has included in the Materials approval submittal.

19 CONTRACTOR'S SECTION

Project and / or Area:

Name: Write the official name of the contract

Consultant: The name of the site supervision consultant of the project and its full address including the site telephone numbers, the fax numbers and the official email

Contractor: The name of the contractor of the project and its full address including the site telephone numbers, the fax numbers and the official email

Submittal No. Write the number of the Submittal No.

Rev.: if a particular Material is returned to the contractor for any reason by any department then he has to revise it after removing the objection. When this is done it is called revised. This rev number is to be written in the box provide below. Write A if it is first revision, B if second and so on like 5A then 5B, then 5C if needed.

Date Submitted: The date when these Materials are actually submitted to the consultant. Be it revised or original.

Producer/Fabricator: The complete postal name and address which shall include the:

Name & Address: Street address if any, Telephone and Fax Nos, and email or website. This is for cross checking the authenticity.

Supplier's the complete postal name and address which shall include the:

Name & Address: Street address if any, Telephone and Fax Nos, and email or website.

Specification Ref: The specification reference article No. of these material in the general/particular Spec.

BOQ Reference: The specification reference article No. of these material in BOQ.

Product Registration: This is the product certification acquired by any organization.

Body: For example

BSI Kite mark, DWI mark for the product from UK;

DIN, MPA, FRG, DVGW from Germany;

AENOR from France;

ACI, ANSI, ASTM from USA, and so on

These registration bodies are Govt. controlled/sponsored bodies formed by the act of law. They generally give the certificate for the compliance of the product with a particular well known latest international material standard. After issuing certification these registration bodies continue to monitor the said factory every six months/one year to check whether the company is continuing to implement the basic product quality or not (for they are certified).

ISO Registration: This is the Quality Management System certification issued to an organization by ISO Registrar, who is entitled to issue ISO certification. After issuing certification these registration bodies continue to monitor the said factory every Six Months / One Year to check whether the company is continuing to implement the basic Quality Management System. (For they are certified)

Technical Details: These shall include the main summary of details of the product like class, type, strength, dimensions, in the nutshell the identifying properties by which we will be able to identify and differentiate our product from the other similar products and the main raw materials used also should be mentioned and if there is a space the properties of it as well.

Previous Contract & its Scope of Application or limitation:

Where this Product is used and applied in the contract with the name of the contract. Was there any limitation placed at that time of approval/application. Attach a copy of the previous approval that can be obtained from the supplier/manufacturer

Proposed area/s of application/s:

Where this materials is to be used now with respect to the application and environment.

Project Manager the signature of the PM of the contractor after thoroughly going through the statement written for his name. The date and the stamp shall also be imprinted.

20 CONSULTANT SECTION

STATUS: Approved / Not Approved

If not approved by the consultant then he shall send it back to the contractor for revision. If approved then passed it to the project management/client after check marking the status

A.R.E/M.E: To be signed by the ARE or Material Engineer of Consultant after thoroughly going through the submission and made sure that it is submitted as authority/department wants it.

R.E: To be signed and stamped by the RE of Consultant after thoroughly going

Through submission and made sure that it is submitted as authority/department wants it.

I. CLIENT

To be filled by the client.

You can have a look at the ideal submission which is with the Quality In charge, Quality Section or Quality Consultant of Gwadar Development Authority.

II. ATTACHMENTS

All the attachments that needs to be appended shall be check marked

Compliance checklist: It shall be in the form of table where a comparison is made between the specified parameters and the submitted parameters and contractor's inference about its compliance.

Specification/s: General and Particular specifications & addendum if any.

Drawings: Related Drawings of the material submitted for approval.

Catalogue/Brochure: Where the technical Details of the product are given.

Test Certificates: Test certificates of the test conducted on the submitted product within last one year but preferably 6 months. These certificates are of those parameters that are mentioned in specifications.

BOQ: Related BOQ articles of the submitted material.

Complying Standards copy: A copy of the international standards with which the submitted material complies or that is mentioned in specifications.

Previous approvals: A copy of the previous approval from Gwadar Authority.

General Approval: A copy of the latest/last issued General Approval, if any.

Sample: Sample of the product submitted.

Guarantee: A letter of Guarantee of the products from the manufacturer signed by president, CEO, and authenticated by the supplier.

ISO Certifications: ISO 9000 Certificate and if needed both the manual and processes.

Product Certification: Product certificate from product certifying international standard bodies like BSI Kite mark , DIN, AENOR, MPA, FRG, ETC.

Certificate of Origin: From where this material is coming attested by the PAKISTAN embassy and chamber of commerce of that country.

Certificate of Manufacture: The address of the factory where this material is manufactured attested by the PAKISTAN embassy and chamber of commerce of that country.

Bill of Lading: Bill that shows the details of shipment of the submitted materials.

Packing List: Which comes along with the Bill of Lading which shows what is packed.

License/s: License of the manufacturer and preferably of the supplier too. In any case manufacturer's license is obligatory.

Letter of Appointment: Letter of appointment as authorized distributor or agent from the manufacturer to the supplier, preferably attested.

Arrangement of the Materials Approval Submittal in a folder

All attachments shall be stamped and approved

FOLDER SETTING

Top

Covering Letter from the consultant

Covering Letter from the contractor

Divider No.1 divider no	1
Compliance checklist	
Divider No.2 Divider No.1 divider no	2
Specification/s	
Divider No.3 Divider No.1 divider no	3
Drawings	
Divider No.4 Divider No.1 divider no	4
Catalogue/Brochure	
Divider No.5 Divider No.1 divider no	5
Test Certificates	
Divider No.6 Divider No.1 divider no	6
BOQ	
Divider No.7 Divider No.1 divider no	7
Complying Standards copy	
Divider No.8 Divider No.1 divider no	8
Previous approvals	
Divider No.9 Divider No.1 divider no	9
General Approval	
Divider No.10 Divider No.1 divider no	10
Sample	
Divider No.11 Divider No.1 divider no	11
Warranty	
Divider No.12 Divider No.1 divider no	12
ISO Certifications	
Divider No.13 Divider No.1 divider no	13
Product Certification	
Divider No.14 Divider No.1 divider no	14
Certificate of Origin	
Divider No.15 Divider No.1 divider no	15
Certificate of Manufacture	
Divider No.16 Divider No.1 divider no	16
Bill of Lading	
Divider No.18 Divider No.1 divider no	18
Packing List	
Divider No.19 Divider No.1 divider no	19
License/s	
Divider No.20 Divider No.1 divider no	20
Chamber of Commerce	
Divider No.21 20 Divider No.1 divider no	21

Letter of Appointment

20.1 FOLDER SETTINGS

There are 12/21 or more attachments required for any Materials approval. All these are given in the Materials approval form. All these attachments are numbered from 1 to 21. There are certain blanks left which is used only when some special need comes. Special attachments shall be mentioned in these blanks.

There shall be 1 copy and one original Materials approval submittal.

The submittal for the Materials is to be arranged in the above mentioned fashion, every time you make a submittal.

On the Top the official covering letter of the consultant. Followed by the Contractor's letter.

Next to it is the contractors detailed Materials approval submittal arranged AS MENTIONED ABOVE in the form of sections separated by numbered plastic dividers. The number of numbered plastic dividers shall be at least 25. Numbered as 1, 2, 3...14, 21... Each number represents the number of the attachment that is mentioned in the Materials approval form.

Please Note Even if you are not attaching any sheet in these dividers then also you still have to keep this divider without any attachments.

For example:

Divider Number 1 represents the Compliance checklist.

Divider Number 2 Specification/s

Divider Number 3 Drawings

Divider Number 4 represents the technical Details of the product. In this division separate each product by A4 size coloured sheet on which the product name is mentioned and then append the product details. Suppose you're submitted materials has a total of 10 different products/models then you shall have 10 A4 size coloured sheets with the product name written on it. Likewise if you materials has 15 products/ model bills you shall have 15 A4 size colour sheet dividers.

Divider Number 5 Test Certificates of the submitted product/s

Divider Numbers 21, 22, 23 is left blank to accommodate any other irregular attachment that may be required. If there is any such attachment then you write the name of that attachment in these numbers 21, 22, 23.

NECESSARY FACILITIES OF FRESH WATER TREATMENT, WATER SUPPLY AND DISTRIBUTION GWADAR
GOVERNMENT OF BALUCHISTAN

MATERIALS APPROVAL SUBMITTAL

Form "P" (for previously approved materials)

All sections of the form must be completed and attachment enclosed where not applicable shall be marked "NA"

C O N T R A C T O R S S E C T I O N	Project Name and / or Area		ATTACHMENTS ↓		✓	
	Consultant:		Contractor:			
			1	Compliance checklist		
			2	Specification/s		
	Submittal No.	Rev:	Date Submitted:	3	Drawings	
	Material:		Produced Name:	4	Catalogue/Brochure	
	Producer/Fabricator's Name & Address:		Supplier's Name & Address	5	Test Certificates	
				6	BOQ	
				7	Complying Standards copy	
				8	Previous Approvals	
	Specification Ref:		BOQ Reference:	9	General Approval	
	Product Registration Body		ISO Certification Body	10	Sample	
	Technical Details:		Quantity/s	11	Warranty	
				12	Iso Certifications	
				13	Product Certification	
				14	Certificate of Origin	
				15	Certificate of Manufacture	
				16	Bill of Lading	
				17	Packing List	
				Previous Contract & its Scope of Application or limitation		18
	Proposed area/s of application/s		19	Chamber of Commerce		
			20	Letter of Appointment		
			21			
	"I declare that the proposed materials comply with Contract documents etc, & the information given above is authentic"		→ Sign with stamp	P.M	22	
					23	
					24	

<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved	<input type="checkbox"/> Returned with comments
-----------------------------------	---------------------------------------	---

Comments: 	
We verified the enclosed attachments and certify that the submission complies with contract documents & AM requirements	→ sign with stamp A.R.E. / M.E. R.E.

<input type="checkbox"/> Recommended	<input type="checkbox"/> Not Recommended	<input type="checkbox"/> Returned with comments
--------------------------------------	--	---

Comments: 	
We reviewed the consultant's evaluation and found it complying with contract requirements	→ sign with stamp A.R.E. / M.E. R.E.

<input type="checkbox"/> Endorsed	<input type="checkbox"/> Not Endorsed	<input type="checkbox"/> Further information Required
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Comments: 	
Signatures with dates QUALITY ENGINEER	HEAD OF MATERIALS QC SECTION

20.2 PIPE MANUFACTURER/SUPPLIER ASSISTANCE:

Manufacturer shall ensure to provide technical assistance during and till whole length of pipe installation period including, but not limited to:

- Unhindered technical assistance, via modern modes of communication i.e. Email, Telephone, Fax etc.
- Full time technical staff deployment to the site for fool proof installation of pipe and to ascertain up to the mark workman ship.
- Number of deployed technical staff, their schedule of working and other relevant details shall be provided prior to the start of installation of the pipe.
- Qualification details and experience of all deployed technical staff shall be made available prior to the deputation to the site.
- Any special equipment or machinery which is essential for the installation of pipe on site, if deemed necessary, shall be supplied by the manufacturer.
- Manufacturer's technical staff shall supervise loading, unloading and transportation process of the pipe for each consignment.
- On site hydraulic test, as listed in the specifications, shall be carried out in the presence of, and up to entire satisfaction and approval of the manufacturer's technical staff.
- Formal approval certificate duly signed by in charge of manufacturer's technical staff shall be provided for further approval by the Engineer.

20.3 FIELD QUALITY CONTROL

- All sampling and testing of material and work shall be carried out by the Contractor under the direction of the Engineer in accordance with the specifications and standards specified.
- The Contractor shall provide all material, labor, plant and testing equipment required to carry out the tests. Costs for all testing are deemed to be included in the rates and Contract price.
- Random tests of field density of backfill shall be taken at formation level and at each layer of backfill and at location and frequency as directed and required by the Engineer.
- If tests indicate Works does not meet specified requirements, the Contractor shall remove Work, replace, compact, and retest, all at the Contractors expense.

- Where instructed by the Engineer, the Contractor shall arrange for an approved independent testing laboratory to carry out tests to determine in-situ the density of the backfill material.
- Compaction, testing and analysis of soil materials shall be performed in compliance with the following standards:

Description	AASHTO Standard
Sampling	T-2, T-88
Sample Preparation	T-87
Sieve Analysis	T-27
Density in place (Sand Cone Method)	T-191
Liquid Limit	T-89
Plastic Limit & Plasticity Index	T-90
Moisture Content	T-93, T-217
Modified Proctor Compaction	T-180
Sand Equivalent	T-176
CBR	T-193
Classification	M-145



**Sindh Madressatul Islam
University**

**DEVELOPMENT OF SINDH MADRESSATUL ISLAM UNIVERSITY
(SMIU) CAMPUS AT EDUCATION CITY MALIR, KARACHI
LOT NO.4 FACULTY STAFF RESIDENCES, BACHELOR FACULTY
MALE / FEMALE HOSTELS (REMAINING WORKS)**



**VOLUME-III
Bill of Quantities**



EA Consulting Pvt Ltd

**ARCHITECTURE | ENGINEERING | PROJECT MANAGEMENT
PAKISTAN | UAE | CANADA**

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April, 2024

LOT-4
RESIDENCES

LOT-4 SUMMARY

S.No	Description	Amount (Rs.)
A	<u>LOT-4A</u>	
1	Faculty Apartment Type-A (Ground+2)	
2	Faculty Apartment Type-B (Ground+3)	
3	Faculty Apartment Type-C (Ground+2)	
4	Staff Houses (Ground+2)	
5	VC Residence (Ground Floor)	
	Sub-Total - Lot-4A	
B	<u>LOT-4B</u>	
	Female Faculty Hostel	
	Male Faculty Hostel	
	Sub-Total - Lot-4B	
TOTAL COST OF LOT-4 (A + B)		

Faculty Apartment Type-A(Ground+2)

ment Type-A(Ground+2)

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

Faculty Apartment
Type-
A(Ground+2)

BILL OF QUANTITIES

Faculty Apartment	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	104,906
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	165,043
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	-
3	SUPER STRUCTURE (Concrete/RCC and steel works)	1,087,532
4	MASONRY WORKS	1,842,028
5	THERMAL & MOISTURE PROTECTION	272,482
6	METAL WORKS	2,524,907
7	WOOD WORKS	3,692,362
8	FLOOR FINISHES	3,586,725
9	WALL FINISHES	5,453,830
10	CEILING FINISHES	750,832
11	EXTERNAL FINISHES (BUILDING)	6,018,411
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	66,651
	Schedule Items - A	25,565,709
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

Faculty A part men	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	5	6	7 = 4 x 6
SCHEDULE ITEMS						
1		EARTH WORKS				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
	Item # 11	From ± 0'-0" to -5' - 0"	5658 Cft	100 Cft	1,566.56	88,636
	Item #11+28	From -5' - 0" to -8' - 0"	0 Cft	100 Cft	1,804.06	-
	Item # 11+28+28	From -8' - 0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 2+28+28+28	From -11' - 0" to -14' - 0"	0 Cft	100 Cft	2,279.06	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	500 Cft	100 Cft	3,254.05	16,270
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spralls and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						104,906

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i> CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
2.1	Code -106					
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	461 Cft	100 Cft	32,221.55	148,541
2.2	Code -106					
	Item # 12	Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	47 Cft	100 Cft	34,857.58	16,502
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
	Item # 1+136	Foundation for any type (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	38,098.77	-
Total Carried to Collection						165,043

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	53,250.89	-
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	40,365.27	-
Total Carried to Collection						-

Faculty A part men	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	0 Cft
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	46,752.23	-
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						-

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	0 Kg	Kg	282.45	-
Total Carried to Collection						-
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	0 Rft	Rft	592.81	-
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	0 Sft	100 Sft	1,010.75	-
Total Carried to Collection						-
		<u>COLLECTION</u>				
		Page No -2				165,043
		Page No -3				-
		Page No -4				-
		Total from this Page				-
Total Carried to Summary (Concrete/RCC and steel works)						165,043
Total Carried to Summary (Excluding Concrete/RCC and steel works)						-

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u> <u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSIN or TENKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard, specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>	0 Sft	Sft		
Total Carried to Summary						

Faculty A part men	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		SUPER STRUCTURE Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.1	Code -114					
	P-176,It#24+134+137	Columns (Cylindrical Strength 3125 Psi) Ground Floor	0 Cft	100 Cft	56,426.81	-
	P-176,It#24+134+137+159	First Floor	0 Cft	100 Cft	60,442.44	-
	P-176,It#24+134+137+159+160	Second Floor	0 Cft	100 Cft	63,604.94	-
	P-176,It#24+134+137+159+160+160	Roof	108 Cft	100 Cft	66,767.44	72,109
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 30+135+138	RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi) Ground Floor	0 Cft	100 Cft	58,813.05	-
	Item # 30+135+138+92	First Floor	0 Cft	100 Cft	61,624.51	-
	Item # 30+135+138+92+93	Second Floor	0 Cft	100 Cft	63,835.10	-
	Item # 30+135+138+92+93+93	Roof	0 Cft	100 Cft	66,045.69	-
Total Carried to Collection						72,109

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi)				
		Item # 38+136 Ground Floor	0 Cft	100 Cft	47,322.89	-
		Item # 38+136+92 First Floor	0 Cft	100 Cft	50,134.35	-
		Item # 38+136+92+93 Second Floor	0 Cft	100 Cft	52,344.94	-
3.4	Code -114	Item # 38+136+92+93+93 Roof Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	43 Cft	100 Cft	54,555.53	23,459
		Slab i/c projections (Cylindrical Strength 2500 Psi)				
		Item # 57+136 Ground Floor	0 Cft	100 Cft	43,716.64	-
		Item # 57+136+92 First Floor	0 Cft	100 Cft	46,528.10	-
		Item # 57+136+92+93 Second Floor	0 Cft	100 Cft	48,738.69	-
		Item # 57+136+92+93+93 Roof	110 Cft	100 Cft	50,949.28	56,044
Total Carried to Collection						79,503

Faculty A part men	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 50+136	Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	57,830.03	-
	Item # 50+136+92	First Floor	0 Cft	100 Cft	60,641.49	-
	Item # 50+136+92+93	Second Floor	0 Cft	100 Cft	62,852.08	-
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136+(127x3),	OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	85 Cft	100 Cft	65,270.28	55,480
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136+(127x3),	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	168 Cft	100 Cft	68,265.97	114,687
Total Carried to Collection						170,167

Faculty Apartments	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	59 Cft	100 Cft	59,662.68	35,201
3.9	Code -114	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi) Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>				
	Item # 166	Ground Floor	0 Kg	Kg	282.45	-
	Item # 166+174	First Floor	0 Kg	Kg	286.89	-
	Item # 166+174+175	Second Floor	0 Kg	Kg	291.33	-
	Item # 166+174+175 +175	Roof	2470 Kg	Kg	295.77	730,552
Total Carried to Collection						765,753
		<u>COLLECTION</u>				
		Page No -7				72,109
		Page No -8				79,503
		Page No -9				170,167
		Total from this Page				765,753
Total Carried to Summary						1,087,532

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
4		<u>DPC & MASONRY WORKS</u>				
4.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. 2" thick DPC	0 Sft	100 Sft	5555.26	-
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
4.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	41 Cft	100 Cft	27806.49	11,401
	Item # 1+9+12+18+19	First Floor	508 Cft	100 Cft	29118.31	147,921
	Item # 1+9+10+12+18+19	Second Floor	1225 Cft	100 Cft	30001.14	367,514
	Item # 1+9+10+10+12+ 18+19	Roof	170 Cft	100 Cft	30883.97	52,503
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	17 Cft	100 Cft	35217.54	5,987
	Item # 44+92+100+70	First Floor	818 Cft	100 Cft	37074.72	303,271
	Item # 34+92+100+70+71	Second Floor	1558 Cft	100 Cft	38931.90	606,559
	Item # 44+92+100+70+71 +71	Roof	795 Cft	100 Cft	40789.08	324,273
4.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	63 Cft	100 Cft	35871.8	22,599
Total Carried to Summary						1,842,028

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		<u>THERMAL & MOISTURE PROTECTION</u> Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge In terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.				
5.1	Code-108					
	Item # 25 Page #49	Second Floor & Above	3311 Sft	100 Sft	8229.59	272,482
Total Carried to Summary						272,482

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		METAL WORKS				
		M.S. / G.I Door Frame				
6.1	Code -119 Item # 43 Page # 240	Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer	0 Rft	Rft	393.51	-
6.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	131 Sft	100 Sft	6071.25	7,953
6.3	Code -119 Item #69 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass	678 Sft	Sft	1742.19	1,181,205
6.4	Code -119 Item #60 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	818 Sft	Sft	847.22	693,026
6.5	Code -119 Item #119 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	1496 Sft	Sft	371.82	556,243
6.6	Code -119 Item #53 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	77 Rft	Rft	1123.12	86,480
Total Carried to Summary						2,524,907

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		WOOD WORKS				
7.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor F.Floor S.Floor & Roof	61 Cft 0 Cft 0 Cft	Cft Cft Cft	12731.98 12731.98 12731.98	776,651 - -
7.2	Code-120 Item # 63 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip alround with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1498 Sft	Sft	1695.81	2,540,323
7.3	Code-122 Item # 189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	7291 Sft	100 Sft	5133.35	374,273
7.4	Code-119 Item # 119 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	3 Sft	Sft	371.82	1,115
7.5	Code-120 Item # 182 Page # 279	Providing and fixing 2 inches (51 mm) thick best quality deodar wood partition fully glazed with glass panes 24 oz. (7.34 kg./SM.) deodar wood beading with putty packing to glasses etc., as required.	0 Sft	Sft	1,772.05	-
Total Carried to Summary						3,692,362

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		<u>FLOOR FINISHES</u>				
		Mosaic Tiles				
8.1	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 99 Page# 244	Ground Floor	40 Sft	100 Sft	24276.97	9,711
	Item # 114 Page#	First Floor	40 Sft	100 Sft	24870.72	9,948
	Item # 115 Page#	Second Floor	81 Sft	100 Sft	25274.47	20,472
		Porcelain Tiles				
8.2	Code-117 Item # 159 Page# 209	Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	3329 Sft	100 Sft	36016.99	1,199,006
	Item # 159 Page# 209	First Floor	3259 Sft	100 Sft	36016.99	1,173,794
	Item # 159 Page# 209	Second Floor	3259 Sft	100 Sft	36016.99	1,173,794
Total Carried to Summary						3,586,725

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		WALL FINISHES				
9.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	10696 Sft	100 Sft	4034.92	431,575
	Item # 6+87 Page # 320 & 327	First Floor	10523 Sft	100 Sft	4342.42	456,953
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	10523 Sft	100 Sft	4578.67	481,813
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	1651 Sft	100 Sft	4814.92	79,494
9.2	Code-117 Item # 159 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	1651 Sft	100 Sft	36016.99	594,641
	Item # 159 Page# 209	First Floor	1642 Sft	100 Sft	36016.99	591,399
	Item # 159 Page# 209	Second Floor	1642 Sft	100 Sft	36016.99	591,399
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1/2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	22 Sft	100 Sft	23338.43	5,134
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	22 Sft	100 Sft	24229.06	5,330
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	26 Sft	100 Sft	24977.19	6,494

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	394 Sft	100 Sft	5335.06	21,020
	Item # 8+88	O.H.W.T Plaster	347 Sft	100 Sft	5745.06	19,935
9.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	11 Kg	Kg	179.31	1,972
	Item # 30	O.H.W.T	9 Kg	Kg	179.31	1,614
9.6	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	32135 Sft	100 Sft	6737.38	2,165,057
Total Carried to Summary						5,453,830.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		CEILING FINISHES				
		Internal Ceiling Plaster				
10.1	Code-122	1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	0 Sft	100 Sft	4034.92	-
	Item # 6+87 Page # 320 & 327	First Floor	0 Sft	100 Sft	4342.42	-
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	2696 Sft	100 Sft	4578.67	123,441
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	162 Sft	100 Sft	4814.92	7,800
10.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	7930 Sft	100 Sft	3401.25	269,719
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	0 Sft	Sft	172.73	-
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any	2286 Sft	Sft	153.05	349,872
Total Carried to Summary						750,832

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	6254 Sft	100 Sft	5335.06	333,655
	Item # 8+88 Page # 320 & 327	First Floor	4972 Sft	100 Sft	5745.06	285,644
	Item # 8+88+91 Page # 320, 327 e. 220	Second Floor	4972 Sft	100 Sft	6060.06	301,306
	Item # 8+88+91+91 Page # 320, 327 & 328	Roof	3784 Sft	100 Sft	6375.06	241,232
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	19982 Sft	100 Sft	1575	314,717
11.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	1417 Sft	100 Sft	4408.75	62,472
11.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	6254 Sft	100 Sft	20706.56	1,294,988
	Item # 79+82+83+88 Page # 326 & 327	First Floor	4972 Sft	100 Sft	22281.56	1,107,839
	Item # 79+82+83+88+91 Page # 326 & 327	Second Floor	4972 Sft	100 Sft	22596.56	1,123,501
	Item # 79+82+83+88+91+91 Page # 326 & 327	Above Second floor & Roof	3784 Sft	100 Sft	22911.56	866,973
11.5	Item # 88 Page #149 & 150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	38 Cft	100 Cft	73694.78	28,004
	Item # 88+94	First Floor	38 Cft	100 Cft	75660.59	28,751
	Item # 88+94+95	Second Floor	38 Cft	100 Cft	77181.74	29,329
Total Carried to Summary						6,018,411

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA) C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
12.1	Code-117	Ground Floor	180 Sft	100 Sft	9562.54	17,213
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-
12.3	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	404 Sft	100 Sft	12,237.02	49,438
12.4	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing				
	Item # 110 Page# 204	Ground Floor	0 Sft	100 Sft	21,963.50	-
	Item # 110+111 Page# 204	First Floor	0 Sft	100 Sft	22,557.25	-
	Item # 110+111+114 Page# 204	Second Floor	0 Sft	100 Sft	22,949.13	-
Total Carried to Summary						66,651

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
7		<p>All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.</p> <p>WOOD WORKS FIRE RATED DOORS</p> <p>Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating. including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb tum concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)</p> <p>Wooden Cabinets</p> <p>Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)</p> <p>Ground Floor First Floor Second Floor</p> <p>Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)</p> <p>Ground Floor First Floor Second Floor</p>	0 Sft	Sft		
7.1	N.S.I					
7.2	N.S.I					
7.3	N.S.I					
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer. FLOOR FINISHES Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.1	N.S.I	Ground Floor	172 Sft	Sft		
		First Floor	98 Sft	Sft		
		Second Floor	98 Sft	Sft		
8.2	N.S.I	Providing and laying Terrazzo files/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	86 Sft	Sft		
		First Floor	49 Sft	Sft		
		Second Floor	49 Sft	Sft		
8.3	N.S.I	Providing, laying and fixing Per-Polished Marble Counter Top 24" wide and 3/4" thick as per drawing, activities include provide & fixe 1-1/2" thick RCC slab, setting with Dry Bond, fixing in wall with cutting/chiseling in RCC / CC members etc, grouting with matching colour approved grouting material in joints, chamfering edging/half D gola around the counter top, finishing, maintaining proper level with curing etc. where required complete in all respects as per specifications and as directed by the Engineer	169 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
11.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING ("SINDH MADRESSATUL ISLAM UNIVERSITY- FACULTY APARTMENT CATEGORY A") lettering with 48" dia Logo on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rowel bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. a) Lettering with 4' dia Logo b) Logo Plaster (6'-0" x 24'-6")	60 Each 150 Each	Each Sft.		
11.3	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	37 Rft	Rft		
11.4	N.S.I	Providing and fixing Kaprail/Clay Tile of approved size, thickness, colors & patterns, over roof., including fixing with 1:4 cement sand mortar/Dry bond, grouting with approved material including cutting, jointing, curing, etc complete in all respect as per drawings, specifications and the satisfaction of the Engineer. (at any height in any floor)	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	64 Sft	Sft		
12.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	37 Sft	Sft		
12.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	446 Sft	Sft		
Total Carried to Summary						

ELECTRIC

WORK

**BILL OF QUANTITIES
SUMMARY OF COST**

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	EARTHING SYSTEM	
9	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,296	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	888	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	12	Mtr.		
iv		Wiring for sub-main with 3x 6 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 25 mm (1")dia PVC conduit recessed in the wall, column and roof etc as required.	15	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMD) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		MDB-AA	1	No.		
ii		DB-AA-COM	1	No.		
iii		DB-AA-GF1	1	No.		
iv		DB-AA-GF2	1	No.		
v		DB-AA-1F1	1	No.		
vi		DB-AA-1F2	1	No.		
vii		DB-AA-2F1	1	No.		
viii		DB-AA-2F2	1	No.		
		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
b)						
i		20A, SPN Isolator	1	Nos.		
c)		Providing & fixing Three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board l/c connection as required. (Syed Brother, PEL)	7	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 10 Sq.mm Cu/PVC Cable	520	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 10 Sq.mm Cu/PVC Cable	130	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		38 mm dia PVC	20	Mtr.		
ii		50 mm dia PVC	125	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		50 mm dia UPVC (Class-D)	30	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)		Providing & installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	12	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES				
		Supply, installation, testing & commissioning of following				
a)		10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
i		10A, One Gang Switch	35	Nos.		
ii		10A, One Gang 2-Way Switch	4	Nos.		
iii		10A, Two Gang Switch	29	Nos.		
iv		10A, Three Gang Switch	20	Nos.		
v		10A, Four Gang Switch	4	Nos.		
vi		One Gang Dimmer with 10A Switch	24	Nos.		
vii		Two Gang Dimmer with 10A Switch	6	Nos.		
viii		Door Bell Unit	6	No.		
ix		Bell Push Button	6	No.		
x		10A, 2-Pin 1-Gang Switched Socket Outlet	97	Nos.		
xi		15A, 3-Pin Switched Socket Outlet	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	60	Nos.		
ii		Type D2	11	Nos.		
iii		Type D3	108	Nos.		
iv		Type D4	15	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		56" dia Sweep Ceiling Fan	36	Nos.		
ii		8" dia Exhaust Fan	30	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	8	Nos.		
ii		Type W1	4	Nos.		
iii		Type W3	8	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		EARTHING SYSTEM				
a)		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	No.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	120	Mtr.		HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.		HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.		HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	38	Nos.		HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		HOLD
f)		Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		HOLD

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>						

ELV WORK

BILL OF QUANTITIES

SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		CONDUITS & PIPES				
a)		Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i		2" dia UPVC Conduit	25	Mtr.		
b)		Providing and laying of following size (inner dia) PVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor. As per specifications and drawings, complete in all respect.				
i		2" dia PVC Conduit	50	Mtr.		
c)		Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	1	No.		
d)		Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	12	No.		
CARRIED TO ELV SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		VOICE COMMUNICATION & CABLING SYSTEM (Passive Equipment Only)				
a)		Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	24	Nos.		HOLD
b)		Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (for Voice outlets) in 25mm dia PVC conduit concealed/surface from each outlet to TJB, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	410	Mtr.		
c)		Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Male Student Hostel building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	720	Mtr.		HOLD
d)		Supply, installing, testing and commissioning of following block in Telephone junction box, as per drawing and specification, complete in all respect.				
i		TJB with 50 Pair IDC Block	1	No.		HOLD
e)		Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing, as build drawing, Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		CABLE TELEVISION SYSTEM (CATV)				
a)		Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	24	Nos.		HOLD
b)		Supply and installation of CATV 3x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)		Supply and installation of CATV 1x4 Way Splitter with box, complete in all respects.	6	No.		HOLD
d)		Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	300	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>						

PLUMBING & FIRE

WORKS

[illegible]

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	10	Nos.	12,602.50	126,025
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	6	Nos.	13,420.00	80,520
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthenware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall /2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).	16	Nos.	21,880.00	350,080
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>PLUMBING FIXTURES (Cont....)</u>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	12	Nos.	6,587.50	79,050
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	12	Nos.	6,127.50	73,530
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	4	Nos.	34,495.00	137,980
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	4	Nos.	3,045.74	12,183
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	16	Nos.	11,812.50	189,000
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	16	Nos.	3,381.75	54,108
		CARRIED TO SUMMARY				1,102,476

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<u>SANITARY SEWAGE:</u> Manholes and Gully traps Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg,in 6" thick RCC 1:2:4 slab 8" thick,c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling , disposal of excavated sruff, manhole cover and frame.	6	Nos.	28,528.86	171,173
		CARRIED TO SUMMARY				171,173

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		WATER SUPPLY:				
		Cold and Hot Water Supply Piping				
12	Code-306	Supply, installation Testing and Commissioning of PPR PN 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	580	Rft	153.45	89,001
ii	Item-30	1" dia	470	Rft	215.32	101,200
iii	Item-31	1¼" dia	210	Rft	320.26	67,255
iv	Item-32	1½" dia	30	Rft	433.66	13,010
v	Item-33	2" dia	110	Rft	747.61	82,237
vi	Item-34	2½" dia	150	Rft	1,147.61	172,142
vii		3" dia	40	Rft		0
viii		4" dia	0	Rft	-	0
		Valves				
13	Code-307	Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-8	¾" dia	2	Nos.	2,017.90	4,036
ii	Item-9	1" dia	4	Nos.	4,012.90	16,052
iii	Item-10	1¼" dia	12	Nos.	6,366.65	76,400
iv	Item-11	1½" dia	16	Nos.	8,169.15	130,706
v	Item-12	2" dia	2	Nos.	8,699.40	17,399
vi	Item-13	2½" dia	2	Nos.	9,891.15	19,782
vii		3" dia	1	Nos.		0
viii		4" dia	0	Nos.	-	0
		Water Tanks and Connection				
14	Code-307	Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	0	Item	42,500.00	0
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				798,975
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
18	Code-306	<u>SANITARY SEWAGE:</u> Soil, Waste, Vent and Rainwater Pipes Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval. (i) 2" dia	90	Rft.	448.80	40,392
	Item-15	(ii) 3" dia	600	Rft.	520.97	312,582
	Item-17	(iii) 4" dia	230	Rft.	719.12	165,398
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval. (iv) 6" dia	260	Rft.	716.62	186,321
20	Code-301 Item-30	Drainage Specialties Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	18	Nos	1,459.43	26,270
21	Code-314 Item-3	Gully traps Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	6	Nos.	4,139	24,834
		CARRIED TO SUMMARY				755,797

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	8	Nos.	15,896.88	127,175
		CARRIED TO SUMMARY				127,175

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
B NON-SCHEDULE ITEMS						
		<u>WATER SUPPLY</u>				
		Plumbing Specialties:				
1	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
2	Non-Sch	Pumps				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 95ft. head	1	set		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
3	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	2 0 0	Nos Nos Nos		
4	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	4	Nos		
5		<u>Storage Water Heaters</u> Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	4	Nos		
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
6	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
8		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia 1" dia	180 0	RFt RFt		
9		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	6	Nos		
10		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	4	Nos		
		Sub Total for Non Schedule Items	Total			

Faculty Apartment Type-B(Ground+2)

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

BILL OF QUANTITIES

	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	129,435
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	190,324
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	20,215
3	SUPER STRUCTURE (Concrete/RCC and steel works)	5,073,397
4	MASONRY WORKS	2,404,457
5	THERMAL & MOISTURE PROTECTION	218,660
6	METAL WORKS	3,738,604
7	WOOD WORKS	5,048,039
8	FLOOR FINISHES	3,327,393
9	WALL FINISHES	6,211,223
10	CEILING FINISHES	638,580
11	EXTERNAL FINISHES (BUILDING)	6,260,398
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	55,905
	Schedule Items - A	33,316,630
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4	6	7 = 4 x 6	
SCHEDULE ITEMS						
1		EARTH WORKS Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
1.1	Code -103,					
	Item # 11	From ± 0'-0" to -5' - 0"	4108 Cft	100 Cft	1,566.56	64,354
	Item #11+28	From -5' - 0" to -8' - 0"	0 Cft	100 Cft	1,804.06	-
	Item # 11+28+28	From -8' - 0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 2+28+28+28	From -11' - 0" to -14' - 0"	0 Cft	100 Cft	2,279.06	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	2000 Cft	100 Cft	3,254.05	65,081
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with sprwls and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						129,435

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i> CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
2.1	Code -106	Item # 11 Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	476 Cft	100 Cft	32,221.55	153,375
2.2	Code -106	Item # 12 Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	106 Cft	100 Cft	34,857.58	36,949
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm ² at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
Total Carried to Collection						190,324

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	53,250.89	-
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	40,365.27	-
Total Carried to Collection						-

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	0 Cft
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	46,752.23	-
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						-

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	0 Kg	Kg	282.45	-
Total Carried to Collection						-
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	0 Rft	Rft	592.81	-
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	2000 Sft	100 Sft	1,010.75	20,215
Total Carried to Collection						20,215
		<u>COLLECTION</u>				
		Page No -2				190,324
		Page No -3				-
		Page No -4				-
		Total from this Page				-
Total Carried to Summary (Concrete/RCC and steel works)						190,324
Total Carried to Summary (Excluding Concrete/RCC and steel works)						20,215

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>	0 Sft	Sft		
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>				
Total Carried to Summary						

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		<u>SUPER STRUCTURE</u> Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.1	Code -114	Columns (Cylindrical Strength 3125 Psi)				
	Item # 24+134+137	Ground Floor	0 Cft	100 Cft	56,426.81	-
	Item # 24+134+137 +159	First Floor	0 Cft	100 Cft	60,442.44	-
	Item # 24+134+137 +159+160	Second Floor	0 Cft	100 Cft	63,604.94	-
	Item # 24+134+137 +159+160+160	Roof	108 Cft	100 Cft	66,767.44	72,109
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi)				
	Item # 30+135+138	Ground Floor	0 Cft	100 Cft	58,813.05	-
	Item # 30+135+138+92	First Floor	0 Cft	100 Cft	61,624.51	-
	Item # 30+135+138+92+93	Second Floor	0 Cft	100 Cft	63,835.10	-
	Item # 30+135+138+ 92+93+93	Roof	0 Cft	100 Cft	66,045.69	-
Total Carried to Collection						72,109

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 38+136	Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi)				
		Ground Floor	0 Cft	100 Cft	47,322.89	-
	Item # 38+136+92	First Floor	0 Cft	100 Cft	50,134.35	-
	Item # 38+136+92+93	Second Floor	0 Cft	100 Cft	52,344.94	-
		Thied Floor	854 Cft	100 Cft	54,555.53	465,904
	Item # 38+136+92+93+93	Roof	133 Cft	100 Cft	56,766.12	75,499
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Slab i/c projections (Cylindrical Strength 2500 Psi)				
	Item # 57+136	Ground Floor	0 Cft	100 Cft	43,716.64	-
	Item # 57+136+92	First Floor	0 Cft	100 Cft	46,528.10	-
	Item # 57+136+92+93	Second Floor	0 Cft	100 Cft	48,738.69	-
		Third Floor	1929 Cft	100 Cft	50,949.28	982,812
	Item # 57+136+92+93+93	Roof	39 Cft	100 Cft	53,159.81	20,732
Total Carried to Collection						1,544,947

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 50+136	Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	57,830.03	-
	Item # 50+136+92	First Floor	0 Cft	100 Cft	60,641.49	-
	Item # 50+136+92+93	Second Floor	0 Cft	100 Cft	62,852.08	-
	Item # 50+136+92+93+93	Third Floor	115 Cft	100 Cft	65,062.67	74,822
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136+(127x3),	OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	105 Cft	100 Cft	65,270.28	68,534
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136+(127x3),	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	167 Cft	100 Cft	68,265.97	114,004
Total Carried to Collection						257,360

	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 118+136+(127x3),	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi)	74 Cft	100 Cft	59,662.68	44,150
3.9	Code -114	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>				
	Item # 166	Ground Floor	0 Kg	Kg	282.45	-
	Item # 166+174	First Floor	0 Kg	Kg	286.89	-
	Item # 166+174+175	Second Floor	0 Kg	Kg	291.33	-
		Third Floor	7793 Kg	Kg	295.77	2,304,936
	Item # 166+174+175 +175	Roof	2831 Kg	Kg	300.21	849,895
Total Carried to Collection						3,198,981
		<u>COLLECTION</u>				
		Page No -7				72,109
		Page No -8				1,544,947
		Page No -9				257,360
		Total from this Page				3,198,981
Total Carried to Summary						5,073,397

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
4		<u>DPC & MASONRY WORKS</u>				
		Damp Proof Course (DPC)				
4.1	Item # 3 Code -108 Page # 47	Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of 2" thick DPC	0 Sft	100 Sft	5555.26	-
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
4.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	125 Cft	100 Cft	27806.49	34,758
	Item # 1+9+12+18+19	First Floor	335 Cft	100 Cft	29118.31	97,546
	Item # 1+9+10+12+18+19	Second Floor	1006 Cft	100 Cft	30001.14	301,811
	Item # 1+9+10+10+12+ 18+19	Third Floor	1281 Cft	100 Cft	30883.97	395,624
	Item # 1+9+10+10+10+12 +18+19	Roof	178 Cft	100 Cft	31766.80	56,545
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	685 Cft	100 Cft	35217.54	241,240
	Item # 44+92+100+70	First Floor	610 Cft	100 Cft	37074.72	226,156
	Item # 34+92+100+70+71	Second Floor	682 Cft	100 Cft	38931.90	265,516
	Item # 44+92+100+70+71 +71	Third Floor	1219 Cft	100 Cft	40789.08	497,219

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
4.5	Item # 44+92+100+70+71 +71+71	Roof	630 Cft	100 Cft	42646.26	268,671
	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	54 Cft	100 Cft	35871.8	19,371
Total Carried to Summary						2,404,457
5		<u>THERMAL & MOISTURE PROTECTION</u>				
5.1	Code-108	Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge in terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.				
	Item # 25 Page #49	Second Floor & Above	2657 Sft	100 Sft	8229.59	218,660
Total Carried to Summary						218,660

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		METAL WORKS M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.51	-
6.1	Code -119 Item # 43 Page # 240					
6.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
6.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	1221 Sft	Sft	1742.19	2,127,214
6.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	853 Sft	Sft	847.22	722,679
6.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	2073 Sft	Sft	371.82	770,783
6.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	105 Rft	Rft	1123.12	117,928
Total Carried to Summary						3,738,604

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		WOOD WORKS				
7.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc... as required . G.Floor F.Floor S.Floor & Roof 3rd Floor & Roof	41 Cft 34 Cft 34 Cft 36 Cft	Cft Cft Cft Cft	12731.98 12731.98 12731.98 12731.98	522,011 432,887 432,887 458,351
7.2	Code-120 Item # 66 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip alround with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1645 Sft	Sft	1695.81	2,789,607
7.3	Code-122 Item # 189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	8010 Sft	100 Sft	5133.35	411,181
7.4	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	3 Sft	Sft	371.82	1,115
7.5	Code-120 Item # 182 Page # 279	Providing and fixing 2 inches (51 mm) thick best quality deodar wood partition fully glazed with glass panes 24 oz. (7.34 kg./SM.) deodar wood beading with putty packing to glasses etc. as required	0 Sft	Sft	1,772.05	-
Total Carried to Summary						5,048,039

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		FLOOR FINISHES				
		Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.1	Code-117	Ground Floor	40 Sft	100 Sft	24276.97	9,711
	Item # 99 Page# 244	First Floor	40 Sft	100 Sft	24870.72	9,948
	Item # 114 Page# 244	Second Floor	40 Sft	100 Sft	25274.47	10,110
	Item # 115 Page# 244	Third Floor	81 Sft	100 Sft	25678.22	20,799
		Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the				
8.2	Code-117 Item # 159 Page# 209	G.Floor	2637 Sft	100 Sft	36016.99	949,768
	Item # 159 Page# 209	First Floor	2657 Sft	100 Sft	36016.99	956,971
	Item # 159 Page# 209	Second Floor	1902 Sft	100 Sft	36016.99	685,043
	Item # 159 Page# 209	Third Floor	1902 Sft	100 Sft	36016.99	685,043
Total Carried to Summary						3,327,393

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		WALL FINISHES				
9.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	9098 Sft	100 Sft	4034.92	367,097
	Item # 6+87 Page # 320 & 327	First Floor	8839 Sft	100 Sft	4342.42	383,827
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	8839 Sft	100 Sft	4578.67	404,709
	Item # 6+87+90+90 Page # 320, 327 & 328	Third Floor	8839 Sft	100 Sft	4814.92	425,591
	Item # 6+87+90+90+90 Page # 320, 327 & 328	Roof	428 Sft	100 Sft	5051.17	21,619
9.2	Code-117 Item # 159 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	1446 Sft	100 Sft	36016.99	520,806
	Item # 159 Page# 209	First Floor	1479 Sft	100 Sft	36016.99	532,691
	Item # 159 Page# 209	Second Floor	1479 Sft	100 Sft	36016.99	532,691
	Item # 159 Page# 209	Third Floor	1479 Sft	100 Sft	36016.99	532,691
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	13 Sft	100 Sft	23338.43	3,034
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	13 Sft	100 Sft	24229.06	3,150
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	13 Sft	100 Sft	24977.19	3,247

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9.4	Code-118 Item # 55 + 58+60+61+61 Page# 219	3rd.Floor	28 Sft	100 Sft	25725.32	7,203
	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	401 Sft	100 Sft	5335.06	21,394
9.5	Item # 8+88	O.H.W.T Plaster	340 Sft	100 Sft	5745.06	19,533
	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	11 Kg	Kg	179.31	1,972
9.6	Item # 30	O.H.W.T	9 Kg	Kg	179.31	1,614
	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor	36043 Sft	100 Sft	6737.38	2,428,354
Total Carried to Summary						6,211,223.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		CEILING FINISHES				
10.1	Code-122	Internal Ceiling Plaster 1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	100 Sft	100 Sft	4034.92	4,035
	Item # 6+87 Page # 320 & 327	First Floor	100 Sft	100 Sft	4342.42	4,342
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	100 Sft	100 Sft	4578.67	4,579
	Item # 6+87+90+90 Page # 320, 327 & 328	Third Floor	2370 Sft	100 Sft	4814.92	114,114
	Item # 6+87+90+90+90 Page # 320, 327 & 328	Roof	162 Sft	100 Sft	5051.17	8,183
10.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	9250 Sft	100 Sft	3401.25	314,616
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	0 Sft	Sft	172.73	-
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	1233 Sft	Sft	153.05	188,711
Total Carried to Summary						638,580

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
11.1	Code-122 Item # 8 Page # 320 Item # 8+88 Page # 320 & 327 Item # 8+88+91 Page # 320, 327 & 328 Item # 8+88+91+91 Page # 320, 327 & 328 Item # 8+88+91+91+91 Page # 320, 327 & 328	Ground Floor First Floor Second Floor Third Floor Roof	5050 Sft 4297 Sft 4297 Sft 4255 Sft 3067 Sft	100 Sft 100 Sft 100 Sft 100 Sft 100 Sft	5335.06 5745.06 6060.06 6375.06 6690.06	269,421 246,865 260,401 271,259 205,184
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over Item No. 11.1 Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	17899 Sft	100 Sft	1575	281,909
11.3	Code-122 Item # 172	Ground Floor to Roof	1041 Sft	100 Sft	4408.75	45,895
11.4	Code-122 Item # 79+82+83 Page # 326 & 327 Item # 79+82+83+88 Page # 326 & 327 Item # 79+82+83+88+91 Page # 326 & 327 Item # 79+82+83+88+91+91 Page # 326 & 327	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. Ground Floor First Floor Second Floor Third floor	5050 Sft 4297 Sft 4297 Sft 4255 Sft	100 Sft 100 Sft 100 Sft 100 Sft	20706.56 22281.56 22596.56 22911.56	1,045,681 957,439 970,974 974,887

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11.5	Item # 79+82+83+88+91+ 91+91 Page # 326 & 327	Above Third floor & Roof	3067 Sft	100 Sft	23226.56	712,359
	Item # 88 Page #149 &150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	8 Cft	100 Cft	73694.78	5,896
	Item # 88+94	First Floor	8 Cft	100 Cft	75660.59	6,053
	Item # 88+94+95	Second Floor	8 Cft	100 Cft	77181.74	6,175
Total Carried to Summary						6,260,398
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	Code-117	C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	234 Sft	100 Sft	9562.54	22,376
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-
12.3	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	274 Sft	100 Sft	12,237.02	33,529
12.4	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 110 Page# 204	Ground Floor	0 Sft	100 Sft	21,963.50	-
Total Carried to Summary						55,905

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
7		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer WOOD WORKS FIRE RATED DOORS Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating, including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer.	0 Sft	Sft		
7.1	N.S.I					
7.2	N.S.I	Wooden Cabinets Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	70 Sft	Sft		
		First Floor	70 Sft	Sft		
		Second Floor	70 Sft	Sft		
		Third Floor	70 Sft	Sft		
7.3	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	62 Sft	Sft		
		First Floor	62 Sft	Sft		
		Second Floor	62 Sft	Sft		
		Third Floor	62 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer				
		FLOOR FINISHES				
8.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	89 Sft	Sft		
		First Floor	89 Sft	Sft		
		Second Floor	89 Sft	Sft		
		Third Floor	89 Sft	Sft		
8.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	45 Sft	Sft		
		First Floor	45 Sft	Sft		
		Second Floor	45 Sft	Sft		
		Third Floor	45 Sft	Sft		
8.3	N.S.I	Providing, laying and fixing Per-Polished Marble Counter Top 24" wide and 3/4" thick as per drawing, activities include provide & fixe 1-1/2" thick RCC slab, setting with Dry Bond, fixing in wall with cutting/chiseling in RCC / CC members etc, grouting with matching colour approved grouting material in joints, chamfering edging/half D gola around the counter top, finishing, maintaining proper level with curing etc. where required complete in all respects as per specifications and as directed by the Engineer.	181 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
11.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING ("SINDH MADRESSATUL ISLAM UNIVERSITY-FACULTY APARTMENT CATEGORY B") lettering with 48" dia Logo on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rowel bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. a) Lettering with 4' dia Logo	60 Each	Each		
		b) Logo Plaster (6'-0" x 24'-6")	150 Each	Sft.		
11.3	N.S.I	Rain Water Spouts Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Each	Each		
11.4	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
11.5		a) Ornamental Pre cast Columns	0 Rft	Rft		
		b) Ornamental Pre cast ball finial with base	0 Rft	Nos		
11.6	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	37 Rft	Rft		
11.7	N.S.I	Providing and fixing Kaprail/Clay Tile of approved size, thickness, colors & patterns, over roof., including fixing with 1:4 cement sand mortar/Dry bond, grouting with approved material including cutting, jointing, curing, etc complete in all respect as per drawings, specifications and the satisfaction of he Engineer. (at any height in any	0 Sft	Sft		
Total Carried to Summary						335,450

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	58 Sft	Sft		
12.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	29 Sft	Sft		
12.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	177 Sft	Sft		
Total Carried to Summary						

ELECTRIC

WORK

BILL OF QUANTITIES
SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	EARTHING SYSTEM	
9	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,326	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,112	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	10	Mtr.		
iv		Wiring for sub-main with 3x 6 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 25 mm (1")dia PVC conduit recessed in the wall, column and roof etc as required.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		MDB-BA	1	No.		
ii		DB-BA-COM	1	No.		
iii		DB-BA-GF1	1	No.		
iv		DB-BA-GF2	1	No.		
v		DB-BA-1F1	1	No.		
vi		DB-BA-1F2	1	No.		
vii		DB-BA-2F1	1	No.		
viii		DB-BA-2F2	1	No.		
ix		DB-BA-3F1	1	No.		
x		DB-BA-3F2	1	No.		
		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
b)						
i		20A, SPN Isolator	2	Nos.		
c)		Providing & fixing Three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board I/c connection as required. (Syed Brother, PEL)	9	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 10 Sq.mm Cu/PVC Cable	740	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 10 Sq.mm Cu/PVC Cable	185	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		38 mm dia PVC	30	Mtr.		
ii		50 mm dia PVC	140	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		50 mm dia UPVC (Class-D)	30	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)		Providing & installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	16	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES				
		Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
a)						
i		10A, One Gang Switch	42	Nos.		
ii		10A, One Gang 2-Way Switch	5	Nos.		
iii		10A, Two Gang Switch	25	Nos.		
iv		10A, Three Gang Switch	24	Nos.		
v		10A, Four Gang Switch	13	Nos.		
vi		One Gang Dimmer with 10A Switch	24	Nos.		
vii		Two Gang Dimmer with 10A Switch	16	Nos.		
viii		Door Bell Unit	8	No.		
ix		Bell Push Button	8	No.		
x		10A, 2-Pin 1-Gang Switched Socket Outlet	137	Nos.		
xi		15A, 3-Pin Switched Socket Outlet	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	64	Nos.		
ii		Type D2	23	Nos.		
iii		Type D3	144	Nos.		
iv		Type D4	30	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		48" dia Sweep Ceiling Fan	16	Nos.		
ii		56" dia Sweep Ceiling Fan	40	Nos.		
iii		8" dia Exhaust Fan	48	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	6	Nos.		
ii		Type W1	3	Nos.		
iii		Type W2	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		EARTHING SYSTEM				
		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
a)						
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	No.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	145	Mtr.		HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.		HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.		HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	38	Nos.		HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		HOLD
f)		Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect	2	Job.		HOLD
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>						

ELV WORK

BILL OF QUANTITIES

SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
a)	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i	2" dia UPVC Conduit	25	Mtr.		
b)	Providing and laying of following size (inner dia) PVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor. As per specifications and drawings, complete in all respect.				
i	2" dia PVC Conduit	100	Mtr.		
c)	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	1	No.		
d)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	17	No.		
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE COMMUNICATION & CABLING SYSTEM (Passive Equipment Only)				
a)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	32	Nos.		HOLD
b)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (for Voice outlets) in 25mm dia PVC conduit concealed/surface from each outlet to TJB, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	770	Mtr.		
c)	Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Male Student Hostel building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	560	Mtr.		HOLD
d)	Supply, installing, testing and commissioning of following block in Telephone junction box, as per drawing and specification, complete in all respect.				
i	TJB with 50 Pair IDC Block	1	No.		HOLD
e)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing, as build drawing, Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	32	Nos.		HOLD
b)	Supply and installation of CATV 3x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)	Supply and installation of CATV 1x4 Way Splitter with box, complete in all respects.	8	No.		HOLD
d)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	400	Mtr.		
CARRIED TO ELV SUMMARY =====>>>					

PLUMBING & FIRE

WORKS

[illegible]

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	16	Nos.	12,602.50	201,640
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	16	Nos.	13,420.00	214,720
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthen ware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall /2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make)	32	Nos.	21,880.00	700,160
Continued..						

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>PLUMBING FIXTURES (Cont....)</u>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	24	Nos.	6,587.50	158,100
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	24	Nos.	6,127.50	147,060
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	8	Nos.	34,495.00	275,960
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	12	Nos.	3,045.74	36,549
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	32	Nos.	11,812.50	378,000
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	32	Nos.	3,381.75	108,216
		CARRIED TO SUMMARY				2,220,405

Page No. 2

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<u>SANITARY SEWAGE:</u> Manholes and Gully traps Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg,in 6" thick RCC 1:2:4 slab 8" thick,c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling , disposal of excavated sruff, manhole cover and frame.	13	Nos.	28,528.86	370,875
		CARRIED TO SUMMARY				370,875

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>WATER SUPPLY:</u>				
		Cold and Hot Water Supply Piping				
12	Code-306	Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval				
i	Item-29	¾" dia	1,425	Rft	153.45	218,666
ii	Item-30	1" dia	270	Rft	215.32	58,136
iii	Item-31	1¼" dia	390	Rft	320.26	124,901
iv	Item-32	1½" dia	150	Rft	433.66	65,049
v	Item-33	2" dia	140	Rft	747.61	104,665
vi	Item-34	2½" dia	400	Rft	1,147.61	459,044
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
		Valves				
13	Code-307	Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	4	Nos.	6,366.65	25,467
iv	Item-11	1½" dia	8	Nos.	8,169.15	65,353
v	Item-12	2" dia	2	Nos.	8,699.40	17,399
vi	Item-13	2½" dia	1	Nos.	9,891.15	9,891
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
		Water Tanks and Connection				
14	Code-307	Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications	0	Item	42,500.00	0
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				1,166,354
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
18	Code-306	<u>SANITARY SEWAGE:</u> Soil, Waste, Vent and Rainwater Pipes Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
	Item-15	(i) 2" dia	240	Rft.	448.80	107,712
	Item-17	(ii) 3" dia	680	Rft.	520.97	354,260
	Item-18	(iii) 4" dia	310	Rft.	719.12	222,927
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval. (iv) 6" dia	290	Rft.	716.62	207,820
20	Code-301 Item-30	Drainage Specialties Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	20	Nos	1,459.43	29,189
21	Code-314 Item-3	Gully traps Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	9	Nos.	4,139	37,251
		CARRIED TO SUMMARY				959,158

Page No. 5

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	18	Nos.	15,896.88	286,144
		CARRIED TO SUMMARY				286,144

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
B NON-SCHEDULE ITEMS						
1	Non-Sch	<u>WATER SUPPLY</u>				
		Plumbing Specialties:				
		Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
		i 1" Air Relief Valve	1	Nos.		
		ii 1¼" dia foot valve	1	Nos.		
2	Non-Sch	iii 2" Y-type Strainer	2	Nos.		
		iv 2" Flexible Connector	4	Nos.		
3	Non-Sch	Pumps				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 95ft. head	1	set		
CARRIED TO SUMMARY			Total			

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
4	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects (i) 3" dia (ii) 4" dia (iii) 6" dia	2 0 0	Nos Nos Nos		
5	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	2	Nos		
6		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications 20 Gallon Capacity	8	Nos		
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
7	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
		CARRIED TO SUMMARY	Total			

Page No. 9

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		<u>FIRE FIGHTING</u> Supply and installation of below mentioned Portable Fire extinguishers with Wall mount brackets as indicated on the drawings, as per specifications and Engineers Recommendation				
i	Non-Sch	12 Kg Automatic Dry Powder Fire extinguisher.	0	Nos.		
Sub Total for Non Schedule Items			Total			

Page No. 10

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia 1" dia	280 0	RFt RFt		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	16	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	8	Nos		
		Sub Total for Non Schedule Items	Total			

Page No. 11

Faculty Apartment Type-C(Ground+2)

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

BILL OF QUANTITIES

S.No	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	39,768
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	47,211
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	10,108
3	SUPER STRUCTURE (Concrete/RCC and steel works)	6,269,878
4	MASONRY WORKS	1,465,369
5	THERMAL & MOISTURE PROTECTION	185,742
6	METAL WORKS	2,297,112
7	WOOD WORKS	3,181,635
8	FLOOR FINISHES	2,413,651
9	WALL FINISHES	3,955,586
10	CEILING FINISHES	417,402
11	EXTERNAL FINISHES (BUILDING)	4,592,388
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	55,538
	Schedule Items - A	24,931,388
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
SCHEDULE ITEMS						
1		<u>EARTH WORKS</u>				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
	Item # 11	From ± 0'-0" to -5' - 0"	1500 Cft	100 Cft	1,566.56	23,498
	Item # 11+28	From -5' - 0" to -8' - 0"	0 Cft	100 Cft	1,804.06	-
	Item # 11+28+28	From -8' - 0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 11+28+28+28	From -11' - 0" to -14' - 0"	0 Cft	100 Cft	2,279.06	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	500 Cft	100 Cft	3,254.05	16,270
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spraws and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						39,768

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i> CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
2.1	Code -106					
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	100 Cft	100 Cft	32,221.55	32,222
2.2	Code -106					
	Item # 12	Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	43 Cft	100 Cft	34,857.58	14,989
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 1+136	Foundation for any type (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	38,098.77	-
Total Carried to Collection						47,211

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	53,250.89	-
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	40,365.27	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	-
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	46,752.23	-
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	0 Kg	Kg	282.45	-
Total Carried to Collection						-
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	0 Rft	Rft	592.81	-
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	1000 Sft	100 Sft	1,010.75	10,108
Total Carried to Collection						10,108
		<u>COLLECTION</u>				
		Page No -2				47,211
		Page No -3				-
		Page No -4				-
		Total from this Page				-
Total Carried to Summary (Concrete/RCC and steel works)						47,211
Total Carried to Summary (Excluding Concrete/RCC and steel works)						10,108

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>	0 Sft	Sft		
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALL AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>				
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		<u>SUPER STRUCTURE</u> Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.1	Code -114	Columns (Cylindrical Strength 3125 Psi)				
	Item # 24+134+137	Ground Floor	0 Cft	100 Cft	56,426.81	-
	Item # 24+134+137 +159	First Floor	0 Cft	100 Cft	60,442.44	-
	Item # 24+134+137 +159+160	Second Floor	688 Cft	100 Cft	63,604.94	437,602
	Item # 24+134+137 +159+160+160	Roof	108 Cft	100 Cft	66,767.44	72,109
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi)				
	Item # 30+135+138	Ground Floor	0 Cft	100 Cft	58,813.05	-
	Item # 30+135+138+92	First Floor	0 Cft	100 Cft	61,624.51	-
	Item # 30+135+138+92+ 93	Second Floor	0 Cft	100 Cft	63,835.10	-
	Item # 30+135+138+ 92+93+93	Roof	0 Cft	100 Cft	66,045.69	-
Total Carried to Collection						509,711

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi)				
	Item # 38+136	Ground Floor	131 Cft	100 Cft	47,322.89	61,993
	Item # 38+136+92	First Floor	131 Cft	100 Cft	50,134.35	65,676
	Item # 38+136+92+93	Second Floor	780 Cft	100 Cft	52,344.94	408,291
	Item # 38+136+92+93+93	Roof	98 Cft	100 Cft	54,555.53	53,464
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Slab i/c projections (Cylindrical Strength 2500 Psi)				
	Item # 57+136	Ground Floor	0 Cft	100 Cft	43,716.64	-
	Item # 57+136+92	First Floor	0 Cft	100 Cft	46,528.10	-
	Item # 57+136+92+93	Second Floor	1610 Cft	100 Cft	48,738.69	784,693
	Item # 57+136+92+93+93	Roof	92 Cft	100 Cft	50,949.28	46,873
Total Carried to Collection						1,420,990

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 50+136	Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	57,830.03	-
	Item # 50+136+92	First Floor	0 Cft	100 Cft	60,641.49	-
	Item # 50+136+92+93	Second Floor	110 Cft	100 Cft	62,852.08	69,137
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136+(127x3),	OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	88 Cft	100 Cft	65,270.28	57,438
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136+(127x5),	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	167 Cft	100 Cft	72,233.57	120,630
Total Carried to Collection						247,205

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 118+136+(127x3),	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi) Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	62 Cft	100 Cft	59,662.58	36,991
3.9	Code -114					
	Item # 166	Ground Floor	0 Kg	Kg	282.45	-
	Item # 166+174	First Floor	0 Kg	Kg	286.89	-
	Item # 166+174+175	Second Floor	11197 Kg	Kg	291.33	3,262,022
	Item # 166+174+175 +175	Roof	2681 Kg	Kg	295.77	792,959
Total Carried to Collection						4,091,972
		<u>COLLECTION</u>				
		Page No -7				509,711
		Page No -8				1,420,990
		Page No -9				247,205
		Total from this Page				4,091,972
Total Carried to Summary						6,269,878

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
4		<u>DPC & MASONRY WORKS</u>				
4.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	0 Sft	100 Sft	5555.26	-
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
4.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	286 Cft	100 Cft	27806.49	79,527
	Item # 1+9+12+18+19	First Floor	497 Cft	100 Cft	29118.31	144,718
	Item # 1+9+10+12+18+19	Second Floor	1220 Cft	100 Cft	30001.14	366,014
	Item # 1+9+10+10+12+ 18+19	Roof	178 Cft	100 Cft	30883.97	54,973
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	162 Cft	100 Cft	35217.54	57,052
	Item # 44+92+100+70	First Floor	453 Cft	100 Cft	37074.72	167,948
	Item # 34+92+100+70+71	Second Floor	866 Cft	100 Cft	38931.90	337,150
	Item # 44+92+100+70+71 +71	Roof	585 Cft	100 Cft	40789.08	238,616
4.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	54 Cft	100 Cft	35871.8	19,371
Total Carried to Summary						1,465,369

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		<u>THERMAL & MOISTURE PROTECTION</u> Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge in terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete* on ground floor roof.				
5.1	Code-108 Item # 25 Page #49	Second Floor & Above	2257 Sft	100 Sft	8229.59	185,742
Total Carried to Summary						185,742

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		METAL WORKS				
6.1	Code -119 Item # 43 Page # 240	M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.51	-
6.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
6.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting, fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	475 Sft	Sft	1742.19	827,540
6.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	990 Sft	Sft	847.22	838,748
6.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	1464 Sft	Sft	371.82	544,344
6.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	77 Rft	Rft	1123.12	86,480
Total Carried to Summary						2,297,112

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		WOOD WORKS				
7.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors. windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor F.Floor S.Floor & Roof	34 Cft 27 Cft 29 Cft	Cft Cft Cft	12731.98 12731.98 12731.98	432,887 343,763 369,227
7.2	Code-120 Item # 66 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip around with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1046 Sft	Sft	1695.81	1,773,817
7.3	Code-122 Item # 189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	5081 Sft	100 Sft	5133.35	260,826
7.4	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	3 Sft	Sft	371.82	1,115
7.5	Code-120 Item # 182 Page # 279	Providing and fixing 2 inches (51 mm) thick best quality deodar wood partition fully glazed with glass panes 24 oz. (7.34 kg./SM.) deodar wood beading with putty packing to glasses etc., as required.	0 Sft	Sft	1,772.05	-
Total Carried to Summary						3,181,635

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		FLOOR FINISHES				
		Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.1	Code-117					
	Item # 99 Page# 244	Ground Floor	40 Sft	100 Sft	24276.97	9,711
	Item # 114 Page# 244	First Floor	40 Sft	100 Sft	24870.72	9,948
	Item # 115 Page# 244	Second Floor	81 Sft	100 Sft	25274.47	20,472
		Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelan tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.2	Code-117 Item # 159 Page# 209					
	Item # 159 Page# 209	G.Floor	2106 Sft	100 Sft	36016.99	758,518
	Item # 159 Page# 209	First Floor	2242 Sft	100 Sft	36016.99	807,501
	Item # 159 Page# 209	Second Floor	2242 Sft	100 Sft	36016.99	807,501
Total Carried to Summary						2,413,651

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		WALL FINISHES				
9.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	7636 Sft	100 Sft	4034.92	308,106
	Item # 6+87 Page # 320 & 327	First Floor	7359 Sft	100 Sft	4342.42	319,559
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	7359 Sft	100 Sft	4578.67	336,944
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	408 Sft	100 Sft	4814.92	19,645
9.2	Code-117 Item # 159 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	1288 Sft	100 Sft	36016.99	463,899
	Item # 159 Page# 209	First Floor	1277 Sft	100 Sft	36016.99	459,937
	Item # 159 Page# 209	Second Floor	1277 Sft	100 Sft	36016.99	459,937
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1/2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	13 Sft	100 Sft	23338.43	3,034
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	13 Sft	100 Sft	24229.06	3,150
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	13 Sft	100 Sft	24977.19	3,247

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	402 Sft	100 Sft	5335.06	21,447
	Item # 8+88	O.H.W.T Plaster	340 Sft	100 Sft	5745.06	19,533
9.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	11 Kg	Kg	179.31	1,972
	Item # 30	O.H.W.T	9 Kg	Kg	179.31	1,614
9.6	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	22762 Sft	100 Sft	6737.38	1,533,562
9.7	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	0 Sft	100 Sft	3401.25	-
Total Carried to Summary						3,955,586.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		CEILING FINISHES				
10.1	Code-122 Item # 6 Page # 320 Item # 6+87 Page # 320 & 327 Item # 6+87+90 Page # 320, 327 & 328 Item # 6+87+90+90 Page # 320, 327 & 328	Internal Ceiling Plaster 1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. Ground Floor First Floor Second Floor Roof	0 Sft 0 Sft 1974 Sft 162 Sft	100 Sft 100 Sft 100 Sft 100 Sft	4034.92 4342.42 4578.67 4814.92	- - 90,383 7,800
10.2	Code-122 Item # 151	Distemper with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	5754 Sft	100 Sft	3401.25	195,708
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	0 Sft	Sft	172.73	-
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	807 Sft	Sft	153.05	123,511
Total Carried to Summary						417,402

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	4735 Sft	100 Sft	5335.06	252,615
	Item # 8+88 Page # 320 & 327	First Floor	4034 Sft	100 Sft	5745.06	231,756
	Item # 8+88+91 Page # 320, 327 & 328	Second Floor	4034 Sft	100 Sft	6060.06	244,463
	Item # 8+88+91+91 Page # 320, 327	Roof	2856 Sft	100 Sft	6375.06	182,072
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	12802 Sft	100 Sft	1575	201,632
11.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	942 Sft	100 Sft	4408.75	41,530
11.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	4735 Sft	100 Sft	20706.56	980,456
	Item # 79+82+83+88 Page # 326 & 327	First Floor	4034 Sft	100 Sft	22281.56	898,838
	Item # 79+82+83+88+91 Page # 326 & 327	Second Floor	4034 Sft	100 Sft	22596.56	911,545
	Item # 79+82+83+88+91+91 Page # 326 & 327	Above Third floor & Roof	2826 Sft	100 Sft	22911.56	647,481
11.5	Item # 88 Page #149 &150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	0 Cft	100 Cft	73694.78	-
	Item # 88+94	First Floor	0 Cft	100 Cft	75660.59	-
	Item # 88+94+95	Second Floor	0 Cft	100 Cft	77181.74	-
Total Carried to Summary						4,592,388

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	Code-117	C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	234 Sft	100 Sft	9562.54	22,376
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warping etc. complete as per direction of Engineer in charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-
12.3	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	271 Sft	100 Sft	12,237.02	33,162
	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 110 Page# 204	Ground Floor	0 Sft	100 Sft	21,963.50	-
		First Floor	0 Sft	100 Sft	21,963.50	-
		Second Floor	0 Sft	100 Sft	21,963.50	-
Total Carried to Summary						55,538

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
7		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		WOOD WORKS				
		FIRE RATED DOORS				
7.1	N.S.I	Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating, including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	0 Sft	Sft		
		Wooden Cabinets				
7.2	N.S.I	Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partial wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc.,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	70 Sft	Sft		
		First Floor	70 Sft	Sft		
		Second Floor	70 Sft	Sft		
7.3	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partial wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	62 Sft	Sft		
		First Floor	62 Sft	Sft		
		Second Floor	62 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
8.1	N.S.I	FLOOR FINISHES Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	89 Sft	Sft		
		First Floor	89 Sft	Sft		
		Second Floor	89 Sft	Sft		
8.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	45 Sft	Sft		
		First Floor	45 Sft	Sft		
		Second Floor	45 Sft	Sft		
8.3	N.S.I	Providing, laying and fixing Per-Polished Marble Counter Top 24" wide and 3/4" thick as per drawing, activities include provide & fixe 1-1/2" thick RCC slab, setting with Dry Bond, fixing in wall with cutting/chiseling in RCC / CC members etc, grouting with matching colour approved grouting material in joints, chamfering edging/half D gola around the counter top, finishing, maintaining proper level with curing etc. where required complete in all respects as per specifications and as directed by the Engineer.	135 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
11.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING ("SINDH MADRESSATUL ISLAM UNIVERSITY-FACULTY APARTMENT CATEGORY C") lettering with 48" dia Logo on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rowel bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		a) Lettering with 4' dia Logo	60 Each	Each		
		b) Logo Plaster (6'-0" x 24'-6")	150 Each	Sft.		
11.3	N.S.I	Rain Water Spouts Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Each	Each		
11.4	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
11.5		a) Ornamental Pre cast Columns	0 Rft	Rft		
		b) Ornamental Pre cast ball finial with base	0 Rft	Nos		
11.6	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	37 Rft	Rft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA) Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	58 Sft	Sft		
12.1	N.S.I					
12.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	29 Sft	Sft		
12.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	176 Sft	Sft		
Total Carried to Summary						

ELECTRIC WORK

BILL OF QUANTITIES
SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	EARTHING SYSTEM	
9	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,870	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,000	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	10	Mtr.		
iv		Wiring for sub-main with 3x 6 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 25 mm (1")dia PVC conduit recessed in the wall, column and roof etc as required.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMD) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		MDB-CA	1	No.		
ii		DB-CA-COM	1	No.		
iii		DB-CA-GF1	1	No.		
iv		DB-CA-GF2	1	No.		
v		DB-CA-1F1	1	No.		
vi		DB-CA-1F2	1	No.		
vii		DB-CA-2F1	1	No.		
viii		DB-CA-2F2	1	No.		
		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
b)						
i		20A, SPN Isolator	2	Nos.		
c)		Providing & fixing Three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board I/c connection as required. (Syed Brother, PEL)	7	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 10 Sq.mm Cu/PVC Cable	500	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 10 Sq.mm Cu/PVC Cable	125	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		38 mm dia PVC	30	Mtr.		
ii		50 mm dia PVC	125	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		50 mm dia UPVC (Class-D)	30	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)		Providing & installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	12	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
a)						
i		10A, One Gang Switch	20	Nos.		
ii		10A, One Gang 2-Way Switch	5	Nos.		
iii		10A, Two Gang Switch	19	Nos.		
iv		10A, Three Gang Switch	18	Nos.		
v		10A, Four Gang Switch	12	Nos.		
vi		One Gang Dimmer with 10A Switch	12	Nos.		
vii		Two Gang Dimmer with 10A Switch	12	Nos.		
viii		Door Bell Unit	6	No.		
ix		Bell Push Button	6	No.		
x		10A, 2-Pin 1-Gang Switched Socket Outlet	85	Nos.		
xi		15A, 3-Pin Switched Socket Outlet	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	42	Nos.		
ii		Type D2	18	Nos.		
iii		Type D3	90	Nos.		
iv		Type D4	23	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		48" dia Sweep Ceiling Fan	12	Nos.		
ii		56" dia Sweep Ceiling Fan	24	Nos.		
iii		8" dia Exhaust Fan	24	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	6	Nos.		
ii		Type W1	3	Nos.		
iii		Type W2	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		EARTHING SYSTEM				
a)		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	No.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	105	Mtr.		HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.		HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.		HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	29	Nos.		HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		HOLD
f)		Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		HOLD

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

ELV WORK

BILL OF QUANTITIES

SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
a)	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i	2" dia UPVC Conduit	25	Mtr.		
b)	Providing and laying of following size (inner dia) PVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor. As per specifications and drawings, complete in all respect.				
i	2" dia PVC Conduit	75	Mtr.		
c)	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	1	No.		
d)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	13	No.		
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE COMMUNICATION & CABLING SYSTEM (Passive Equipment Only)				
a)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	18	Nos.		HOLD
b)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (for Voice outlets) in 25mm dia PVC conduit concealed/surface from each outlet to TJB, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	400	Mtr.		
c)	Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Male Student Hostel building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	230	Mtr.		HOLD
d)	Supply, installing, testing and commissioning of following block in Telephone junction box, as per drawing and specification, complete in all respect.				
i	TJB with 50 Pair IDC Block	1	No.		HOLD
e)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing, as build drawing, Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	18	Nos.		HOLD
b)	Supply and installation of CATV 3x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)	Supply and installation of CATV 1x4 Way Splitter with box, complete in all respects.	6	No.		HOLD
d)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	220	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>					

PLUMBING & FIRE

WORKS

TOTAL AMOUNT (A+B)

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A		SCHEDULE ITEMS				
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	13	Nos.	12,602.50	163,833
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	13	Nos.	13,420.00	174,460
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthen ware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall /2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).	26	Nos.	21,880.00	568,880
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>PLUMBING FIXTURES (Cont....)</u>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	20	Nos.	6,587.50	131,750
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	20	Nos.	6,127.50	122,550
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	6	Nos.	34,495.00	206,970
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	2	Nos.	3,045.74	6,091
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	26	Nos.	11,812.50	307,125
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	26	Nos.	3,381.75	87,926
		CARRIED TO SUMMARY				1,769,584

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<u>SANITARY SEWAGE:</u> Manholes and Gully traps Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg,in 6" thick RCC 1:2:4 slab 8" thick,c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling , disposal of excavated sruff, manhole cover and frame.	13	Nos.	28,528.86	370,875
		CARRIED TO SUMMARY				370,875

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		WATER SUPPLY:				
		Cold and Hot Water Supply Piping				
12	Code-306	Supply, installation Testing and Commissioning of PPR PN 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	1,115	Rft	153.45	171,097
ii	Item-30	1" dia	200	Rft	215.32	43,064
iii	Item-31	1¼" dia	310	Rft	320.26	99,281
iv	Item-32	1½" dia	150	Rft	433.66	65,049
v	Item-33	2" dia	120	Rft	747.61	89,713
vi	Item-34	2½" dia	400	Rft	1,147.61	459,044
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
		Valves				
13	Code-307	Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	4	Nos.	6,366.65	25,467
iv	Item-11	1½" dia	8	Nos.	8,169.15	65,353
v	Item-12	2" dia	2	Nos.	8,699.40	17,399
vi	Item-13	2½" dia	1	Nos.	9,891.15	9,891
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
		Water Tanks and Connection				
14	Code-307	Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	0	Item	42,500.00	0
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				1,063,139
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
18	Code-306	SANITARY SEWAGE: Soil, Waste, Vent and Rainwater Pipes Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval. (i) 2" dia	198	Rft.	448.80	88,862
	Item-15	(ii) 3" dia	604	Rft.	520.97	314,666
	Item-18	(iii) 4" dia	276	Rft.	719.12	198,477
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval. (iv) 6" dia	290	Rft.	716.62	207,820
20	Code-301 Item-30	Drainage Specialties Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	20	Nos	1,459.43	29,189
21	Code-314 Item-3	Gully traps Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	9	Nos.	4,139	37,251
		CARRIED TO SUMMARY				876,265

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	14	Nos.	15,896.88	222,556
		CARRIED TO SUMMARY				222,556

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
4	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	2 0 0	Nos Nos Nos		
5	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	2	Nos		
6		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	6	Nos		
		Continued..				

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
7	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2022 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia 1" dia	40 100	RFt RFt		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	14	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	2	Nos		
		Sub Total for Non Schedule Items	Total			

Staff Houses (Ground+2)

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

BILL OF QUANTITIES

S.No	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	104,374
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	3,607,292
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	72,003
3	SUPER STRUCTURE (Concrete/RCC and steel works)	14,002,475
4	MASONRY WORKS	2,284,997
5	THERMAL & MOISTURE PROTECTION	174,138
6	METAL WORKS	2,588,807
7	WOOD WORKS	3,052,219
8	FLOOR FINISHES	1,735,800
9	WALL FINISHES	4,034,897
10	CEILING FINISHES	1,460,400
11	EXTERNAL FINISHES (BUILDING)	4,128,426
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	47,108
	Schedule Items - A	37,292,936
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	MASONRY WORKS	
5	THERMAL & MOISTURE PROTECTION	
6	METAL WORKS	
7	WOOD WORKS	
8	FLOOR FINISHES	
9	WALL FINISHES	
10	CEILING FINISHES	
11	EXTERNAL FINISHES (BUILDING)	
12	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
SCHEDULE ITEMS						
1		EARTH WORKS Excavation for foundations trenches, drains, underground tanks and septic tanks in gravelly soil (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
1.1	Code -103,					
	Item # 2	From ± 0'-0" to -5' - 0"	500 Cft	100 Cft	1,566.56	7,833
	Item # 2+28	From -5' - 0" to -8' - 0"	300 Cft	100 Cft	1,804.06	5,412
	Item # 2+28+28	From -8' - 0" to -11' - 0"	200 Cft	100 Cft	2,041.56	4,083
	Item # 2+28+28+28	From -11' - 0" to -14' - 0"	0 Cft	100 Cft	2,279.06	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	2675 Cft	100 Cft	3,254.05	87,046
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spraws and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						104,374

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		<u>SUB STRUCTURE</u> <i>Note: All RCC Concrete will be used only Ready mixed.</i> CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
2.1	Code -106	Item # 11 Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	1057 Cft	100 Cft	32,221.55	340,582
2.2	Code -106	Item # 12 Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	135 Cft	100 Cft	34,857.58	47,058
2.3	Code -114	Item # 1+136 REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. Foundation for any type (Cylindrical Strength 2500 Psi)	1425 Cft	100 Cft	38,098.77	542,907
Total Carried to Collection						930,547

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+137+138	Columns upto plinth (Cylindrical Strength 4000 Psi)	76 Cft	100 Cft	42,339.37	32,178
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	870 Cft	100 Cft	40,365.27	351,178
Total Carried to Collection						383,356

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	-
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	120 Cft	100 Cft	46,752.23	56,103
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						56,103

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer)</i>	7921 Kg	Kg	282.45	2,237,286
Total Carried to Collection						2,237,286
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	38 Rft	Rft	592.81	22,527
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	4895 Sft	100 Sft	1,010.75	49,476
Total Carried to Collection						72,003
		<u>COLLECTION</u>				
		Page No -2				930,547
		Page No -3				383,356
		Page No -4				56,103
		Total from this Page				2,237,286
Total Carried to Summary (Concrete/RCC and steel works)						3,607,292
Total Carried to Summary (Excluding Concrete/RCC and steel works)						72,003

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>	2825 Sft	Sft		
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces</i>				
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		SUPER STRUCTURE Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. Columns (Cylindrical Strength 3125 Psi)				
3.1	Code -114 Item # 4+135+138	Ground Floor	675 Cft	100 Cft	56,426.81	380,881
	Item # 24+135+138	First Floor	745 Cft	100 Cft	60,442.44	450,296
	Item # 24+135+138+92	Second Floor	815 Cft	100 Cft	63,604.94	518,380
	Item # 24+135+138+92+93	Roof	180 Cft	100 Cft	66,767.44	120,181
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi)				
	Item # 30+135+138	Ground Floor	0 Cft	100 Cft	58,813.05	-
	Item # 30+135+138+92	First Floor	0 Cft	100 Cft	61,624.51	-
	Item # 30+135+138+92+93	Second Floor	0 Cft	100 Cft	63,835.10	-
	Item # 30+135+138+92+93+93	Roof	0 Cft	100 Cft	66,045.69	-
Total Carried to Collection						1,469,738

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 38+136	Ground Floor	835 Cft	100 Cft	47,322.89	395,146
	Item # 38+136+92	First Floor	835 Cft	100 Cft	50,134.35	418,622
	Item # 38+136+92+93	Second Floor	835 Cft	100 Cft	52,344.94	437,080
	Item # 38+136+92+93+93	Roof	100 Cft	100 Cft	54,555.53	54,556
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 57+136	Ground Floor	1275 Cft	100 Cft	43,716.64	557,387
	Item # 57+136+92	First Floor	1275 Cft	100 Cft	46,528.10	593,233
	Item # 57+136+92+93	Second Floor	1275 Cft	100 Cft	48,738.69	621,418
	Item # 57+136+92+93+93	Roof	90 Cft	100 Cft	50,949.28	45,854
Total Carried to Collection						3,123,296

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi)				
		Item # 50+136 Ground Floor	100 Cft	100 Cft	57,830.03	57,830
		Item # 50+136+92 First Floor	100 Cft	100 Cft	60,641.49	60,641
3.6	Code -114	Item # 50+136+ 92+93 Second Floor	100 Cft	100 Cft	62,852.08	62,852
		Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
		Item # 114+136+(127x3), OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	95 Cft	100 Cft	65,270.28	62,007
		Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.7	Code -114	Item # 112+136+(127x3), OH Water Tank Walls (Cylindrical Strength 2500 Psi)	175 Cft	100 Cft	68,265.97	119,465
Total Carried to Collection						362,795

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 118+136+(127x3),	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi) Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. (Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).	65 Cft	100 Cft	59,662.68	38,781
3.9	Code -114					
	Item # 166	Ground Floor	9170 Kg	Kg	282.45	2,590,067
	Item # 166+174	First Floor	9560 Kg	Kg	286.89	2,742,668
	Item # 166+174+175	Second Floor	9950 Kg	Kg	291.33	2,898,734
	Item # 166+174+175 +175	Roof	2625 Kg	Kg	295.77	776,396
Total Carried to Collection						9,046,646
		<u>COLLECTION</u>				
		Page No -7				1,469,738
		Page No -8				3,123,296
		Page No -9				362,795
		Total from this Page				9,046,646
Total Carried to Summary						14,002,475

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
4		<u>DPC & MASONRY WORKS</u>				
4.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	315 Sft	100 Sft	5555.26	17,499
4.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	9 Kg	Kg	179.24	1,613
4.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	1049 Cft	100 Cft	27806.49	291,690
	Item # 1+9+12+18+19	First Floor	994 Cft	100 Cft	29118.31	289,436
	Item # 1+9+10+12+18+19	Second Floor	994 Cft	100 Cft	30001.14	298,211
	Item # 1+9+10+10+12+ 18+19	Roof	0 Cft	100 Cft	30883.97	-
4.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	930 Cft	100 Cft	35217.54	327,523
	Item # 44+92+100+70	First Floor	934 Cft	100 Cft	37074.72	346,278
	Item # 34+92+100+70+71	Second Floor	934 Cft	100 Cft	38931.90	363,624
	Item # 44+92+100+70+71 +71	Roof	797 Cft	100 Cft	40789.08	325,089
4.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	67 Cft	100 Cft	35871.8	24,034
Total Carried to Summary						2,284,997

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		<u>THERMAL & MOISTURE PROTECTION</u> Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge In terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.				
5.1	Code-108 Item # 25 Page #49	Second Floor & Above	2116 Sft	100 Sft	8229.59	174,138
Total Carried to Summary						174,138

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		METAL WORKS				
6.1	Code -119 Item # 43 Page # 240	M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.51	-
6.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
6.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	1189 Sft	Sft	1742.19	2,071,464
6.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	0 Sft	Sft	847.22	-
6.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	1189 Sft	Sft	371.82	442,094
6.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	67 Rft	Rft	1123.12	75,249
Total Carried to Summary						2,588,807

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		WOOD WORKS				
7.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor F.Floor S.Floor & Roof	35 Cft 26 Cft 26 Cft	Cft Cft Cft	12731.98 12731.98 12731.98	445,619 331,031 331,031
7.2	Code-120 Item # 63 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip alround with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	1038 Sft	Sft	1695.81	1,760,251
7.3	Code -122 Item #160 Page # 333	Polish & Paint Painting wood work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat complete at any height in any floor . For Door Frame	3590 Sft	100 Sft	5133.35	184,287
7.4	Code-119 Item # 119 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	0 Sft	Sft	371.82	-
7.5	Code-120 Item # 182 Page # 279	Providing and fixing 2 inches (51 mm) thick best quality deodar wood partition fully glazed with glass panes 24 oz. (7.34 kg./SM.) deodar wood beading with putty packing to glasses etc., as required.	0 Sft	Sft	1,772.05	-
Total Carried to Summary						3,052,219

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		FLOOR FINISHES				
		Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.1	Code-117					
	Item # 79 Page# 199	Ground Floor	36 Sft	100 Sft	21944.87	7,900
	Item # 79+94 Page# 199 & 201	First Floor	36 Sft	100 Sft	22538.62	8,114
	Item # 79+94+95 Page# 199 & 201	Second Floor	36 Sft	100 Sft	22942.37	8,259
		Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
8.2	Code-117 Item # 159 Page# 209					
	Item # 159 Page# 209	G.Floor	1584 Sft	100 Sft	36016.99	570,509
	Item # 159 Page# 209	First Floor	1584 Sft	100 Sft	36016.99	570,509
	Item # 159 Page# 209	Second Floor	1584 Sft	100 Sft	36016.99	570,509
Total Carried to Summary						1,735,800

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		<u>WALL FINISHES</u>				
9.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	6300 Sft	100 Sft	4034.92	254,200
	Item # 6+87 Page # 320 & 327	First Floor	6431 Sft	100 Sft	4342.42	279,261
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	6431 Sft	100 Sft	4578.67	294,454
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	1243 Sft	100 Sft	4814.92	59,849
9.2	Code-117 Item # 159 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	1243 Sft	100 Sft	36016.99	447,691
	Item # 159 Page# 209	First Floor	0 Sft	100 Sft	36016.99	-
	Item # 159 Page# 209	Second Floor	1482 Sft	100 Sft	36016.99	533,772
9.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 55 + 58 Page# 219	G.Floor	11 Sft	100 Sft	23338.43	2,567
	Code-118 Item # 55 + 58+60 Page# 219	F.Floor	11 Sft	100 Sft	24229.06	2,665
	Code-118 Item # 55 + 58+60+61 Page# 219	S.Floor	11 Sft	100 Sft	24977.19	2,747

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	508 Sft	100 Sft	5335.06	27,102
	Item # 8+88	O.H.W.T Plaster	359 Sft	100 Sft	5745.06	20,625
9.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	14 Kg	Kg	179.31	2,510
	Item # 30	O.H.W.T	10 Kg	Kg	179.31	1,793
9.6	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	19615 Sft	100 Sft	6737.38	1,321,537
10.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	23054 Sft	100 Sft	3401.25	784,124
Total Carried to Summary						4,034,897.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		<u>CEILING FINISHES</u>				
10.1	Code-122	Internal Ceiling Plaster 1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	1424 Sft	100 Sft	4034.92	57,457
	Item # 6+87 Page # 320 & 327	First Floor	1387 Sft	100 Sft	4342.42	60,229
	Item # 6+87+90 Page # 320, 327 & 328	Second Floor	1387 Sft	100 Sft	4578.67	63,506
	Item # 6+87+90+90 Page # 320, 327 & 328	Roof	142 Sft	100 Sft	4814.92	6,837
10.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	4030 Sft	100 Sft	3401.25	137,070
10.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	5987 Sft	Sft	172.73	1,034,135
10.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	661 Sft	Sft	153.05	101,166
Total Carried to Summary						1,460,400

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	4469 Sft	100 Sft	5335.06	238,424
	Item # 8+88 Page # 320 & 327	First Floor	3545 Sft	100 Sft	5745.06	203,662
	Item # 8+88+91 Page # 320, 327 & 328	Second Floor	3545 Sft	100 Sft	6060.06	214,829
	Item # 8+88+91+91 Page # 320, 327	Roof	2942 Sft	100 Sft	6375.06	187,554
11.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	1864 Sft	100 Sft	1575	29,358
11.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	1462 Sft	100 Sft	4408.75	64,456
11.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	4469 Sft	100 Sft	20706.56	925,376
	Item # 79+82+83+88 Page # 326 & 327	First Floor	3544 Sft	100 Sft	22281.56	789,658
	Item # 79+82+83+88+91 Page # 326 & 327	Second Floor	3544 Sft	100 Sft	22596.56	800,822
	Item # 79+82+83+88+91+91 Page # 326 & 327	Above Second floor & Roof	2943 Sft	100 Sft	22911.56	674,287
11.5	Item # 88 Page # 149 & 150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	0 Cft	100 Cft	73694.78	-
	Item # 88+94	First Floor	0 Cft	100 Cft	75660.59	-
	Item # 88+94+95	Second Floor	0 Cft	100 Cft	77181.74	-
Total Carried to Summary						4,128,426

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	Code-117	C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	293 Sft	100 Sft	9562.54	28,018
12.2	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-
12.3	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	156 Sft	100 Sft	12,237.02	19,090
12.4	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 110 Page# 204	Ground Floor	0 Sft	100 Sft	21,963.50	-
	Item # 110+111 Page# 204	First Floor	0 Sft	100 Sft	22,557.25	-
	Item # 110+111+114 Page# 204	Second Floor	0 Sft	100 Sft	22,949.13	-
Total Carried to Summary						47,108

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
7		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		WOOD WORKS				
		FIRE RATED DOORS				
		Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating, including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	0 Sft	Sft		
7.1	N.S.I					
		Wooden Cabinets				
		Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
7.2	N.S.I					
		Ground Floor	78 Sft	Sft		
		First Floor	78 Sft	Sft		
		Second Floor	78 Sft	Sft		
		Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
7.3	N.S.I					
		Ground Floor	30 Sft	Sft		
		First Floor	30 Sft	Sft		
		Second Floor	30 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		FLOOR FINISHES				
8.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	71 Sft	Sft		
		First Floor	79 Sft	Sft		
		Second Floor	79 Sft	Sft		
8.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	39 Sft	Sft		
		First Floor	39 Sft	Sft		
		Second Floor	39 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		EXTERNAL FINISHES				
11.1	N.S.I	Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
11.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING (" SINDH MADRESSATUL ISLAM UNIVERSITY -HOUSES FOR STAFF BPS (11-15) ") lettering with 48" dia Logo) on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rowel bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		a) Lettering with 4' dia Logo	55 Each	Each		
		b) Logo Plaster (6'-0" x 24'-6")	150 Sft	Sft.		
11.3	N.S.I	Rain Water Spouts Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	6 Each	Each		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
12.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	71 Sft	Sft		
12.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	31 Sft	Sft		
12.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	84 Sft	Sft		
Total Carried to Summary						

ELECTRIC WORK

BILL OF QUANTITIES

SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	EARTHING SYSTEM	
9	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,250	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,355	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	25	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDb) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		MDB-HS	1	No.		
ii		DB-HS-COM	1	No.		
iii		DB-HS-GF1	1	No.		
iv		DB-HS-GF2	1	No.		
v		DB-HS-GF3	1	No.		
vi		DB-HS-1F1	1	No.		
vii		DB-HS-1F2	1	No.		
viii		DB-HS-1F3	1	No.		
ix		DB-HS-2F1	1	No.		
x		DB-HS-2F2	1	No.		
xi		DB-HS-2F3	1	No.		
		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
b)						
i		20A, SPN Isolator	1	No.		
ii		40A, TPN Isolator	1	No.		
c)		Providing & fixing Three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board I/c connection as required. (Syed Brother, PEL)	10	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 10 Sq.mm Cu/PVC Cable	775	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 10 Sq.mm Cu/PVC Cable	195	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
a)						
i		38 mm dia PVC	20	Mtr.		
ii		50 mm dia PVC	135	Mtr.		
		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
b)						
i		50 mm dia UPVC (Class-D)	20	Mtr.		
		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
c)						
d)		Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
a)						
i		10A, One Gang Switch	17	Nos.		
ii		10A, One Gang 2-Way Switch	4	Nos.		
iii		10A, Two Gang Switch	19	Nos.		
iv		10A, Three Gang Switch	27	Nos.		
v		10A, Four Gang Switch	1	Nos.		
vi		One Gang Dimmer with 10A Switch	27	Nos.		
vii		Door Bell Unit	9	No.		
viii		Bell Push Button	9	No.		
ix		10A, 2-Pin 1-Gang Switched Socket Outlet	94	Nos.		
x		15A, 3-Pin Switched Socket Outlet	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	44	Nos.		
ii		Type D2	16	Nos.		
iii		Type D3	75	Nos.		
iv		Type D4	12	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		56" dia Sweep Ceiling Fan	27	Nos.		
ii		8" dia Exhaust Fan	18	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	11	Nos.		
ii		Type W1	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		EARTHING SYSTEM				
a)		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	No.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	20	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	110	Mtr.		HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.		HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.		HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	34	Nos.		HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		HOLD
f)		Providing and installation of Earth Electrode Copperbond earth rod 3 meters and clamp, Polypropelene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		HOLD

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

ELV WORK

BILL OF QUANTITIES

SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
a)	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i	2" dia UPVC Conduit	20	Mtr.		
b)	Providing and laying of following size (inner dia) PVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor. As per specifications and drawings, complete in all respect.				
i	2" dia PVC Conduit	55	Mtr.		
c)	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	1	No.		
d)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	10	No.		
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE COMMUNICATION & CABLING SYSTEM (Passive Equipment Only)				
a)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	27	Nos.		HOLD
b)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (for Voice outlets) in 25mm dia PVC conduit concealed/surface from each outlet to TJB, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	455	Mtr.		
c)	Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Male Student Hostel building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	640	Mtr.		HOLD
d)	Supply, installing, testing and commissioning of following block in Telephone junction box, as per drawing and specification, complete in all respect.				
i	TJB with 50 Pair IDC Block	1	No.		HOLD
e)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing, as build drawing, Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	27	Nos.		HOLD
b)	Supply and installation of CATV 3x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)	Supply and installation of CATV 1x4 Way Splitter with box, complete in all respects.	9	No.		HOLD
d)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	275	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>					

PLUMBING & FIRE

WORKS

[illegible]

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	6	Nos.	12,602.50	75,615
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	6	Nos.	13,420.00	80,520
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthenware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall 1/2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).	12	Nos.	21,880.00	262,560
		Continued..				

Page No. 1

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>PLUMBING FIXTURES (Cont....)</u>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	10	Nos.	6,587.50	65,875
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	10	Nos.	6,127.50	61,275
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	6	Nos.	34,495.00	206,970
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	6	Nos.	3,045.74	18,274
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	12	Nos.	11,812.50	141,750
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	12	Nos.	3,381.75	40,581
		CARRIED TO SUMMARY				953,420

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Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<p><u>SANITARY SEWAGE:</u></p> <p>Manholes and Gully traps</p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg,in 6" thick RCC 1:2:4 slab 8" thick,c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling , disposal of excavated sruff, manhole cover and frame.</p>	9	Nos.	28,528.86	256,760
		CARRIED TO SUMMARY				256,760

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
12	Code-306	WATER SUPPLY: Cold and Hot Water Supply Piping Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	510	Rft	153.45	78,260
ii	Item-30	1" dia	220	Rft	215.32	47,370
iii	Item-31	1¼" dia	230	Rft	320.26	73,660
iv	Item-32	1½" dia	80	Rft	433.66	34,693
v	Item-33	2" dia	140	Rft	747.61	104,665
vi	Item-34	2½" dia	110	Rft	1,147.61	126,237
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
		Valves Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
13	Code-307					
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	2	Nos.	6,366.65	12,733
iv	Item-11	1½" dia	2	Nos.	8,169.15	16,338
v	Item-12	2" dia	6	Nos.	8,699.40	52,196
vi	Item-13	2½" dia	0	Nos.	9,891.15	0
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
		Water Tanks and Connection Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.				
14	Code-307		0	Item	42,500.00	0
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				563,934

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>SANITARY SEWAGE:</u>				
		Soil, Waste, Vent and Rainwater Pipes				
18	Code-306	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
	Item-15	(i) 2" dia	80	Rft.	448.80	35,904
	Item-17	(ii) 3" dia	365	Rft.	520.97	190,154
	Item-18	(iii) 4" dia	95	Rft.	719.12	68,316
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(iv) 6" dia	220	Rft.	716.62	157,656
		Drainage Specialties				
20	Code-301 Item-30	Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	30	Nos	1,459.43	43,783
		Gully traps				
21	Code-314 Item-3	Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	6	Nos.	4,139	24,834
		CARRIED TO SUMMARY				520,648

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Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	16	Nos.	15,896.88	254,350
		CARRIED TO SUMMARY				254,350

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
B NON-SCHEDULE ITEMS						
		<u>WATER SUPPLY (Cont....)</u>				
		Plumbing Specialties:				
7	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
8	Non-Sch	Pumps				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
i		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 25ft. head	1	set		
		CARRIED TO SUMMARY	Total			

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Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	8 0 0	Nos Nos Nos		
12	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	3	Nos		
		Continued..				

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Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
14	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
15		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	14	Nos		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia	360	Rft		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	6	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	3	Nos		
		Sub Total for Non Schedule Items	Total			

VC Residency (Ground Floor)

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

S.No	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	23,011
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	67,080
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	46,040
3	SUPER STRUCTURE (Concrete/RCC and steel works)	111,591
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	-
5	MASONRY WORKS	211,441
6	THERMAL & MOISTURE PROTECTION	150,519
7	METAL WORKS	742,018
8	WOOD WORKS	968,769
9	FLOOR FINISHES	631,738
10	WALL FINISHES	865,431
11	CEILING FINISHES	58,502
12	EXTERNAL FINISHES (BUILDING)	1,490,733
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Schedule Items - A	5,366,873
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	
5	MASONRY WORKS	
6	THERMAL & MOISTURE PROTECTION	
7	METAL WORKS	
8	WOOD WORKS	
9	FLOOR FINISHES	
10	WALL FINISHES	
11	CEILING FINISHES	
12	EXTERNAL FINISHES (BUILDING)	
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
SCHEDULE ITEMS						
1		EARTH WORKS				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
	Item # 11	From ± 0'-0" to -5' - 0"	200 Cft	100 Cft	1,566.56	3,133
	Item # 11+28	From -5'-0" to -8' - 0"	200 Cft	100 Cft	1,804.06	3,608
	Item # 11+28+28	From - 8'-0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 11+28+28+28	From - 11'-0" to -14' - 0"	0 Cft	100 Cft	2,620.92	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	500 Cft	100 Cft	3,254.05	16,270
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spraws and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						23,011

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i>				
2.1	Code -106	CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	100 Cft	100 Cft	32,221.55	32,222
2.2	Code -106	Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 12	For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	100 Cft	100 Cft	34,857.58	34,858
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 1+136	Foundation for any type (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	38,098.77	-
Total Carried to Collection						67,080

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+135+138	Columns upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	53,250.89	-
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 8+136	Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	40,365.27	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	0 Cft
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	46,752.23	-
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	0 Kg	Kg	282.45	-
Total Carried to Collection						-
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	0 Rft	Rft	592.81	-
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	4555 Sft	100 Sft	1,010.75	46,040
Total Carried to Collection						46,040
		<u>COLLECTION</u>				
		Page No -2				67,080
		Page No -3				-
		Page No -4				-
		Total from this Page				-
Total Carried to Summary (Concrete/RCC and steel works)						67,080
Total Carried to Summary (Excluding Concrete/RCC and steel works)						46,040

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>	0 Sft	Sft		
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURS BIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>				
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		<u>SUPER STRUCTURE</u> Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
3.1	Code -114 Item # 4+135+138	Columns (Cylindrical Strength 4000 Psi) Ground Floor	0 Cft	100 Cft	64,028.94	-
3.2	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 30+135+138	RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi) Ground Floor	0 Cft	100 Cft	58,813.05	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 38+136	Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	47,322.89	-
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 57+136	Slab i/c projections (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	43,716.64	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 50+136	Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi) Ground Floor	0 Cft	100 Cft	57,830.03	-
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136,	OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	59,318.88	-
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 112+136	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	62,314.57	-
Total Carried to Collection						-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 118+136	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi)	50 Cft	100 Cft	53,711.28	26,856
3.9	Code -114	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>				
	Item # 166	Ground Floor	300 Kg	Kg	282.45	84,735
Total Carried to Collection						111,591
		<u>COLLECTION</u>				
		Page No -7				-
		Page No -8				-
		Page No -9				-
		Total from this Page				111,591
Total Carried to Summary						111,591

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		<u>DPC & MASONRY WORKS</u>				
5.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	0 Sft	100 Sft	5555.26	-
5.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
5.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	100 Cft	100 Cft	27806.49	27,806
	Item # 1+9+12+18+19	Roof	0 Cft	100 Cft	29118.31	-
5.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	100 Cft	100 Cft	35217.54	35,218
	Item # 44+92+100+70	Roof	380 Cft	100 Cft	37074.72	140,884
5.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	21 Cft	100 Cft	35871.8	7,533
Total Carried to Summary						211,441

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		<u>THERMAL & MOISTURE PROTECTION</u> Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge In terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete* on ground floor roof.				
6.1	Code-108 Item # 25 Page #49	Second Floor & Above	1829 Sft	100 Sft	8229.59	150,519
Total Carried to Summary						150,519

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		METAL WORKS				
7.1	Code -119 Item # 43 Page # 240	M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.50	-
7.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
7.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	351 Sft	Sft	1742.19	611,509.00
7.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partiton as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	0 Sft	Sft	847.22	-
7.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	351 Sft	Sft	371.82	130,509.00
7.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	0 Rft	Rft	1123.12	-
Total Carried to Summary						742,018

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		WOOD WORKS				
8.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor Roof	24 Cft 0 Cft	Cft Cft	12731.98 12731.98	305,568.00 -
8.2	Code-120 Item # 66 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip around with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	354 Sft	Sft	1695.81	600,317.00
8.3	Code -122 Item #189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	1225 Sft	100 Sft	5133.35	62,884.00
8.4	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	0 Sft	Sft	371.82	-
Total Carried to Summary						968,769

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		FLOOR FINISHES				
9.1	Code-117	Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 97 Page# 199	Ground Floor	0 Sft	100 Sft	21944.87	-
9.2	Code-117 Item # 179 Page# 209	Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 179 Page# 209	G.Floor	1754 Sft	100 Sft	36016.99	631,738.00
9.3	Code-117 Item # 97 Page# 208	Providing and laying floor 1 inch (25 mm) thick of cement tiles 12" X 12" X 1" (1 /2" topping and 1 /2 inch base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in grey cement in ground floor over 1 inch (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with neat cement slurry, polishing and curing etc. complete including the cost of mortar. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		G.Floor	0 Sft	100 Sft		-
Total Carried to Summary						631,738

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		WALL FINISHES				
10.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	5973 Sft	100 Sft	4034.92	241,006
	Item # 6+87 Page # 320 & 327	Roof	0 Sft	100 Sft	4342.42	-
10.2	Code-117 Item # 159 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 159 Page# 209	G.Floor	528 Sft	100 Sft	36016.99	190,170
10.3	Code-118 Item # 55 + 58 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 51+56 Page# 219	G.Floor	0 Sft	100 Sft	23338.43	-
	Code-118 Item # 51+56+58 Page# 219	Roof	29 Sft	100 Sft	24229.06	7,026
10.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc.,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	162 Sft	100 Sft	5335.06	8,643
	Item # 8+88	O.H.W.T Plaster	247 Sft	100 Sft	5745.06	14,190
10.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	4 Kg	Kg	179.31	717
	Item # 30	O.H.W.T	7 Kg	Kg	179.31	1,255
10.6	Code-122 Item # 162	Painting with (ICI) Deluxe plastic emulsion paint VIP of approved shade two coats over and including the cost of one priming coat complete over plastered surface at any height in any floor .	5973 Sft	100 Sft	6737.38	402,424
Total Carried to Summary						865,431.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		CEILING FINISHES				
		Internal Ceiling Plaster				
11.1	Code-122	1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	0 Sft	100 Sft	4034.92	-
	Item # 6+87 Page # 320 & 327	Roof	0 Sft	100 Sft	4342.42	-
11.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	1720 Sft	100 Sft	3401.25	58,502
11.3	Code-124 Item # 186 Page# 361	Providing and fixing Gypsum board 2' x 2'x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	0 Sft	Sft	172.73	-
11.4	Code-124 Item # 187 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	0 Sft	Sft	153.05	-
Total Carried to Summary						58,502

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES				
		External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
12.1	Code-122 Item # 8 Page # 320 Item # 8+88 Page # 320 & 327	Ground Floor	3982 Sft	100 Sft	5335.06	212,442
		Roof	1319 Sft	100 Sft	5745.06	75,777
12.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	1319 Sft	100 Sft	1575	20,774
12.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	617 Sft	100 Sft	4408.75	27,202
12.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327 Item # 79+82+83+88 Page # 326 & 327	Ground Floor	3982 Sft	100 Sft	20706.56	824,535
		Roof	1319 Sft	100 Sft	22281.56	293,894
12.5	Item # 88 Page # 149 & 150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88 Item # 88+94	Ground Floor	0 Cft	100 Cft	73694.78	-
		Roof	0 Cft	100 Cft	75660.59	-
	Code-117	Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	92 Sft	100 Sft	9562.54	8,798
12.6	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 110 Page# 204	Ground Floor	111 Sft	100 Sft	24,604.32	27,311
Total Carried to Summary						1,490,733

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		WOOD WORKS				
		Wooden Cabinets				
8.1	N.S.I	Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partal wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	43 Sft	Sft		
		Roof	0 Sft	Sft		
8.2	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partal wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	43 Sft	Sft		
		Roof	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		FLOOR FINISHES				
9.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	25 Sft	Sft		
		Roof	0 Sft	Sft		
9.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	12 Sft	Sft		
		First Floor	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES				
12.1	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	131 Rft	Rft		
12.2	N.S.I	Providing and fixing Kaprail/Clay Tile of approved size, thickness, colors & patterns, over roof., including fixing with 1:4 cement sand mortar/Dry bond, grouting with approved material including cutting, jointing, curing, etc complete in all respect as per drawings, specifications and the satisfaction of he Engineer. (at any height in any floor)	900 Sft	Sft		
Total Carried to Summary						

ELECTRIC WORK

BILL OF QUANTITIES
SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	196	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	224	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	140	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		DB-VC-GF	1	No.		
b)		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
i		20A, SPN Isolator	2	Nos.		
c)		Providing & fixing Three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board I/c connection as required. (Syed Brother, PEL)	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 10 Sq.mm Cu/PVC Cable	40	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 10 Sq.mm Cu/PVC Cable	10	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		38 mm dia PVC	10	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		50 mm dia UPVC (Class-D)	45	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	2	Nos.		
d)		Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	2	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
a)						
i		10A, One Gang Switch	9	Nos.		
ii		10A, Two Gang Switch	6	Nos.		
iii		10A, Two Gang Switch Weatherproof type	1	Nos.		
iv		10A, Four Gang Switch	5	Nos.		
v		20A Double Pole Switch	2	Nos.		
vi		One Gang Dimmer with 10A Switch	5	Nos.		
vii		Two Gang Dimmer with 10A Switch	3	Nos.		
viii		Door Bell Unit	1	No.		
ix		Bell Push Button	1	No.		
x		Shaver Socket	2	Nos.		
xi		10A, 2-Pin 1-Gang Switched Socket Outlet	21	Nos.		
xii		15A, 3-Pin Switched Socket Outlet	1	No.		
xiii		Flex Outlet	2	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	12	Nos.		
ii		Type D3	30	Nos.		
iii		Type F1	2	Nos.		
iv		Type M1	3	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		48" dia Sweep Ceiling Fan	6	Nos.		
ii		56" dia Sweep Ceiling Fan	5	Nos.		
iii		8" dia Exhaust Fan	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	3	Nos.		
ii		Type W1	2	Nos.		
iii		Type W2	5	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

ELV WORK

BOQ

SUMMARY OF COST

[illegible]

BOQ

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
a)	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i	2" dia UPVC Conduit	15	Mtr.		
b)	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	1	No.		
c)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	1	No.		
CARRIED TO ELV SUMMARY =====>>>					

BOQ

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE COMMUNICATION & CABLING SYSTEM (Passive Equipment Only)				
a)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging,as per drawing and specification, complete in all respect.	4	Nos.		HOLD
b)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (for Voice outlets) in 25mm dia PVC conduit concealed/surface from each outlet to TJB, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	60	Mtr.		
c)	Supply, laying, testing and commissioning of Cat 5e, 10 pair Backbone cable from Faculty Apartment Type-A to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	65	Mtr.		HOLD
d)	Supply, installing, testing and commissioning of following block in Telephone junction box, as per drawing and specification, complete in all respect.				
i	TJB with 10 Pair IDC Block	1	No.		HOLD
e)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing,as build drawing,Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>>					

BOQ

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	4	Nos.		HOLD
b)	Supply and installation of CATV 2x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	55	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>					

PLUMBING & FIRE

WORKS

[illegible]

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	1	Nos.	12,602.50	12,603
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	4	Nos.	13,420.00	53,680
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthenware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall 1/2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).	4	Nos.	21,880.00	87,520
		Continued..				

Page No. 1

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>PLUMBING FIXTURES (Cont....)</u>				
5	301-13	Providing and fixing Shower tray made of fiber glass of any color and design 31 inches x 31 inches (787 mm x 787 mm).	4	Nos.	6,587.50	26,350
6	301-20	Providing and fixing standing wall shower of CP brass 3 knobs of approved quality mixer unit and moveable shower head complete..	4	Nos.	6,127.50	24,510
7	301-21	Providing and fixing approved quality stainless steel sink 60" x 20" Pak made (Atlas) complete with brass oxidized bolt kit/angle iron brackets built into walls ½" dia CP sink mixer 1-1/4" rubber plug and CP brass chain 1-1/4" CP brass waste 1-1/4" dia malleable iron or CP brass bottle trap with malleable iron or brass unions and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	1	Nos.	34,495.00	34,495
8	302-6	Providing and fixing 20 inches x 16 inches (508 mm x 406 mm) Looking mirror of Belgium glass complete with Plastic frame and C.P. Brass screws.	3	Nos.	3,045.74	9,137
9	302-9	Providing and fixing bath room accessories of set of 6 pieces consist of one shelf, one towel rod with bracket, one soap dish, one tooth brush holder with glass and cover, one tissue paper holder one double hook one towel ring etc. complete of approved quality as per direction of Engineer in-charge.	4	Nos.	11,812.50	47,250
10	302-13	Providing and fixing chrome plated Muslim bib-cock without Muslim shower of approved quality	4	Nos.	3,381.75	13,527
		CARRIED TO SUMMARY				309,072

Page No. 2

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<p><u>SANITARY SEWAGE:</u></p> <p>Manholes and Gully traps</p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg, in 6" thick RCC 1:2:4 slab 8" thick, c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling, disposal of excavated stuff, manhole cover and frame.</p>	4	Nos.	28,528.86	114,115
		CARRIED TO SUMMARY				114,115

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
12	Code-306	WATER SUPPLY: Cold and Hot Water Supply Piping Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	240	Rft	153.45	36,828
ii	Item-30	1" dia	40	Rft	215.32	8,613
iii	Item-31	1¼" dia	60	Rft	320.26	19,216
iv	Item-32	1½" dia	110	Rft	433.66	47,703
v	Item-33	2" dia	150	Rft	747.61	112,142
vi	Item-34	2½" dia	30	Rft	1,147.61	34,428
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
13	Code-307	Valves Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	2	Nos.	6,366.65	12,733
iv	Item-11	1½" dia	2	Nos.	8,169.15	16,338
v	Item-12	2" dia	1	Nos.	8,699.40	8,699
vi	Item-13	2½" dia	0	Nos.	9,891.15	0
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
14	Code-307	Water Tanks and Connection Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	0	Item	42,500.00	0
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				314,481

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>SANITARY SEWAGE:</u>				
		Soil, Waste, Vent and Rainwater Pipes				
18	Code-306	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
	Item-15	(i) 2" dia	30	Rft.	448.80	13,464
	Item-17	(ii) 3" dia	150	Rft.	520.97	78,146
	Item-18	(iii) 4" dia	80	Rft.	719.12	57,530
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(iv) 6" dia	240	Rft.	716.62	171,989
		Drainage Specialties				
20	Code-301 Item-30	Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	6	Nos	1,459.43	8,757
		Gully traps				
21	Code-314 Item-3	Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	4	Nos.	4,139	16,556
		CARRIED TO SUMMARY				346,440

Page No. 5

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	2	Nos.	15,896.88	31,794
		CARRIED TO SUMMARY				31,794

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
B NON-SCHEDULE ITEMS						
		<u>WATER SUPPLY (Cont....)</u>				
		Plumbing Specialties:				
7	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
8	Non-Sch	Pumps				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
i		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 25ft. head	1	set		
CARRIED TO SUMMARY			Total			

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	2 0 0	Nos Nos Nos		
12	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	2	Nos		
		Continued..				

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
14	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
15		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	2	Nos		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		<u>FIRE FIGHTING</u> Supply and installation of below mentioned Portable Fire extinguishers with Wall mount brackets as indicated on the drawings, as per specifications and Engineers Recommendation				
i	Non-Sch	12 Kg Automatic Dry Powder Fire extinguisher.	0	Nos.		
		Sub Total for Non Schedule Items	Total			

Page No. 10

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia	70	Rft		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	1	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	1	Nos		
		Sub Total for Non Schedule Items	Total			

Female Faculty Hostel

Female Faculty Hostel

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

Female Faculty	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	53,759
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	1,933,335
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	112,458
3	SUPER STRUCTURE (Concrete/RCC and steel works)	13,207,488
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	-
5	MASONRY WORKS	2,097,400
6	THERMAL & MOISTURE PROTECTION	587,840
7	METAL WORKS	1,087,240
8	WOOD WORKS	2,357,254
9	FLOOR FINISHES	2,296,237
10	WALL FINISHES	3,564,765
11	CEILING FINISHES	1,000,276
12	EXTERNAL FINISHES (BUILDING)	2,981,860
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	202,980
	Schedule Items - A	31,482,892
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	
5	MASONRY WORKS	
6	THERMAL & MOISTURE PROTECTION	
7	METAL WORKS	
8	WOOD WORKS	
9	FLOOR FINISHES	
10	WALL FINISHES	
11	CEILING FINISHES	
12	EXTERNAL FINISHES (BUILDING)	
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

Female Faculty	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
SCHEDULE ITEMS						
1		<u>EARTH WORKS</u>				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as				
	Item # 11	From ± 0'-0" to -5' - 0"	939 Cft	100 Cft	1,566.56	14,710
	Item # 11+28	From -5'-0" to -8' - 0"	0 Cft	100 Cft	1,804.06	-
	Item # 11+28+28	From - 8'-0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 11+28+28+28	From - 11'-0" to -14' - 0"	0 Cft	100 Cft	2,620.92	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer	1200 Cft	100 Cft	3,254.05	39,049
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spralls and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						53,759

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i>				
2.1	Code -106	CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer				
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	2277 Cft	100 Cft	32,221.55	733,685
2.2	Code -106	Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer				
	Item # 12	For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	262 Cft	100 Cft	34,857.58	91,327
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer				
	Item # 1+136	Foundation for any type (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	38,098.77	-
Total Carried to Collection						825,012

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 4+137+138	Columns upto plinth (Cylindrical Strength 3125 Psi)	0 Cft	100 Cft	42,339.37	-
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the				
	Item # 9+135+138	RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the				
	Item # 8+136	Plinth Beams l/c nibs / projections (Cylindrical Strength 2500 Psi)	614 Cft	100 Cft	40,365.27	247,843
Total Carried to Collection						247,843

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31431 Cft	0 Cft
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	45 Cft	100 Cft	46,752.23	21,039
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	54,533.03	-
Total Carried to Collection						21,039

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	2972 Kg	Kg	282.45	839,441
Total Carried to Collection						839,441
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer	25 Rft	Rft	592.81	14,820
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	9660 Sft	100 Sft	1,010.75	97,638
Total Carried to Collection						112,458
		<u>COLLECTION</u>				
		Page No -2				825,012
		Page No -3				247,843
		Page No -4				21,039
		Total from this Page				839,441
Total Carried to Summary (Concrete/RCC and steel works)						1,933,335
Total Carried to Summary (Excluding Concrete/RCC and steel works)						112,458

Rem ale Facu lty	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>				
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSIN or TENKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>				
Total Carried to Summary						

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		<u>SUPER STRUCTURE</u> Note: All RCC Concrete will be used only Ready mixed.				
3.1	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. Columns (Cylindrical Strength 3125 Psi)	1500 Cft	100 Cft	56,426.80	846,402
3.2	Code -114	Ground Floor Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the				
	Item # 30+135+138	RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi) Ground Floor	0 Cft	100 Cft	58,813.05	-
Total Carried to Collection						846,402

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi)				
	Item # 38+136	Ground Floor	2635 Cft	100 Cft	47,322.89	1,246,958
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as				
	Item # 57+136	Slab i/c projections (Cylindrical Strength 2500 Psi) Ground Floor	4670 Cft	100 Cft	43,716.64	2,041,567
Total Carried to Collection						3,288,525

Female Faculty Hostel	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi)				
	Item # 50+136	Ground Floor	210 Cft	100 Cft	57,830.03	121,443
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 114+136,	OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)	40 Cft	100 Cft	59,318.88	23,728
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the				
	Item # 112+136	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	70 Cft	100 Cft	62,314.57	43,620
Total Carried to Collection						188,791

Female Faculty	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer.				
	Item # 118+136	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi)	25 Cft	100 Cft	53,711.28	13,428
3.9	Code -114	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>				
	Item # 166	Ground Floor	31405 Kg	Kg	282.45	8,870,342
Total Carried to Collection						8,883,770
		<u>COLLECTION</u>				
		Page No -7				846,402
		Page No -8				3,288,525
		Page No -9				188,791
		Total from this Page				8,883,770
Total Carried to Summary						13,207,488

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		DPC & MASONRY WORKS				
5.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	0 Sft	100 Sft	5555.26	-
5.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
5.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	1870 Cft	100 Cft	27806.49	519,981
	Item # 1+9+12+18+19	Roof	409 Cft	100 Cft	29118.31	119,094
5.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	3416 Cft	100 Cft	35217.54	1,203,031
	Item # 44+92+100+70	Roof	587 Cft	100 Cft	37074.72	217,629
5.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	105 Cft	100 Cft	35871.8	37,665
Total Carried to Summary						2,097,400

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		<u>THERMAL & MOISTURE PROTECTION</u> Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge In terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.				
6.1	Code-108 Item # 25 Page #49	Second Floor & Above	7143 Sft	100 Sft	8229.59	587,840
Total Carried to Summary						587,840

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		<u>METAL WORKS</u>				
7.1	Code -119 Item # 43 Page # 240	M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.51	-
7.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
7.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting ,fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	469 Sft	Sft	1742.19	817,087
7.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	50 Sft	Sft	847.22	42,361
7.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	519 Sft	Sft	371.82	192,975
7.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	31 Rft	Rft	1123.12	34,817
Total Carried to Summary						1,087,240

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		WOOD WORKS				
8.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors, windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor Roof	60 Cft 3 Cft	Cft Cft	12731.98 12731.98	763,919 38,196
8.2	Code-120 Item # 63 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip alround with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	843 Sft	Sft	1695.81	1,429,568
8.3	Code -122 Item #189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	2381 Sft	100 Sft	5133.35	122,225
8.4	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	9 Sft	Sft	371.82	3,346
Total Carried to Summary						2,357,254

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		FLOOR FINISHES				
9.1	Code-117	Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 97 Page# 199	Ground Floor	721 Sft	100 Sft	21944.87	158,223
9.2	Code-117 Item # 179 Page# 209	Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 179 Page# 209	G.Floor	5666 Sft	100 Sft	36016.99	2,040,723
9.3	Code-117 Item # 117 Page# 208	Providing and laying floor 1 inch (25 mm) thick of cement tiles 12" X 12" X 1" (1 /2" topping and 1 /2 inch base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in grey cement in ground floor over 1 inch (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with neat cement slurry, polishing and curing etc. complete including the cost of mortar. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		G.Floor	495 Sft	100 Sft	19654.8	97,291
Total Carried to Summary						2,296,237

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		WALL FINISHES				
10.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	23675 Sft	100 Sft	4034.92	955,267
	Item # 6+87 Page # 320 & 327	Roof	910 Sft	100 Sft	4342.42	39,516
10.2	Code-117 Item # 179 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 179 Page# 209	G.Floor	2400 Sft	100 Sft	36016.99	864,408
10.3	Code-118 Item # 51 + 56 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 51+56 Page# 219	G.Floor	79 Sft	100 Sft	23338.43	18,437
	Code-118 Item # 51+56+58 Page# 219	Roof	29 Sft	100 Sft	24229.06	7,026
10.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc.,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	257 Sft	100 Sft	5335.06	13,711
	Item # 8+88	O.H.W.T Plaster	140 Sft	100 Sft	5745.06	8,043
10.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	7 Kg	Kg	179.31	1,255
	Item # 30	O.H.W.T	4 Kg	Kg	179.31	717
10.6	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	24585 Sft	100 Sft	6737.38	1,656,385
Total Carried to Summary						3,564,765.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		<u>CEILING FINISHES</u>				
		Internal Ceiling Plaster 1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
11.1	Code-122					
	Item # 6 Page # 320	Ground Floor	1459 Sft	100 Sft	4034.92	58,869
	Item # 6+87 Page # 320 & 327	Roof	372 Sft	100 Sft	4342.42	16,154
11.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	1831 Sft	100 Sft	3401.25	62,277
11.3	Code-124 Item # 186 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	1435 Sft	Sft	172.73	247,868
11.4	Code-124 Item # 187 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	4019 Sft	Sft	153.05	615,108
Total Carried to Summary						1,000,276

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES				
12.1	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	6237 Sft	100 Sft	5335.06	332,748
	Item # 8+88 Page # 320 & 327	Roof	4360 Sft	100 Sft	5745.06	250,485
12.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	4360 Sft	100 Sft	1575	68,670
12.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	1520 Sft	100 Sft	4408.75	67,013
12.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	6237 Sft	100 Sft	20706.56	1,291,468
	Item # 79+82+83+88 Page # 326 & 327	Roof	4360 Sft	100 Sft	22281.56	971,476
12.5	Item # 88 Page #149 &150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	0 Cft	100 Cft	73694.78	-
	Item # 88+94	Roof	0 Cft	100 Cft	75660.59	-
Total Carried to Summary						2,981,860

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
		Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc., complete, but excluding the cost of water proofing agent etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
13.1	Item # 3 Code -108 Page # 47	2" thick DPC	0 Sft	100 Sft	5555.26	-
13.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
13.3	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	0 Cft	100 Cft	35217.54	-
13.4	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	0 Sft	100 Sft	5335.06	-
13.5	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	0 Sft	100 Sft	1575	-
13.6	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	0 Sft	100 Sft	4408.75	-
13.7	Code-117	C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	263 Sft	100 Sft	9562.54	25,149
13.8	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warring etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13.9	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	398 Sft	100 Sft	21944.87	87,341
13.10	Code-119 Item # 18 Page# 237	Providing and fixing steel gate of flat iron sections of approved design with or without M.S. sheet covering including hold fast, with or without rollers and track arrangement including providing wicket shutter of required size with all accessories and locking arrangement complete as per direction of the Engineer-in-Charge.	0 Kg	Kg.	346.44	-
13.11	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 130	Ground Floor	412 Sft	100 Sft	21,963.50	90,490
Total Carried to Summary						202,980

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		WOOD WORKS				
		FIRE RATED DOORS				
8.1	N.S.I	Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating, including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	87 Sft	Sft		
8.2	N.S.I	Wooden Cabinets Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partial wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	29 Sft	Sft		
		Roof	0 Sft	Sft		
8.3	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partial wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	14 Sft	Sft		
		Roof	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		FLOOR FINISHES				
9.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	151 Sft	Sft		
		First Floor	0 Sft	Sft		
		Second Floor	0 Sft	Sft		
9.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	76 Sft	Sft		
		First Floor	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
12.1	N.S.I					
12.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING ("SINDH MADRESSATUL ISLAM UNIVERSITY-MALE FACULTY HOSTEL" lettering with 48" dia Logo on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rawal bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. a) Lettering with 4' dia Logo b) Logo Plaster (6'-0" x 24'-6")	50 Each 150 Each	Each Sft.		
12.3	N.S.I	Rain Water Spouts Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	2 Each	Each		
12.4	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
12.5		a) Ornamental Pre cast Columns b) Ornamental Pre cast ball finial with base	0 Rft 0 Rft	Rft Nos		
12.6	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	641 Rft	Rft		
12.7	N.S.I	Providing and fixing Kaprail/Clay Tile of approved size, thickness, colors & patterns, over roof., including fixing with 1:4 cement sand mortar/Dry bond, grouting with approved material including cutting, jointing, curing, etc complete in all respect as per drawings, specifications and the satisfaction of he Engineer. (at any height in any floor)	330 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
13.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	123 Sft	Sft		
13.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	62 Sft	Sft		
13.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	574 Sft	Sft		
Total Carried to Summary						

ELECTRIC WORK

BILL OF QUANTITIES
SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	UPS SYSTEM (ON HOLD)	
9	EARTHING SYSTEM	
10	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,450	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,185	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	480	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
a)		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
i		MDB-FF	1	No.		
ii		DB-FF-GF-L	1	No.		
iii		DB-FF-GF-P	1	No.		
iv		DB-FF-GF-ICT	1	No.		
b)		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
i		20A, SPN Isolator	2	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 25 Sq.mm Cu/PVC Cable	100	Mtr.		
ii		1 Core - 10 Sq.mm Cu/PVC Cable	180	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 16 Sq.mm Cu/PVC Cable	25	Mtr.		
ii		1 Core - 10 Sq.mm Cu/PVC Cable	65	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		25 mm dia PVC	20	Mtr.		
ii		50 mm dia PVC	65	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		100 mm dia UPVC (Class-D)	20	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)		Providing & installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES				
a)		Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
i		10A, One Gang Switch	6	Nos.		
ii		10A, One Gang Switch Weatherproof type	2	Nos.		
iii		10A, One Gang 2-Way Switch	6	Nos.		
iv		10A, Two Gang Switch	35	Nos.		
v		10A, Two Gang Switch Weatherproof type	3	Nos.		
vi		10A, Three Gang Switch	8	Nos.		
vii		10A, Three Gang Switch Weatherproof type	1	Nos.		
viii		10A, Four Gang Switch	2	Nos.		
ix		10A, Four Gang Switch Weatherproof type	1	No.		
x		20A, Double Pole Switch	15	Nos.		
xi		One Gang Dimmer with 10A Switch	16	Nos.		
xii		Two Gang Dimmer with 10A Switch	3	Nos.		
xiii		10A, 2-Pin 1-Gang Switched Socket Outlet	75	Nos.		
xiv		13A, 3 Pin Flat 2-Gang Switched Socket Outlet	2	Nos.		
xv		13A, Unswitched Spur Outlet	2	Nos.		
xvi		15A, 3Pin Switched Socket Outlet	2	Nos.		
xvii		Flex Outlet	15	Nos.		
xviii		32A, 3-Pin Industrial Socket with Plugtop	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS				
a)		Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i		Type D1	41	Nos.		
ii		Type D2	20	Nos.		
iii		Type D3	41	Nos.		
iv		Type D4	8	Nos.		
v		Type LD1	6	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		56" dia Sweep Ceiling Fan	22	Nos.		
ii		8" dia Exhaust Fan	15	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING				
a)		Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
i		Type R1	9	Nos.		
ii		Type W1	8	Nos.		
iii		Type W2	34	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		UPS SYSTEM Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 6 kVA Single Phase in, Single Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external Bypass and all accessories as per specification & drawings, complete in all respect.	1	No.		HOLD
a)						
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		EARTHING SYSTEM				
a)		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	Nos.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
10		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	130	Mtr.		HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350μs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.		HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.		HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	67	Nos.		HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.		HOLD
f)		Providing and installation of Earth Electrode Copper bond earth rod 3 meters and clamp, Polypropylene earth pit, as per drawing and specification, complete in all respect.	6	Nos.		HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.		HOLD

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.		HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

ELV WORK

BILL OF QUANTITIES SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
a)					
i	2" dia UPVC Conduit	50	Mtr.		
	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	2	No.		
b)					
c)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	1	No.		
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE, DATA COMMUNICATION & CCTV CABLING SYSTEMS (Passive Equipment Only) Providing, installation, testing and commissioning of following Data / Voice Cabinets, for patch panel, Fiber panels, adapter, PDU's, Fans and space for active switches as it may require to accommodate complete the entire passive and active network as per the single line diagram drawing and specification, complete in all respect.				
a)					
i	12U Data Rack in IT Room (800mmx800mm)	1	No.		HOLD
b)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	15	Nos.		HOLD
c)	Providing, fixing, testing and commissioning of 4 Pair RJ-45, Cat-6 Simplex Outlet for Data with I/O - Shutter type with 16 SWG back box as per drawing and specification, complete in all respect.	10	Nos.		HOLD
d)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Camera with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	10	Nos.		HOLD
e)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for WIFI with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	3	No.		HOLD
f)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (Data, Voice, Camera, Wifi and Access control system) in 25mm dia PVC conduit concealed/surface from each outlet to IDF racks, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	700	Mtr.		
g)	Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Admin building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	670	Mtr.		HOLD
h)	Supply, laying, testing and commissioning of 2 core single mode OS2 Fiber optic cable from Admin Building to IDF Racks in already laid cable tray / conduit, including with all necessary accessories, as per drawing and specification, complete in all respect.	1340	Mtr.		HOLD

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
j)	Supply, installing, testing and commissioning of 24 port Cat 6, RJ 45 UTP Patch Panel fully loaded with tool less jacks and rear cable manager, as per drawing and specification, complete in all respect.	2	No.		HOLD
k)	Supply, installing, testing and commissioning of 24 port Fiber Patch Panel fully loaded with pigtails etc., and rear cable manager, as per drawing and specification, complete in all respect.	1	No.		HOLD
l)	Supply, installing, testing and commissioning of 19" front/rear (as required) cable organizer between patch panels and active equipment to provide patch cable management including with all necessary accessories, as per drawing and specification, complete in all respect.	3	Nos.		HOLD
m)	Providing, installation, testing and commissioning of CAT-6 UTP (RJ-45 to RJ-45) for the above Patch Panels including with all necessary accessories, as per drawing and specification, complete in all respect.				
i	CAT-6 (1m) Long Patch Cord.	38	Nos.		HOLD
ii	CAT-6 (2m) Long Patch Cord.	38	Nos.		HOLD
n)	Supply, installing, testing and commissioning of following blocks in Data rack, as per drawing and specification, complete in all respect.				
i	100 Pair IDC Block	1	No.		HOLD
o)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing,as build drawing,Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	ACCESS CONTROL SYSTEM				
a)	Supply, installing, testing and commissioning of 2 Door Controller LAN Based with power supply, as per drawings and specification, complete in all respect.	1	No.		HOLD
b)	Supply, installing, testing and commissioning of BIO Proximity Card Reader, as per drawings and specification, complete in all respect.	1	No.		HOLD
c)	Supply, installing, testing and commissioning of Exit Control Push Button, as per drawings and specification, complete in all respect.	1	No.		HOLD
d)	Supply, installing, testing and commissioning of Electromagnetic Door Lock with matching power supply, as per drawings and specification, complete in all respect.	1	No.		HOLD
e)	Supply, installing, testing and commissioning of PVC Card for Reader, as per drawing and specifications, complete in all respect.	15	Nos.		HOLD
f)	Installation, testing, commissioning & programming by Manufacturer Authorized Agent / Dealer and handing over complete Access Control System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
4	CCTV SYSTEM				
a)	Supply, installing, testing and commissioning of 2 MP IP based camera with 1/2.8" CMOS 3.3 to 12mm varfocal lens, power adopter, wall mounted bracket, and IP-65 housing, complete in all respect with fixing accessories, as per drawing and specifications, complete in all respect.	7	Nos.		HOLD
b)	Supply, installing, testing and commissioning of 2 MP IP based indoor Dome camera with 1/2.8" CMOS 3.3 to 9mm varfocal lens, power adopter, complete in all respect with fixing accessories and bracket assembly, as per drawing and specifications, complete in all respect.	3	Nos.		HOLD
c)	Installation, testing, commissioning, programming by Manufacturer Authorized Agent / Dealer and handing over complete CCTV System to Owner with providing training, SOP, complete equipment's manual and warranty documents to owners representative.	1	Job.		HOLD
CARRIED TO ELV SUMMARY =====>>>					-

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
5	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	15	Nos.		HOLD
b)	Supply and installation of CATV 5x4 Way Splitter with box, complete in all respects.	1	No.		HOLD
c)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	215	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>					

PLUMBING & FIRE

WORKS

[illegible]

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<u>PLUMBING FIXTURES:</u> Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.	7	Nos.	12,602.50	88,218
2	301-6	Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4	7	Nos.	13,420.00	93,940
3	301-7	Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthenware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall /2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4 Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal.. Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).	15	Nos.	21,880.00	328,200
		Continued..				

Page No. 1

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<p><u>SANITARY SEWAGE:</u></p> <p>Manholes and Gully traps</p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg, in 6" thick RCC 1:2:4 slab 8" thick, c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling, disposal of excavated stuff, manhole cover and frame.</p>	11	Nos.	28,528.86	313,817
		CARRIED TO SUMMARY				313,817

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
12	Code-306	WATER SUPPLY: Cold and Hot Water Supply Piping Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	560	Rft	153.45	85,932
ii	Item-30	1" dia	150	Rft	215.32	32,298
iii	Item-31	1¼" dia	270	Rft	320.26	86,470
iv	Item-32	1½" dia	150	Rft	433.66	65,049
v	Item-33	2" dia	150	Rft	747.61	112,142
vi	Item-34	2½" dia	120	Rft	1,147.61	137,713
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
13	Code-307	Valves Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	15	Nos.	6,366.65	95,500
iv	Item-11	1½" dia	2	Nos.	8,169.15	16,338
v	Item-12	2" dia	1	Nos.	8,699.40	8,699
vi	Item-13	2½" dia	1	Nos.	9,891.15	9,891
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
14	Code-307	Water Tanks and Connection Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.	1	Item	42,500.00	42,500
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				710,314

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
		<u>SANITARY SEWAGE:</u>				
		Soil, Waste, Vent and Rainwater Pipes				
18	Code-306	Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
	Item-15	(i) 2" dia	100	Rft.	448.80	44,880
	Item-17	(ii) 3" dia	390	Rft.	520.97	203,178
	Item-18	(iii) 4" dia	160	Rft.	719.12	115,059
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(iv) 6" dia	330	Rft.	716.62	236,485
		Drainage Specialties				
20	Code-301 Item-30	Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	33	Nos	1,459.43	48,161
		Gully traps				
21	Code-314 Item-3	Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	12	Nos.	4,139	49,668
		CARRIED TO SUMMARY				697,431

Page No. 5

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	8	Nos.	15,896.88	127,175
		CARRIED TO SUMMARY				127,175

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
B NON-SCHEDULE ITEMS						
		<u>WATER SUPPLY (Cont....)</u>				
		Plumbing Specialties:				
7	Non-Sch	Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
i		1" Air Relief Valve	1	Nos.		
ii		1¼" dia foot valve	1	Nos.		
iii		2" Y-type Strainer	2	Nos.		
iv		2" Flexible Connector	4	Nos.		
8	Non-Sch	Pumps				
	Non-Sch	Supply and installation of below mentioned Transfer Pump Set including pump foundation, control panel, automatic float switch, wiring, valves, piping, accessories, etc., as indicated on the drawing, as per specifications and Engineers approval.				
i		Transfer Pump (1 duty+1 standby) Flow = 100GPM @ 25ft. head	1	set		
		CARRIED TO SUMMARY	Total			

Page No. 7

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	13 0 0	Nos Nos Nos		
12	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	4	Nos		
		Continued..				

Page No. 8

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
14	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
15		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	14	Nos		
		CARRIED TO SUMMARY	Total			

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1	i Non-Sch	FIRE FIGHTING Supply and installation of below mentioned Portable Fire extinguishers with Wall mount brackets as indicated on the drawings, as per specifications and Engineers Recommendation 12 Kg Automatic Dry Powder Fire extinguisher.	0	Nos.		
		Sub Total for Non Schedule Items	Total			

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Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia	40	Rft		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	1	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	1	Nos		
		Sub Total for Non Schedule Items	Total			

Male Faculty

Hostel

S.No	Description	Amount
A	PRELIMINARIES & GENERAL REQUIREMENTS	<i>Included in Permanent works</i>
B	PERMENANT Works	
1	CIVIL WORKS	
2	ELECTRICAL WORKS	
3	ELV WORKS	
4	PLUMBING WORKS	
TOTAL COST		

CIVIL WORK

S.No	Description	Amount
A	SCHEDULE ITEM	
1	EARTH WORKS	351,093
2 (i)	SUB STRUCTURE (Concrete/RCC and steel works)	6,902,886
(ii)	SUB STRUCTURE (Excluding Concrete/RCC and steel works)	176,489
3	SUPER STRUCTURE (Concrete/RCC and steel works)	12,331,410
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	-
5	MASONRY WORKS	2,100,268
6	THERMAL & MOISTURE PROTECTION	587,840
7	METAL WORKS	1,087,240
8	WOOD WORKS	2,357,254
9	FLOOR FINISHES	2,296,237
10	WALL FINISHES	3,564,765
11	CEILING FINISHES	1,000,276
12	EXTERNAL FINISHES (BUILDING)	2,981,860
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	248,710
	Schedule Items - A	35,986,328
	Premium Above / Below in %age	
	Total of Schedule Items - A	
B	NON-SCHEDULE ITEM	
1	EARTH WORKS	
2	SUB STRUCTURE	
3	SUPER STRUCTURE	
4	BOUNDARY WALL STRUCTURE WORKS (NON COVERED AREA)	
5	MASONRY WORKS	
6	THERMAL & MOISTURE PROTECTION	
7	METAL WORKS	
8	WOOD WORKS	
9	FLOOR FINISHES	
10	WALL FINISHES	
11	CEILING FINISHES	
12	EXTERNAL FINISHES (BUILDING)	
13	EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)	
	Total of Non-Schedule Items - B	
	TOTAL CARRIED TO GRAND SUMMARY (A+B)	

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
1	2	3	4		6	7 = 4 x 6
SCHEDULE ITEMS						
1		EARTH WORKS				
1.1	Code -103,	Excavation for foundations trenches, drains, underground tanks and septic tanks in <i>gravelly soil</i> (medium dense to very dense fine to coarse grained sandy gravel) and back filling the excavated material in foundation, plinth or under floor including breaking clods, watering, consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction, dressing and disposal of surplus excavated stuff as directed, lead up to one chain (30.5 R.m) and lift up to 5 feet (1.52 m) etc. complete in all respects as per drawing, standard, specifications and as				
	Item # 11	From ± 0'-0" to -5' - 0"	1000 Cft	100 Cft	1,566.56	15,666
	Item # 11+28	From -5'-0" to -8' - 0"	0 Cft	100 Cft	1,804.06	-
	Item # 11+28+28	From - 8'-0" to -11' - 0"	0 Cft	100 Cft	2,041.56	-
	Item # 11+28+28+28	From - 11'-0" to -14' - 0"	0 Cft	100 Cft	2,279.06	-
1.2	Code -104 Item #8	Supplying earth from approved outside sources within a radius of 5 miles (8 km) including digging, loading and unloading and filling in foundations trenches plinth or under floor, etc. including breaking clods, dressing, watering and consolidation by ramming in layers not exceeding 9 inches (229 mm) in depth to full compaction complete within a lead of one chain (30.5 R.m) and lift of 5 feet (1.52mm) etc. complete, including all lifts etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer	10308 Cft	100 Cft	3,254.05	335,427
1.3	Code -117 Item #1	Providing and laying soling stones 6 inches to 9 inches (152 mm to 229 mm) size under floors/foundations & where required etc. including packing with spraws and chips and consolidating etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer	0 Cft	100 Cft	7,683.13	-
Total Carried to Summary						351,093

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2		SUB STRUCTURE <i>Note: All RCC Concrete will be used only Ready mixed.</i> CONCRETE WORKS Providing and laying in situ 1:4:8 (1 cement 4 sand and 8 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
2.1	Code -106					
	Item # 11	Below plinth beam,situ,walls,tanks, over stone soling or where required (Cylindrical 1000 Psi)	2710 Cft	100 Cft	32,221.55	873,204
2.2	Code -106	Providing and laying in situ 1:3:6 (1 cement 3 sand and 6 coarse aggregate) cement concrete using crushed graded boulders 3/4" inch (19 mm) and down gauge in foundation, basement and plinth including form work, compacting, curing and removal of form work, etc. complete, foundation and basement up to 5 feet (1.52 m) depth and plinth up to 4 feet (1.2 m) height from ground level etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. For Cast in situ / mass concrete or where required (Cylindrical 1500 Psi)	285 Cft	100 Cft	34,857.58	99,344
2.3	Code -114	REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N/mm2 at 28 days) with a mix not leaner than 1:2:4 in columns footing of required shape with columns and pillars, of any shape including form work and its removal, compacting, leveling and curing etc. complete but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 1+136	Foundation for any type (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	38,098.77	-
Total Carried to Collection						972,548

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth. etc. complete in all respects as per drawing, standard , specifications and as Columns upto plinth (Cylindrical Strength 3125 Psi)	1125 Cft	100 Cft	42,339.37	476,318
2.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm ² at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the RCC Wall/Shear Wall upto plinth (Cylindrical Strength 4000 Psi)	0 Cft	100 Cft	56,886.71	-
2.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in plinth beams of required shape and design including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the Plinth Beams i/c nibs / projections (Cylindrical Strength 2500 Psi)	2570 Cft	100 Cft	40,365.27	1,037,387
Total Carried to Collection						1,513,705

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in foundation or bottom slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 99+136	UGWTank Bottom Slab (Cylindrical Strength 2500 Psi)	0 Cft	100 Cft	31,431.41	-
2.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in top slab of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 104+136	UGWTank Top Slab (Cylindrical Strength 2500 Psi)	45 Cft	100 Cft	46,752.23	21,039
2.9	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in walls of rectangular underground water tank or septic tank including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, tn foundation basement and plinth.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
	Item # 101+136	UGWTank Walls (Cylindrical Strength 2500 Psi)	110 Cft	100 Cft	54,533.03	59,986
Total Carried to Collection						81,025

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
2.10	Code -114 Item # 166	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>	15350 Kg	Kg	282.45	4,335,608
Total Carried to Collection						4,335,608
2.11	Code -124 Item # 93	Providing and fixing plain polyvinyl chloride (PVC) water stops 12" (305 mm) wide in vertical or horizontal expansion joints including cutting and jointing complete in all floors etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer	45 Rft	Rft	592.81	26,676
2.12	Code -108 Item # 12	Providing a coat of bitumen emulsion at 10 Lbs. per % sft. (0.49 Kg/sm) on walls and floor in ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	14822 Sft	100 Sft	1,010.75	149,813
Total Carried to Collection						176,489
		<u>COLLECTION</u>				
		Page No -2				972,548
		Page No -3				1,513,705
		Page No -4				81,025
		Total from this Page				4,335,608
Total Carried to Summary (Concrete/RCC and steel works)						6,902,886
Total Carried to Summary (Excluding Concrete/RCC and steel works)						176,489

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
2.13		<u>SUB STRUCTURE</u>	9250 Sft	Sft		
		<u>TERMITE PROOFING</u> Termite control treatment of sub grade soil, excavated surfaces and fill material with HEPTACHLOR emulsifiable to 0.5% with clean water or AGENDA 25 EC containing FIPRONIL or BIFLEX with Bifenthrin or DURSBIN or TENEKIL PLUS or MIRAGE ALI AKBER GROUP or approved equivalent as per manufacturer's specifications and instructions. etc., complete in all respects as per drawing, standard , specifications and as directed by the Engineer. <i>(Note: Plinth Area will be measured one time for payment where is the number of applications will be three times on all horizontal & vertical surfaces of the excavation for termite proofing)</i>				
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3		<u>SUPER STRUCTURE</u> Note: All RCC Concrete will be used only Ready mixed. REINFORCED CONCRETE WORKS Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3750 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1.5:3 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Columns (Cylindrical Strength 3125 Psi)				
3.1	Code -114 Item # 24+134+137	Ground Floor Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in straight walls more than 6 inches (152 mm) thick including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in foundation basement and plinth etc. complete in all respects as per drawing, standard , specifications and as directed by the RCC Wall / Shear Wall (Cylindrical Strength 4000 Psi)	1600 Cft	100 Cft	56,426.81	902,829
3.2	Code -114 Item # 30+135+138	Ground Floor	0 Cft	100 Cft	58,813.05	-
Total Carried to Collection						902,829

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.3	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections (Cylindrical Strength 2500 Psi)				
	Item # 38+136	Ground Floor	2635 Cft	100 Cft	47,322.89	1,246,958
3.4	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as Slab i/c projections (Cylindrical Strength 2500 Psi)				
	Item # 57+136	Ground Floor	4670 Cft	100 Cft	43,716.64	2,041,567
Total Carried to Collection						3,288,525

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.5	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications Stair Case / steps /seats (Steps, Landing & Waist slab) (Cylindrical Strength 2500 Psi)				
	Item # 50+136	Ground Floor	210 Cft	100 Cft	57,830.03	121,443
3.6	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer. OH Water Tank Bottom Slab (Cylindrical Strength 2500 Psi)				
	Item # 114+126		40 Cft	100 Cft	59,318.88	23,728
3.7	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the				
	Item # 112+136	OH Water Tank Walls (Cylindrical Strength 2500 Psi)	70 Cft	100 Cft	62,314.57	43,620
Total Carried to Collection						188,791

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
3.8	Code -114	Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm ² at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard, specifications and as directed				
	Item # 118+136	OH Water Tank Top Slab (Cylindrical Strength 2500 Psi)	25 Cft	100 Cft	57,678.88	14,420
3.9	Code -114	Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi or 414 Mpa) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or Ms. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension.etc. complete in all respects as per drawing, standard, specifications and as directed by the Engineer. <i>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer).</i>				
	Item # 166	Ground Floor	28100 Kg	Kg	282.45	7,936,845
Total Carried to Collection						7,951,265
		<u>COLLECTION</u>				
		Page No -7				902,829
		Page No -8				3,288,525
		Page No -9				188,791
		Total from this Page				7,951,265
Total Carried to Summary						12,331,410

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
5		DPC & MASONRY WORKS				
5.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	0 Sft	100 Sft	5555.26	-
5.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in Item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	16 Kg	Kg	179.24	2,868
5.3	Code-111 Page # 87 & 82	Block Masonry (Hollow & Solids) Providing and laying 1:3:6 cement concrete hollow block masonry of any thickness using graded screened bajri 1/2 inch (13 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking, out Joints and curing etc. complete in basement and ground floor superstructure.				
	Item # 1+12+18+19	Ground Floor	1870 Cft	100 Cft	27806.49	519,981
	Item # 1+9+12+18+19	Roof	409 Cft	100 Cft	29118.31	119,094
5.4	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	3416 Cft	100 Cft	35217.54	1,203,031
	Item # 44+92+100+70	Roof	587 Cft	100 Cft	37074.72	217,629
5.5	Code-110 Page # 76, 80 & 81	Providing and laying 1:3:6 machine made standard size 6"x8"x12" cement concrete solid block masonry more than 6 inches (152 mm) thick in steps, stairs of approved design using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:4 including scaffolding, raking out joints and curing etc. complete in ground floor superstructure etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 34+92+75+68	FOR BLOCK MASONRY STEPS	105 Cft	100 Cft	35871.8	37,665
Total Carried to Summary						2,100,268

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
6		THERMAL & MOISTURE PROTECTION Providing and laying 1:9 cement concrete using screened graded bajri 3/4 inch (19 mm) and down gauge in terracing 3 inches (76 mm) average thickness to required slope in panels including form work, consolidation, finishing, curing etc. and painting the surface with plastic bitumen No. 4 at the rate of 15 lbs per hundred square feet (0.73 Kg per s.m) blinded with sand at the rate of 2 cubic feet per hundred square feet (0.06 Kg per s.m) complete" on ground floor roof.				
6.1	Code-108 Item # 25 Page #49	Second Floor & Above	7143 Sft	100 Sft	8229.59	587,840
Total Carried to Summary						587,840

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
7		METAL WORKS				
7.1	Code -119 Item # 43 Page # 240	M.S. / G.I Door Frame Providing and fixing M.S. moulded steel door frame of 4" x 2-1/2" (102 mm x 64 mm) manufactured from mild steel sheet of 18 gauge (1.41 mm) conforming to BSS. 1245 having a single rebate size 1-1/2" x 1/2" (38 mm x 13 mm) with provision of 3 Nos. M.S. plate, section 1-1/2" x 1/4" (38 mm x 6 mm), (2 Nos. 6 inch long welded with frame at not less than 10 points and 1 No., 12 inch long welded with frame at not less than 20 points), with holes and threads for fixing steel hinges, fitted with one locking box of same sheet (point welded inside the frame), 6 Nos. 6 inches long flat iron fixing lugs, of 1-1/4" x 3/16" section, treated with special red oxide primer coat all around including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height. etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Rft	Rft	393.51	-
7.2	Code -122 Item #159 Page # 333	Painting Iron work with synthetic enamel paint of approved make and shade two coats over and including the cost of one priming coat at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	100 Sft	6071.25	-
7.3	Code -119 Item #70 Page # 244	Providing and fixing double glazed Bronz anodized or Powder Coated aluminium Sliding/openable windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Executive model section double or single glazed 101mm x 37mm and 2mm thick including the cost of aluminium netting, fitting, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	469 Sft	Sft	1742.19	817,087
7.4	Code -119 Item #61 Page # 242	Providing and fixing fully glazed Bronz anodized or powder coated aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan cable and A.C.P. (fixing through their approved fabricators) deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	50 Sft	Sft	847.22	42,361
7.5	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc. including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	519 Sft	Sft	371.82	192,975
7.6	Code -119 Item #54 Page # 242	Providing and fixing G.I. pipe railing of 2" (50 mm) diameter, comprising, vertical posts and horizontal bracing of G.I. pipe of the same dia as per design including cost of specials, bends, threading, cutting and making good the floor or wall of any kind in cement concrete 1:2:4 etc. 'complete in any floor.	31 Rft	Rft	1123.12	34,817
Total Carried to Summary						1,087,240

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
8		WOOD WORKS				
8.1	Code-120 Item # 2 Page # 259	Door Frame Providing and fixing best quality deodar frames for doors. windows, ventilators, clerestory windows, shelves, partitions, trellis work, etc., as required . G.Floor Roof	60 Cft 3 Cft	Cft Cft	12731.98 12731.98	763,919 38,196
8.2	Code-120 Item # 63 Page # 265	Door Shutter Providing and fixing 1-1/2 inches (38 mm) thick pressed veneered door shutters fully flushed with commercial ply wood veneering on all faces and sides fixed over deodar wood cavities core and frame work of not less than 4 inches (102 mm) wide strip around with approved brass hinges and tower bolts etc., as required .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	843 Sft	Sft	1695.81	1,429,568
8.3	Code-122 Item # 189 Page # 336	Polish & Paint Providing & Applying French or spirit polishing, two coat of approved make on wood work at any height in any floor .complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. For Door Frame	2381 Sft	100 Sft	5133.35	122,225
8.4	Code -119 Item #121 Page # 254	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height. For Door Shutter	9 Sft	Sft	371.82	3,346
Total Carried to Summary						2,357,254

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		FLOOR FINISHES				
9.1	Code-117	Mosaic Tiles Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 97 Page# 199	Ground Floor	721 Sft	100 Sft	21944.87	158,223
9.2	Code-117 Item # 179 Page# 209	Porcelain Tiles Providing and laying light colour, glazed/non skid vitrified porcelean tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 179 Page# 209	G.Floor	5666 Sft	100 Sft	36016.99	2,040,723
9.3	Code-117 Item # 117 Page# 208	Providing and laying floor 1 inch (25 mm) thick of cement tiles 12" X 12" X 1" (1 /2" topping and 1 /2 inch base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in grey cement in ground floor over 1 inch (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, jointing and washing the tiles with neat cement slurry, polishing and curing etc., complete including the cost of mortar. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		G.Floor	495 Sft	100 Sft	19654.8	97,291
Total Carried to Summary						2,296,237

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
10		WALL FINISHES				
10.1	Code-122	Internal Wall Plaster 1/2" (13 mm) thick cement plaster 1:6 on wall columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	23675 Sft	100 Sft	4034.92	955,267
	Item # 6+87 Page # 320 & 327	Roof	910 Sft	100 Sft	4342.42	39,516
10.2	Code-117 Item # 179 Page# 209	Dado & Skirting Providing and laying light colour, glazed/non skid vitrified porcelan tiles (Polished) not exceeding 1600 Sqcm each, (Pak made) on walls and floors, in any floor, laid with dry bond (stile bond) over a base of 1" thick cement mortar (1:3) including jointing to tiles with joint filler of approved quality as per direction of the Engineer in charge..complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 179 Page# 209	G.Floor	2400 Sft	100 Sft	36016.99	864,408
10.3	Code-118 Item # 51 + 56 Page# 219	Providing and fixing marble mosaic tile 12" X 6" X 3/4" (305 mm X 152 X 19 mm) with chips No. 0 to 4 in dado and skirting of approved design in light shade over 1 /2 inch (13 mm) thick base of cement mortar 1:3 in ground floor setting of tiles in slurry of grey cement over mortar base including filling of joints and washing the tiles with cement slurry of matching colour curing, grinding, rubbing and polishing etc. complete.				
	Code-118 Item # 51+56 Page# 219	G.Floor	79 Sft	100 Sft	23338.43	18,437
	Code-118 Item # 51+56+58 Page# 219	Roof	29 Sft	100 Sft	24229.06	7,026
10.4	Code-122	Puddlo Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8	U.G.W.T Plaster	257 Sft	100 Sft	5335.06	13,711
	Item # 8+88	O.H.W.T Plaster	140 Sft	100 Sft	5745.06	8,043
10.5	Code-122	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 30	U.G.W.T	7 Kg	Kg	179.31	1,255
	Item # 30	O.H.W.T	4 Kg	Kg	179.31	717
10.6	Code-122 Item # 151	Distemping with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	24585 Sft	100 Sft	6737.38	1,656,385
Total Carried to Summary						3,564,765.00

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
11		CEILING FINISHES				
11.1	Code-122	Internal Ceiling Plaster 1/2" (13 mm) thick cement plaster 1:6 on ceilings cantilever soffits others etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 6 Page # 320	Ground Floor	1459 Sft	100 Sft	4034.92	58,869
	Item # 6+87 Page # 320 & 327	Roof	372 Sft	100 Sft	4342.42	16,154
11.2	Code-122 Item # 151	Distempering with vinyl distemper (ICI) Deluxe Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.	1831 Sft	100 Sft	3401.25	62,277
11.3	Code-124 Item # 182 Page# 361	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i.c hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	1435 Sft	Sft	172.73	247,868
11.4	Code-124 Item # 183 Page# 361	Providing and fixing mineral fiber tiles 2' x 2' x 12mm ceiling including T & L angle hanger clips jointing clips and G.I Wire etc. complete as required in any floor.	4019 Sft	Sft	153.05	615,108
Total Carried to Summary						1,000,276

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES				
12.1	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	6237 Sft	100 Sft	5335.06	332,748
	Item # 8+88 Page # 320 & 327	Roof	4360 Sft	100 Sft	5745.06	250,485
12.2	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	4360 Sft	100 Sft	1575	68,670
12.3	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	1520 Sft	100 Sft	4408.75	67,013
12.4	Code-122	Providing and applying colour Crete 1/4" (6.4 mm) 1:1:2 (1 white cement mixed with pigment, 1 marble powder and 2 marble chips zero No.) with horizontal & vertical joints or Grooves including dragging the surface with wire brush complete with curing etc., over base of 3/4" (19 mm) thick cement plaster 1:3 in plinth, mezzanine and ground floor including chiseling the surface to give texture of stone including the cost of base course etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79+82+83 Page # 326 & 327	Ground Floor	6237 Sft	100 Sft	20706.56	1,291,468
	Item # 79+82+83+88 Page # 326 & 327	Roof	4360 Sft	100 Sft	22281.56	971,476
12.5	Item # 88 Page # 149 & 150	Providing and fixing 1:2 precast reinforced or plain cement concrete jali or louvers up to 2 inches (51 mm) thick in required shape including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in ground floor (no deduction for holes shall be made)				
	Item # 88	Ground Floor	0 Cft	100 Cft	73694.78	-
	Item # 88+94	Roof	0 Cft	100 Cft	75660.59	-
Total Carried to Summary						2,981,860

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
13.1	Item # 3 Code -108 Page # 47	Damp Proof Course (DPC) Providing and laying 2 inches (51 mm) thick damp proof course with cement concrete 1:2:4 cast in situ using graded screened bajri of 3/4 inch (19 mm) and down gauge mixed with any approved water proofing agent including compacting, curing form work and its removal etc. complete, but excluding the cost of water proofing agent .etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		2" thick DPC	0 Sft	100 Sft	5555.26	-
13.2	Item # 5 Code -108 Page # 47	Extra for using water proofing agent pudlo in item Nos. 4.1 (quantity to be used as per manufacturer's specification/2.50Kg per 100Sft).etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Kg	Kg	179.24	-
13.3	Code-110 Page # 77, 80, 81 & 82	Providing and laying 1:3:6 machine made standard size 4"x8"x12" & 6"x8"x12" cement concrete solid block masonry 4 to 6 inches (102 mm to 152 mm) thick using graded screened bajri 3/4 inch (19 mm) and down gauge set in cement mortar 1:6 including scaffolding, raking out joints and curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item #44+92+100	Ground Floor	0 Cft	100 Cft	35217.54	-
13.4	Code-122	External Plaster 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 8 Page # 320	Ground Floor	0 Sft	100 Sft	5335.06	-
13.5	Code-122 Item # 83 Page # 327	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over Item No. 11.1	0 Sft	100 Sft	1575	-
13.6	Code-122	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 172	Ground Floor to Roof	0 Sft	100 Sft	4408.75	-
13.7	Code-117	C.C 1:2:4 Floor Providing and laying floors of 3 inches (76 mm) thick 1:2:4 cement concrete using graded screened bajri 3/4 inch (19 mm) and down gauge in ground floor laid in panels including form work, consolidation, finishing and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 7	Ground Floor	263 Sft	100 Sft	9562.54	25,149
13.8	Code-117 Item # 158 Page# 208	Providing and laying in floor C.C. 1:2:4: tuff pavers 2" thick of approved design and colour and pattern (average strength 7000 psi) laid on sand cushion filling of joint with sand and warping etc. complete as per direction of Engineer In charge. (the cost of sand cushion is included) complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft	135.13	-

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13.9	Code-117	Providing and laying 1 inch (25 mm) thick floor of mosaic marble chips tiles 12" X 12" X 1" (1/2 inch topping 1/2" base) or 305 mm X 305 mm X 25 mm (13 mm topping, 12 mm base) in white cement with approved marble chips in ground floor over 1" (25 mm) lime mortar 1:2 (one lime two sand) including setting the tiles with grey cement slurry over lime mortar, Jointing and washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc. Complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
	Item # 79 Page# 199	Ground Floor	398 Sft	100 Sft	21944.87	87,341
13.10	Code-119 Item # 18 Page# 237	Providing and fixing steel gate of flat iron sections of approved design with or without M.S. sheet covering including hold fast, with or without rollers and track arrangement including providing wicket shutter of required size with all accessories and locking arrangement complete as per direction of the Engineer-in-Charge.	132 Kg	Kg.	346.44	45,730
13.11	Code-117	Providing and laying floor 1 inch (25 mm) thick chequered or ribbed white cement tile 13" X 8" X 1" (1/2 inch topping and 1/2 inch base) or 330 mm X 203 mm X 25 mm (13 mm topping ground floor over treads and stairs and steps with or without carborundum finish with proper nose set in cement and 13 mm base with pigment of light shade in mortar 1:2 (one cement two sand) jointing, washing the tiles with cement slurry of matching colour including grinding, rubbing, polishing and curing etc..				
	Item # 130	Ground Floor	412 Sft	100 Sft	21,963.50	90,490
Total Carried to Summary						248,710

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
NON-SCHEDULE ITEMS						
8		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
		WOOD WORKS				
		FIRE RATED DOORS				
8.1	N.S.I	Providing and fixing wooden fire rated doors single & double leaf as per drawing with frames factory fabricated meet the requirements of the BM TRADA "Q" Mark Third Party Accredited scheme, tested in accordance with BS476 Pt22 1987 achieving a FD 60 minutes fire resisting rating, including standard fire door hardware fire rated locks or exit devices with latching units and exposed door closer (derma or equivalent) key and thumb turn concealed /SS with SS hinges complete 50mm wall size frame and spray paint finish etc., complete from Safeco or approved as per specifications & relevant drawings, and to the entire satisfaction of the Engineer(at any height & any floor)	87 Sft	Sft		
8.2	N.S.I	Wooden Cabinets Providing making and fixing in position floor mounted lower cabinets (Pantry etc.) as per drawing at any height / floor, made of 3/4" thick coloured laminated (both face) Lasani board shutter free from formaldehyde including all around OAK wood lipping kitchen cabinet, 3" x 1-1/2" thick Partial wood frame, complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved as per manufacturer's instruction & specification including all required hardware's for fixing etc,complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	29 Sft	Sft		
		Roof	0 Sft	Sft		
8.3	N.S.I	Providing making and fixing in position wall mounted cabinets for (Kitchen etc.) as per drawing at any height / floor, made of 3/4" thick colored laminated (both side) Lasani board shutter free from formaldehyde including all around Deodar wood lipping 3/8" thick, 3" x 1-1/2" thick Partial wood frame, 6mm one side laminated Lasani board back complete with all accessories i.e. imported hinges, locks, magnetic catchers, best quality handles etc., including any termite treatment, providing & applying 03 coats of approved colour shade lacquer polish by Jaffar Brothers or similar approved equivalent as per manufacturer's instruction & specification including all required hardware's for fixing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (Front face will be measured for payments)				
		Ground Floor	14 Sft	Sft		
		Roof	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
9		All items under this head (Architectural) to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respects and to the entire satisfaction of the Engineer.				
9.1	N.S.I	FLOOR FINISHES Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	0 Sft	Sft		
		First Floor	0 Sft	Sft		
		Second Floor	0 Sft	Sft		
9.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
		Ground Floor	0 Sft	Sft		
		First Floor	0 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
12		EXTERNAL FINISHES Providing & Laying Natural Sand stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 and in any pattern in as per direction of the engineer-in-charge including the cost of curing, making the stone surface smooth etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	0 Sft	Sft		
12.1	N.S.I					
12.2	N.S.I	External Building LOGO's Provide, make, finish and fix in position LOGO & LETTERING ("SINDH MADRESSATUL ISLAM UNIVERSITY-MALE FACULTY HOSTEL" lettering with 48" dia Logo on External walls including 2" thick Plaster in 1:4 cement, sand mortar with LOGO made of Stainless Steel Sheet (size as shown in drawing), fixed to walls with 3" long steel rawal bolts, strictly according to drawings, this includes three coats of plastic emulsion paint and preparation of surface with filling manufactured by ICI, all nails, screws, glues etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. a) Lettering with 4' dia Logo b) Logo Plaster (6'-0" x 24'-6")	0 Each 0 Each	Each Sft.		
12.3	N.S.I	Rain Water Spouts Providing, Making and Fixing in position R.C.C Precast Rain Water spouts (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	2 Each	Each		
12.4	N.S.I	Providing, Making and Fixing ornamental columns, and ball finial comprising of artificial sand stone round & other geometrical shape over around windows & parapet wall (size as shown in drawing), complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
12.5		a) Ornamental Pre cast Columns b) Ornamental Pre cast ball finial with base	0 Rft 0 Rft	Rft Nos		
12.6	N.S.I	Providing & Laying pre cast cornices with 3000 psi concrete over columns, walls, arches & where required with cement sand mortar 1:2 in any pattern in as per direction of the engineer-in-charge including the cost of curing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	641 Rft	Rft		
12.7	N.S.I	Providing and fixing Kaprail/Clay Tile of approved size, thickness, colors & patterns, over roof., including fixing with 1:4 cement sand mortar/Dry bond, grouting with approved material including cutting, jointing, curing, etc complete in all respect as per drawings, specifications and the satisfaction of he Engineer. (at any height in any floor)	330 Sft	Sft		
Total Carried to Summary						

S.No	PWD Schedule 2022 Ref.No	Description	Qty	Unit (Sch. Rate)	Rate (RS)	Amount (RS)
13		EXTERNAL FINISHES OTHER THAN BUILDING (NON COVERED AREA)				
13.1	N.S.I	Providing and laying Terrazzo tiles/slab with bull nosing in one piece /full length (up to 5 feet long) 1-1/2" thick for Treads consisting of 3/4" thick topping 1:2 (One gray cement 2 approved marble chips No. 0 to 4 & chapcha) in white cement over a base 1:2:4 (One cement, two sand & four crush) cement concrete 3/4" thick in any floor laid with cement slurry/dry over existing surface including jointing with approved quality grouting material & grinding, polishing etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft		
13.2	N.S.I	Providing and laying Terrazzo tiles/slab in one pieces for Risers at consisting of 1/2" thick 1:2 (One gray cement 2 approved marble chips No. 0 to 4) laid with cement slurry/dry board over exiting surface in any floor including jointing with approved quality grouting material & grinding, polishing complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	0 Sft	Sft		
13.3	N.S.I	Providing and making Planter/ land escaping as shown on drawing all works comprising (earth filling, sweet earth with manure plants and grassing compacting, curing, finishing & leveling) etc., excluding Tree, complete in all respects as per drawing, standard, specifications and direction of the Engineer.	0 Sft	Sft		
Total Carried to Summary						

ELECTRIC WORK

BILL OF QUANTITIES
SUMMARY OF COST

S. NO.	DESCRIPTION	TOTAL AMOUNT IN PAK RUPEES
NON-SCHEDULE ITEMS		
1	INTERNAL ELECTRIFICATION	
2	L.V. PANELS & DISTRIBUTION BOARDS	
3	LOW VOLTAGE CABLES AND WIRES	
4	CONDUITS & PIPES	
5	WIRING ACCESSORIES	
6	LIGHT FIXTURE & FANS	
7	EXTERNAL LIGHTING	
8	UPS SYSTEM (ON HOLD)	
9	EARTHING SYSTEM	
10	LIGHTNING PROTECTION SYSTEM (LPS) (ON HOLD)	
	TOTAL AMOUNT	

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS						
1		INTERNAL ELECTRIFICATION				
a)		<u>3 WIRE IN PVC RECESSED CONDUIT</u>				
i		Wiring for sub-main with 3x 1.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,450	Mtr.		
ii		Wiring for sub-main with 3x 2.5 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	1,185	Mtr.		
iii		Wiring for sub-main with 3x 4 mm ² , PVC insulated wire 300/500 volts grade, single core, stranded copper conductor wire in 20 mm (3/4")dia PVC conduit recessed in the wall, column and roof etc as required.	480	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
2		L.V. PANELS & DISTRIBUTION BOARDS				
		Supply, installation, testing & commissioning of Wall/Flush mounted Main Distribution Board (MDB) / Sub Main Distribution Board (SMDB) / Distribution Boards (DB), made with 16 SWG sheet steel metal, as per single line diagram, dust protected, vermin proof housing coated with approved color having all the necessary switching & protections, including all mounting accessories as per specifications and drawings, complete in all respect.				
a)						
i		MDB-MF	1	No.		
ii		DB-MF-GF-L	1	No.		
iii		DB-MF-GF-P	1	No.		
iv		DB-MF-GF-ICT	1	No.		
		Supply, installation, testing & commissioning of following Isolators, in 16 SWG sheet steel enclosure with neutral and earth terminal strips, including all mounting accessories as per specification & drawing, complete in all respect.				
b)						
i		20A, SPN Isolator	2	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
3		LOW VOLTAGE CABLES AND WIRES Supply, laying, termination and commissioning of following copper conductor cable In already laid PVC conduit / cable tray / trench as required as per drawing and specification ,complete in all respect.				
a)		1 Core - Cu/PVC Cable (600/1000V)				
i		1 Core - 25 Sq.mm Cu/PVC Cable	100	Mtr.		
ii		1 Core - 10 Sq.mm Cu/PVC Cable	180	Mtr.		
b)		1 Core - CU/PVC Cable as ECC				
i		1 Core - 16 Sq.mm Cu/PVC Cable	25	Mtr.		
ii		1 Core - 10 Sq.mm Cu/PVC Cable	65	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
4		CONDUITS & PIPES				
a)		Providing and laying of following size (inner dia) PVC / UPVC Conduit as race ways with all accessories recessed / surface on wall / column / under floor for Power. As per specifications and drawings, complete in all respect.				
i		25 mm dia PVC	20	Mtr.		
ii		50 mm dia PVC	65	Mtr.		
b)		Providing and laying of UPVC (Class-D) pipe having dia of following size. Buried in ground as per drawing. Including excavation for laying of pipe and backfilling with clean sand (under and above pipe), compaction, concrete, plugging of pipe ends etc. as shown on drawing complete in all respect.				
i		100 mm dia UPVC (Class-D)	20	Mtr.		
c)		Providing and Construction of Manhole Size 600x600x900 mm deep, 6" thick, concrete 1:2:4 ratio with 600mm round heavy duty cast iron cover, 100% water proof, complete in all respect.	1	No.		
d)		Providing & installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	6	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
5		WIRING ACCESSORIES				
a)		Supply, installation, testing & commissioning of following 10/13/15/20A, gang type switches, Dimmer Switches, Sockets including 16 SWG Sheet Steel powder coated back Boxes with earth terminal, recessed in wall, with all accessories as per specification, complete in all respects.				
i		10A, One Gang Switch	6	Nos.		
ii		10A, One Gang Switch Weatherproof type	2	Nos.		
iii		10A, One Gang 2-Way Switch	6	Nos.		
iv		10A, Two Gang Switch	35	Nos.		
v		10A, Two Gang Switch Weatherproof type	3	Nos.		
vi		10A, Three Gang Switch	8	Nos.		
vii		10A, Three Gang Switch Weatherproof type	1	Nos.		
viii		10A, Four Gang Switch	2	Nos.		
ix		10A, Four Gang Switch Weatherproof type	1	No.		
x		20A, Double Pole Switch	15	Nos.		
xi		One Gang Dimmer with 10A Switch	16	Nos.		
xii		Two Gang Dimmer with 10A Switch	3	Nos.		
xiii		10A, 2-Pin 1-Gang Switched Socket Outlet	75	Nos.		
xiv		13A, 3 Pin Flat 2-Gang Switched Socket Outlet	2	Nos.		
xv		13A, Unswitched Spur Outlet	2	Nos.		
xvi		15A, 3Pin Switched Socket Outlet	2	Nos.		
xvii		Flex Outlet	15	Nos.		
xviii		32A, 3-Pin Industrial Socket with Plugtop	1	No.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
6		LIGHT FIXTURE & FANS				
		Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type D1	41	Nos.		
ii		Type D2	20	Nos.		
iii		Type D3	41	Nos.		
iv		Type D4	8	Nos.		
v		Type LD1	6	Nos.		
b)		Supply, installation, testing and commissioning of following items including all connecting accessories as per drawings, specifications, complete in all respects.				
i		56" dia Sweep Ceiling Fan	22	Nos.		
ii		8" dia Exhaust Fan	15	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
7		EXTERNAL LIGHTING Supply, installation, testing & commissioning of following light fixtures complete with starters, Electronic ballast (unless mention otherwise), lamps, lamp holders, drivers, mounting accessories etc., as per specification, complete in all respects. Lighting fixtures sample must be submitted to consultant for approval. Note: Refer light fixtures drawings for complete light fixtures details.				
a)						
i		Type R1	9	Nos.		
ii		Type W1	8	Nos.		
iii		Type W2	34	Nos.		
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
8		UPS SYSTEM Providing, installing, testing & commissioning of True Online Double Conversion UPS rating 6 kVA Single Phase in, Single Phase out, minimum 0.9 output power factor with 10 minutes battery backup, batteries with related DC cables from UPS to batteries, external Bypass and all accessories as per specification & drawings, complete in all respect.	1	No.	HOLD	HOLD
a)						
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
9		EARTHING SYSTEM				
a)		Supply, installing, testing and commissioning of following items for complete earthing system including all connecting accessories as per drawings and specifications complete in all respect.				
i		Earth pit with Rod type earth electrode, 3/4" dia and 3 meters long copper rod .	1	No.		
b)		Supply, Installation, Testing and Commissioning of Earth Copper Bar 300x50x6 mm for earthing system as per drawings and instruction of consultant.	1	Nos.		
c)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable as earth continuity conductor (ECC) in 38 mm dia uPVC conduit, complete in all respect.	30	Mtr.		
CARRIED TO ELECTRICAL SUMMARY =====>>>						

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
10		LIGHTNING PROTECTION SYSTEM (LPS)				
a)		Supply, installation,testing and commissioning of 27mm x 2mm Tinned Copper Tape to be run on roof and on the elevation of the building as required and shown on drawings including all fixing accessories etc.,as per specification, as per site requirement necessary for the functioning of the system and drawing, complete in all respect.	130	Mtr.	HOLD	HOLD
b)		Supply, installation,testing and commissioning of Early Streamer Emission (ESE) Air Terminal mounted on 2 meter elevation mast, as per drawing, complete in all respect and having following specifications: Efficiency: 60 micro seconds Lightning current withstanding test (10/350µs): 100 kA ESE Central Rod: Nickel Plated Copper Metal Housing : Stainless Steel 316L Protection Radius : 31 meter at 2 meter height	1	No.	HOLD	HOLD
c)		Providing and installation of 2 meter high elevation mast consisting side wall mounting bracket for installation and fixing of ESE Air Terminal, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	3	Nos.	HOLD	HOLD
d)		Providing and installation of pyramid holdfasts / studs filled with cement for holding and supporting the flat tape conductor, as per drawing and specification as per site requirement necessary for the system, complete in all respect.	67	Nos.	HOLD	HOLD
e)		Providing and installation of lightning flash counter as per drawing and specification as per site requirement necessary for the system, complete in all respect.	1	No.	HOLD	HOLD
f)		Providing and installation of Earth Electrode Copper bond earth rod 3 meters and clamp, Polypropylene earth pit, as per drawing and specification, complete in all respect.	6	Nos.	HOLD	HOLD
g)		Providing and installation of Test Clamp and Guard Tube 2 m in length, as per drawing and specification, as per specification,as per site requirement necessary for the functioning of the system, complete in all respect.	2	Job.	HOLD	HOLD

BILL OF QUANTITIES

S.NO.	PWD Schedule 2022 Ref.No	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		2	3	4	5	6 = (3 x 5)
h)		Supply, laying, testing and commissioning of 1x70 Sq.mm PVC insulated Cu. Conductor cable in 32 mm dia uPVC Pipe at ground level connecting Lightning protection pits to power earthing pits, complete in all respect.	10	Mtr.	HOLD	HOLD
CARRIED TO ELECTRICAL SUMMARY =====>>>>						

ELV WORK

BILL OF QUANTITIES

SUMMARY OF COST

[illegible]

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
NON-SCHEDULE ITEMS					
1	CONDUITS & PIPES				
a)	Providing and laying of following size UPVC pipe of Class D for ELV Cables (copper / optic fiber). Buried in ground / under roads / under floor as per specification, including excavation for laying of pipe, bricks, warning tape and backfilling with new and fresh soil etc., as shown on the drawing, complete in all respect.				
i	2" dia UPVC Conduit	50	Mtr.		
b)	Providing and Construction of Manhole Size 2' x 2' x 3' mm deep 6" thick concrete 1:2:4 ratio with 2' round heavy duty cast iron cover, 100% water proof, complete in all respect. (For Incoming Telecommunication cables).	2	No.		
c)	Providing and installation of Pull Box as per drawing, specification and requirement at site, complete in all respect.	1	No.		
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
2	VOICE, DATA COMMUNICATION & CCTV CABLING SYSTEMS (Passive Equipment Only)				
a)	Providing, installation, testing and commissioning of following Data / Voice Cabinets, for patch panel, Fiber panels, adapter, PDU's, Fans and space for active switches as it may require to accommodate complete the entire passive and active network as per the single line diagram drawing and specification, complete in all respect.				
i	12U Data Rack in IT Room (800mmx800mm)	1	No.	HOLD	HOLD
b)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Voice with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	15	Nos.	HOLD	HOLD
c)	Providing, fixing, testing and commissioning of 4 Pair RJ-45, Cat-6 Simplex Outlet for Data with I/O - Shutter type with 16 SWG back box as per drawing and specification, complete in all respect.	10	Nos.	HOLD	HOLD
d)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for Camera with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	10	Nos.	HOLD	HOLD
e)	Supply, installing, testing and commissioning of Single RJ-45, Cat-6 outlet for WIFI with shutter type and 16 SWG back box including tagging, as per drawing and specification, complete in all respect.	3	No.	HOLD	HOLD
f)	Supply, laying, testing and commissioning of CAT-6, 4 pair cable for Single RJ-45 outlet (Data, Voice, Camera, Wifi and Access control system) in 25mm dia PVC conduit concealed/surface from each outlet to IDF racks, including tagging and piping with all necessary accessories, complete in all respect. (Cabling on HOLD, only conduiting in Contractor's Scope)	700	Mtr.		
g)	Supply, laying, testing and commissioning of Cat 5e, 25 pair Backbone cable from Admin building to IDF racks in already laid cable tray / conduit, including with all the necessary accessories as per drawing and specifications, complete in all respect.	670	Mtr.	HOLD	HOLD
h)	Supply, laying, testing and commissioning of 2 core single mode OS2 Fiber optic cable from Admin Building to IDF Racks in already laid cable tray / conduit, including with all necessary accessories, as per drawing and specification, complete in all respect.	1340	Mtr.	HOLD	HOLD

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
j)	Supply, installing, testing and commissioning of 24 port Cat 6, RJ 45 UTP Patch Panel fully loaded with tool less jacks and rear cable manager, as per drawing and specification, complete in all respect.	2	No.	HOLD	HOLD
k)	Supply, installing, testing and commissioning of 24 port Fiber Patch Panel fully loaded with pigtails etc., and rear cable manager, as per drawing and specification, complete in all respect.	1	No.	HOLD	HOLD
l)	Supply, installing, testing and commissioning of 19" front/rear (as required) cable organizer between patch panels and active equipment to provide patch cable management including with all necessary accessories, as per drawing and specification, complete in all respect.	3	Nos.	HOLD	HOLD
m)	Providing, installation, testing and commissioning of CAT-6 UTP (RJ-45 to RJ-45) for the above Patch Panels including with all necessary accessories, as per drawing and specification, complete in all respect.				
i	CAT-6 (1m) Long Patch Cord.	38	Nos.	HOLD	HOLD
ii	CAT-6 (2m) Long Patch Cord.	38	Nos.	HOLD	HOLD
n)	Supply, installing, testing and commissioning of following blocks in Data rack, as per drawing and specification, complete in all respect.				
i	100 Pair IDC Block	1	No.	HOLD	HOLD
o)	Installation, testing and commissioning by Manufacturer Authorized Agent / Dealer and handing over complete Voice & Data System to Owner with Providing Training voice data fuke & OTDR Testing,as build drawing,Rack layouts and certification's Principal, complete equipment's Manual and Warranty Documents to Owners representative.	1	Job.	HOLD	HOLD
CARRIED TO ELV SUMMARY =====>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
3	ACCESS CONTROL SYSTEM				
a)	Supply, installing, testing and commissioning of 2 Door Controller LAN Based with power supply, as per drawings and specification, complete in all respect.	1	No.	HOLD	HOLD
b)	Supply, installing, testing and commissioning of BIO Proximity Card Reader, as per drawings and specification, complete in all respect.	1	No.	HOLD	HOLD
c)	Supply, installing, testing and commissioning of Exit Control Push Button, as per drawings and specification, complete in all respect.	1	No.	HOLD	HOLD
d)	Supply, installing, testing and commissioning of Electromagnetic Door Lock with matching power supply, as per drawings and specification, complete in all respect.	1	No.	HOLD	HOLD
e)	Supply, installing, testing and commissioning of PVC Card for Reader, as per drawing and specifications, complete in all respect.	15	Nos.	HOLD	HOLD
f)	Installation, testing, commissioning & programming by Manufacturer Authorized Agent / Dealer and handing over complete Access Control System to Owner with providing training, SOP, complete equipment's manual and warranty documents to Owner's Representative.	1	Job.	HOLD	HOLD
CARRIED TO ELV SUMMARY =====>>>>					

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
4	CCTV SYSTEM				
a)	Supply, installing, testing and commissioning of 2 MP IP based camera with 1/2.8" CMOS 3.3 to 12mm varfocal lens, power adopter, wall mounted bracket, and IP-65 housing, complete in all respect with fixing accessories, as per drawing and specifications, complete in all respect.	7	Nos.	HOLD	HOLD
b)	Supply, installing, testing and commissioning of 2 MP IP based indoor Dome camera with 1/2.8" CMOS 3.3 to 9mm varfocal lens, power adopter, complete in all respect with fixing accessories and bracket assembly, as per drawing and specifications, complete in all respect.	3	Nos.	HOLD	HOLD
c)	Installation, testing, commissioning, programming by Manufacturer Authorized Agent / Dealer and handing over complete CCTV System to Owner with providing training, SOP, complete equipment's manual and warranty documents to owners representative.	1	Job.	HOLD	HOLD
CARRIED TO ELV SUMMARY =====>>>					-

BILL OF QUANTITIES

S.NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	2	3	4	5	6 = (3 x 5)
5	CABLE TELEVISION SYSTEM (CATV)				
a)	Supply, installation, testing and commissioning of TV outlet face plate with 16 SWG back box, complete in all respects.	15	Nos.	HOLD	HOLD
b)	Supply and installation of CATV 5x4 Way Splitter with box, complete in all respects.	1	No.	HOLD	HOLD
c)	Supply and installation of CATV RG-06 Co-axial 75 ohms shielded cable in 25mm dia PVC conduit from Splitter box to TV outlet, complete in all respects. (Cabling on HOLD, only conduiting in Contractor's Scope)	215	Mtr.		
CARRIED TO ELV SUMMARY =====>>>>					

PLUMBING & FIRE

WORKS

Plumbing and Fire Works

[illegible]

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
A SCHEDULE ITEMS						
1	301-1	<p><u>PLUMBING FIXTURES:</u></p> <p>Providing and fixing best quality squatting type glazed earthward W.C.Pan, Pakistan (of not less than 18" clear opening as measured between the flushing rim) Complete with and including the cost of 13.6 liters best quality low level plastic flushing cistern with internal fittings complete, P.V.C. flushing pipe suitable for this type with fittings and making requisite number of holes in walls, plinth & floor for pipe connections and making good in cement concrete 1:2:4.</p>	7	Nos.	12,602.50	88,218
2	301-6	<p>Providing and fixing Pakistani make best available quality European style white glazed earthenware wash down W.C.Pan complete with and including the cost of a plastic seat (PVC cover and buffers 3 galls. (13.6 liters) white glazed earthenware low level flushing cistern with siphon fittings, 1-1/2 inches (40mm) dia white porcelain enameled flush bend, 3/4 inch (20mm) dia, G.I. warning pipe carried outside and bent vertically downwards and making requisite number of holes in walls, plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	7	Nos.	13,420.00	93,940
3	301-7	<p>Providing and fixing Pakistani make flat back lipid front urinal basin (of not less than 17 inches or 430 mm in height of white glazed earthenware complete with and including the cost of one gallon (4.5 liters) glazed earthenware automatic flushing cistern with fittings a pet cock brackets standard flush pipe with fittings, standard waste pipe (enameled iron) connection complete and making requisite number of holes in walls plinth and floor for pipe connections and making good in cement concrete 1:2:4</p>	0	Nos.	18,767.50	-
4	301-8 & 10 & 14	<p>Providing and fixing 25 inches x 18 inches (635 mm x 457 mm) lavatory basin in white glazed earthenware (Pakistani) complete with and including the cost of Brass oxidized bolts kit built into wall /2 inch (15 mm) dia. Chrome plated mixer 1-1/4" inches (32mm) rubber plug and chrome plated brass chain, 1-1/4 inches (32 mm) dia brass waste of approved pattern, 1-1/4 inches (32 mm) dia. Malleable iron or C.P. brass traps malleable iron or brass unions and making requisite number of holes in walls plinth and floor for pipe connections and making god in cement concrete 1:2:4</p> <p>Extra over item No. 8 and 9 (Wasg basin) for providing and fixing best available (Pakistani make) white glazed earthenware pedestal..</p> <p>Extra over item No.8 and 9 for providing single hole chromium plated mixer tap 1/2 inch (15 mm) dia (English or approved foreign make).</p>	15	Nos.	21,880.00	328,200
		Continued..				

Page No. 1

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	315-3	<p><u>SANITARY SEWAGE:</u></p> <p>Manholes and Gully traps</p> <p>Providing manhole Type 'B' size 3'-0" x 2'-6" or 914mm x 762mm x 4ft (1.22mm) deep as per approved design and specifications complete for 4" to 12" diameter pipe, 4 ft. to 7'-5" Depth with cast iron cover and frame weights 1 Cwt. 3 Qtrs or 88.9 kg, in 6" thick RCC 1:2:4 slab 8" thick, c.c. 1:3:6 block masonry walls set in 1:3 c.m. 6" inch thick, 1:3:6, c.c. in foundation 1:2:4 c.c. in benching, 1/2" thick cement plaster in 1:4 c.m. to all inside wall surfaces, channels and benching etc. and top including providing and fixing cast iron foot rest at every foot of depth and making requisite number of main and branch channels complete but excluding that cost of excavation, backfilling, disposal of excavated stuff, manhole cover and frame.</p>	11	Nos.	28,528.86	313,817
		CARRIED TO SUMMARY				313,817

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
12	Code-306	WATER SUPPLY: Cold and Hot Water Supply Piping Supply, installation Testing and Commissioning of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports as indicated on the drawing, as per specifications and Engineers approval.				
i	Item-29	¾" dia	560	Rft	153.45	85,932
ii	Item-30	1" dia	150	Rft	215.32	32,298
iii	Item-31	1¼" dia	270	Rft	320.26	86,470
iv	Item-32	1½" dia	150	Rft	433.66	65,049
v	Item-33	2" dia	150	Rft	747.61	112,142
vi	Item-34	2½" dia	120	Rft	1,147.61	137,713
vii		3" dia	0	Rft		0
viii		4" dia	0	Rft	-	0
		Valves Providing and fixing of PPR Coated, brass Gate valves (of same material as piping) as indicated on the drawing, as per specifications and Engineers approval.				
13	Code-307					
i	Item-8	¾" dia	0	Nos.	2,017.90	0
ii	Item-9	1" dia	2	Nos.	4,012.90	8,026
iii	Item-10	1¼" dia	15	Nos.	6,366.65	95,500
iv	Item-11	1½" dia	2	Nos.	8,169.15	16,338
v	Item-12	2" dia	1	Nos.	8,699.40	8,699
vi	Item-13	2½" dia	1	Nos.	9,891.15	9,891
vii		3" dia	0	Nos.		0
viii		4" dia	0	Nos.	-	0
		Water Tanks and Connection Connection for water tank including with valves, supports, excavation and Backfill, complete all in accordance with the drawing and specifications.				
14	Code-307		1	Item	42,500.00	42,500
15	Item-26	2" Connection to RCC water tanks	1	Nos.	1,588.50	1,589
16	Item-27	Connection to overhead water tanks using Float switch	1	Nos.	4,990.00	4,990
17	Item-26	Cast Iron Medium Duty Cover For RCC water tanks	2	Nos.	1,588.50	3,177
		CARRIED TO SUMMARY				710,314

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
18	Code-306	SANITARY SEWAGE: Soil, Waste, Vent and Rainwater Pipes Providing and fixing, uPVC pipes and fittings as per BS EN 1329 for above ground installations for Soil, Waste, Vent & Rw pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		Item-15 (i) 2" dia	100	Rft.	448.80	44,880
		Item-17 (ii) 3" dia	390	Rft.	520.97	203,178
		Item-18 (iii) 4" dia	160	Rft.	719.12	115,059
19	Item # 27 Page #567	Providing and fixing, uPVC pipes and fittings as per BS EN 1401 for below ground installations for Soil pipes including excavation, backfill, fittings (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
		(iv) 6" dia	330	Rft.	716.62	236,485
20	Code-301 Item-30	Drainage Specialties Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.	33	Nos	1,459.43	48,161
		Gully traps Construction of 18" x 18" Cement Concrete gully trap with 12"x 12" manhole cover as specified and shown on the drawing, as per specifications and Engineers approval.	12	Nos.	4,139	49,668
		CARRIED TO SUMMARY				697,431

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
22	CODE-124 ITEM-27	FIRE FIGHTING Providing and fixing in wall fire extinguisher of approved quality 2 gallons (9.09 litres) capacity complete with brackets including cutting holes in walls, fixing wooden gutties and making good the same with cement concrete 1:2:4 etc. , complete	8	Nos.	15,896.88	127,175
		CARRIED TO SUMMARY				127,175

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
11	Non-Sch	<u>SANITARY SEWAGE:</u> Providing and fixing UPVC cowl for vent pipe of the following dia including all accessories complete in all respects. (i) 3" dia (ii) 4" dia (iii) 6" dia	13 0 0	Nos Nos Nos		
12	Non-Sch	Providing and fixing, PVC Roof Drains as per specifications and Engineers approval.	4	Nos		
		Continued..				

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
14	Non-Sch	<u>SANITARY SEWAGE (Cont....)</u> External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		
15		Storage Water Heaters Supply and installation of Storage type Electric water heater of below mentioned capacity including, 2 no's bass ball valves for piping, Relief valve, Drain, accessories, etc., complete all in accordance with the drawing and specifications. 20 Gallon Capacity	14	Nos		
		CARRIED TO SUMMARY	Total			

Schedule Rates
BILL OF QUANTITIES

Item No.	PWD Schedule 2012 Ref.No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1		GAS WORKS Gas Piping Supply, Installation, testing and Commissioning of G.I Medium Pipes (hot Dipped) with high quality fittings as per BS EN 10255, conforming to Local Gas Company standards including all fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, cutting and fillings complete with testing and as per drawings, specifications and requirements of local gas company. 1/2" dia	40	Rft		
2		Gas Valves Supply, installation, testing and Commissioning of Isolation/Gate valves for Gas piping as indicated on the drawing, as per specifications and Engineers approval. 1/2" dia	1	Nos		
3		CONNECTIONS Supply, Installation, Tersting & Commissioning of Gas Meter Assembly as indicated on the drawing, as per specifications and Engineer's approval.	1	Nos		
		Sub Total for Non Schedule Items	Total			