WEST BENGAL MEDICAL SERVICES CORPORATION LTD.
(Wholly owned by the Government of West Bengal)
Swasthya Sathi, GN-29, Sector-V, Salt Lake, Kolkata - 700 091.

BIDDING DOCUMENTS

FOR

Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis

Bid Reference No.: WBMSCL/NIT- 239/2018 **Dated – 21.12.2018**

SECTION 1

Notice Inviting e-Tender

SECTION – 1

NOTICE INVITING e-TENDER

from eligible bidders for Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis

Issued by:
West Bengal Medical Services Corporation Ltd.,
(Wholly owned by the Government of West Bengal)
CIN: U85110WB2008SGC126373

Regd. Off.: Swasthya Sathi, GN-29, Sector-V, Salt Lake, Kolkata-700 091

 033-4044 0400,  033-4044 0400 **Email ID** – info@wbmsc.gov.in

Bid Reference No.: WBMSCL/NIT- 239/ 2018 **Dated – 21/12/2018**

1. West Bengal Medical Services Corporation Ltd. (WBMSCL), Swasthya Sathi, GN- 29, Sector – V, Salt Lake, Kolkata - 700091, West Bengal has been entrusted by the Health & Family Welfare Department, Government of West Bengal, in terms of the Department's Order Nos. HF/O/MERT/80/W-2018 dated 13th August, 2018 and HF/O/MERT/1513/HFW-24013(15)/13/2018 dated 14th November, 2018 to establish and develop on their behalf to develop 4 nos. of Government medical colleges in the State of West Bengal having capacity of 100 students for admission in 5 years' MBBS course in terms of Medical Council of India (MCI) Guidelines in 2 packages, as shown in the table below.

2. In terms thereof, WBMSCL hereby invites bids through 'e-tendering' from eligible and qualified Indian bidders for "*Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey basis*" at Barasat, Jhargram, Arambagh and Tamluk under the State of West Bengal as shown in the table below **ON TURNKEY BASIS** in **2-BID SYSTEM** as per the Schedule of Requirements given in Section – 5 (Employer's Requirements) hereof**.**

CLUSTER OF UPCOMING MEDICAL COLLEGES & RELATED BID DATA

Package	Location of Medical College	Total Bid Security (Rs. in Crores)	Bid Security payable through e – tendering portal (Rs. in Crores)	Bid Security payable by way of Bank Guarantee (Rs. in Crores)	Time of Completion (Months)
A	Barasat	4.00	0.40	3.60	24 months
	Jhargram	4.00	0.40	3.60	
Total for Package A		**8.00**	**0.80**	**7.20**	
B	Arambagh	4.00	0.40	3.60	24 months
	Tamluk	4.00	0.40	3.60	
Total for Package B		**8.00**	**0.80**	**7.20**	

3. The scope of the Selected Bidder would be planning, design and construction of medical colleges in terms of the Guidelines of Medical Council of India (MCI) or any such apex statutory authority regulating medical education in India alongwith supply and installation of medical equipment and furniture in such colleges. Such colleges shall comprise of academic buildings, two separate hostels for male and female students, interns and resident doctors and separate staff quarters in terms of the Guidelines of Medical Council of India (MCI) or any such apex statutory authority regulating medical education in India as well as a standalone Out Patient Department (OPD) building in all the sites as explained in detail in the Bill of Quantities (BOQ).

4. Intending bidders may download the Bidding Documents from the websites https://www.wbtenders.gov.in, www.wbhealth.gov.in and www.wbmsc.gov.in directly. Bidding Documents may be downloaded from the website and Technical Bid/Financial Bid submitted as per the Schedule stated in Sl. 10.

5. The documents submitted by the bidders should be properly indexed and digitally signed. Both Technical Bid and Financial Bid in respect of each bid are to be submitted in technical (statutory & non-statutory folder) and financial folder concurrently and duly digitally signed in the website https://www.wbtenders.gov.in on or before the date and time mentioned in Sl. 10 of this e-NIT.

6. Appropriate Earnest Money / Bid Security of an amount as mentioned in Sl. 2 hereinabove have to be deposited by the bidder at the time of submission of the Technical Bids and the Financial Bids, on per package basis. The Earnest Money / Bid Security to be submitted for each package is an amount of Rs. 8,00,00,000/- (Rupees Eight Crores only), for which an amount of Rs. 80,00,000/- (Rupees Eighty Lakhs only) may be transferred by way of netbanking to the designated bank account as mentioned in the website https://www.wbtenders.gov.in and the balance Rs. 7,20,00,000/- (Rupees Seven Crores Twenty Lakhs only) may be furnished by way of a bank guarantee in favour of "West Bengal Medical Services Corporation Limited" issued by any scheduled bank and also to be documented through e-filing (scan copy is to be submitted). The original part of online submission of the bank guarantee comprising 90% of the Bid Security shall be submitted physically at the office of WBMSCL under sealed cover within the prescribed date and time limit stated in Sl. 10 of this e-NIT. However, WBMSCL will not be held responsible for late delivery or loss of the Bank Guarantee so mailed through post/courier.

7. The Financial Bid of the bidders will be considered only if the Technical Bid (both statutory and non-statutory documents) of the bidder is found qualified by the Tender Evaluation Committee of WBMSCL. The decision of the Tender Evaluation Committee will be final and absolute in this respect. The list of responsive / technically qualified and non-responsive bidders will be displayed in the websites referred to in Sl. 4 of the e-NIT, on the scheduled date and time.

8. Eligibility criteria for participation in the tender

(i) The Tender Evaluation Committee of WBMSCL will determine the eligibility of each bidder. The bidders shall have to meet the minimum eligibility criteria regarding:

(a) Financial Capacity

(b) Technical Capability comprising of personnel and equipment capability

(c) Experience/Credentials.

(ii) The eligibility of a bidder will be ascertained on the basis of the digitally signed documents in support of the minimum criteria as mentioned in (a), (b) and (c) above. If any document submitted by a bidder is either manufactured or false, in such cases the eligibility of the bidder will be rejected outright at any stage without any prejudice to the rights of WBMSCL.

(iii) The bidders shall have to meet the following eligibility criteria:

(a) The bidder shall be a registered WBPWD Class - I/ CPWD /reputed construction company /agency registered under the relevant laws in India / Public Sector Undertaking— subject to ITB 4.5, with a permanent office at Kolkata.

(b) Bidder(s) must have satisfactorily completed as a contractor:

A. For being qualified for a single package, minimum one multi- storied building construction project (non-residential) of Rs. 250 Crores or upto three multi-storied building construction projects totaling Rs. 250 Crores, out of which 1 shall be of a minimum value of Rs. 100 Crores all on **TURNKEY BASIS** (Planning, Design & Execution) comprising from preparation of architectural plan and elevation, structural design and drawing and related inter-disciplinary services including internal and external electrification and fire-fighting works at any place(s) in India during the last 7 (seven) financial years ending on the

last day of the month previous to the one in which the tender is invited.

B. For being qualified for both packages, minimum one multi-storied building construction project (non-residential) of Rs. 450 Crores or upto three multi-storied building construction projects totaling Rs. 450 Crores, out of which 1 shall be of a minimum value of Rs. 200 Crores all on **TURNKEY BASIS** (Planning, Design & Execution) comprising from preparation of architectural plan and elevation, structural design and drawing and related inter-disciplinary services including internal and external electrification and fire-fighting works at any place(s) in India during the last 7 (seven) financial years ending on the last day of the month previous to the one in which the tender is invited.

N.B. – (1) Partially completed works shall also be considered for determining the eligibility criteria in A and B above, if documentary evidence in support of the fact that the value of the completed portion is Rs. 100 Crores or more (for single package) or Rs. 200 Crores (for both packages) can be produced.

(2) For projects both in the private and public sector, completion certificate along with TDS certificates evidencing payment of at least 60% of the completed similar works shall have to submitted, provided that the completed percentage of such similar works shall meet the minimum value specified in A and B above.

(3) Similar works/ works of similar nature shall mean works executed in India comprising of Design and Construction of RCC framed non-residential complex with all supporting facilities with works including Public Health, internal and external electrical works, Firefighting works, air-conditioning

and mechanical ventilation system, Lift, Sewerage Treatment Plant, Internal Roads, Drains, Landscaping and installation of sub-station. Similar works/ works of similar nature shall exclude inter-alia Road/ Highway/ Airport/ Seaport/ Housing/ Industrial projects.

(4) Certificates of group / subsidiary/ parent/ holding company shall not be considered as a valid certificate of experience of the bidder, unless the same is supported by such documents that the group / subsidiary/ parent/ holding company and the bidder, have amalgamated/ merged into the same entity.

(5) Similar works shall not include any project executed for group / subsidiary/ parent/ holding company.

(6) For determining the value of the projects, the Tendered Amount of the project will be considered for evaluation and not the Estimated Amount.

(c) Minimum Average Annual Turnover of Rs. 500 Crores during the last 3 (three) financial years (i.e. 2015-2016, 2016-2017 and 2017-2018), as certified by a Chartered Accountant, for being qualified for a single package. For being qualified for both packages, minimum Average Annual Turnover shall be Rs. 750 Crores.

(d) A bidder shall be a company within the meaning of the Companies Act, 2013 or any amendment, substitution thereof and shall operate in conformity with the provisions of laws in India.

(e) Participation in the form of Joint venture/Consortium / Special Purpose Vehicle will not be allowed to participate in the above e-NIT.

(f) The bidder is presently not barred/ blacklisted by any Department, Authority or body corporate under the Government of India or any State Government.

(g) The other eligibility criteria including eligibility criteria for technical personnel are described in Clause 1 of Section 3 – Evaluation and Qualification Criteria.

9. Bids shall remain valid for a period not less than 180 days after the deadline/last date for Financial Bid submission as specified in Sl. 10 of this e-NIT. Bids valid for a shorter period shall be rejected as non-responsive.

10. Important Information Date & Time Schedule:

Sl. No.	**Particulars**	**Date & Time**
1.	Date of uploading of Bidding Documents (online)	21.12.2018
2.	Publishing date (Online)	21.12.2018
3.	Documents download start date	21.12.2018 at 17:00 hrs.
4.	Date of Pre-Bid Meeting with the intending bidders in the office of WBMSCL	04.01.2019 at 13:00 hrs.
5.	Bid submission start date (Online)	09.01.2019
6.	Last date and time for submission of Bank Guarantee (offline) alongwith hard copy of Technical Bid	16.01.2019 at 15:00 hrs.
7.	Bid submission closing date (Online)	16.01.2019 at 17:00 hrs.
8.	Opening date for Technical Bid (Online)	17.01.2019
9.	Uploading list of responsive/ non-responsive bidders.	23.01.2019
10.	Financial Bid opening	25.01.2019

11. In the event, any of the specified dates as above being declared a holiday by

WBMSCL or on any account, office of WBMSCL being closed, the event of specified date will be extended to the next working day.

12. All standards, technical specifications and codes of practice referred to shall be the latest editions of Indian Standard Codes including all applicable official amendments. The Selected Bidder shall make available at site all relevant Indian Standard Codes of practice as applicable.

13. Wherever Indian Standards do not cover some particular aspects of design/ construction, International Standard Codes covering such aspects shall be applicable. In the absence of both Indian Standard Codes and International Standard Codes on such aspects, prevailing Indian practice in construction industry shall be followed.

14. In case of discrepancy among standard codes of practice, technical specifications and provisions in Employer's Requirements, the order of precedence shall be as below:

    a) Provisions in Employer's Requirements
    b) Technical Specifications in Employer's Requirements
    c) Indian Standard codes of practice
    d) International Standard Codes of practice

15. All the sites are located within West Bengal. The bidder, at its own responsibility and risk is encouraged to visit and examine the site of work and its surroundings and obtain all information that may be necessary for preparing the bid and entering into a contract for the work as mentioned in the e-NIT, before submitting its bid. The bidder shall bear its own expenses for visiting the sites. Variation, within the meaning of Cl. 13 of GCC shall under no circumstances be allowed, at the time of execution of the Works, due to any discrepancy in the indicative data provided in the Employer's Requirements or elsewhere in the Bidding Documents.

16. The existing Services and Utilities may have to be diverted / relocated with proper liaison and approval of WBMSCL. The Services and Utilities which cannot be diverted but require support, proper support shall be done so that they are not damaged along with their branches. Precautions to be taken while handling the Services and Utilities are mentioned as under:

(i) Services and Utilities shall not be damaged at any cost. If due to some or the other reason mishap occurs, it should be rectified immediately by the Selected Bidder at its own cost, under instructions of WBMSCL.

(ii) The Selected Bidder shall take care so that the ongoing activities are not disturbed in any manner whatsoever by the activities of the Selected Bidder during the execution of the Works. The above instructions are only indicative; other precautions which are specified from time to time by WBMSCL shall be followed by the Selected Bidder at all times.

17. Demolition of old and dilapidated structures on the proposed sites for construction of the 4 medical colleges shall be required to be carried out by the Selected Bidder at its own cost.

18. WBMSCL reserves the right to reject any or all applications for participating in bidding process and to accept or reject any or all offer without assigning any reason whatsoever and is not liable for any cost that might have incurred by any bidder at the stage of bidding.

19. Prospective bidders are advised to note carefully the minimum qualification criteria as mentioned in 'Instructions to Bidders' (ITB) and various conditions in General Conditions of Contract and other Bidding Documents as per ITB 6.1 before tendering the bids.

20. Conditional/ incomplete bids will not be accepted under any

circumstances.

21. The Selected Bidder shall have to comply with the provisions of (a) Contract Labour (Regulation & Abolition) Act, 1970 (b) Apprentices Act, 1961 and (c) Minimum Wages Act, 1948 or the notifications thereof or any other laws relating to and the rules made and orders issued thereunder from time to time pursuant to Clause 6 of the General Conditions of Contract.

22. In case of ascertaining authority of intending bidders at any stage of bidding process or execution of work, necessary registered irrevocable Power of Attorney is to be produced as and when asked for by WBMSCL.

23. During scrutiny, if it comes to notice of WBMSCL that credentials or any record is found incorrect/ manufactured/ fabricated, the bidder would not allowed to participate in the tender and its application will be rejected outright without any prejudice to the rights of WBMSCL.

24. WBMSCL reserves the right to cancel the bidding process due to unavoidable circumstances without assigning any reason, whatsoever, to the bidders and no claim in this respect will be entertained.

25. Before issuance of Notification of Award, WBMSCL or its authorized representative may verify all credentials and other documents, if found necessary. After verification, if it is found that the documents submitted by the lowest bidder is either manufactured or false, in that case, Notification of Award will not be issued in favour of the said bidder under any circumstances and the EMD deposited by the bidder will be forfeited by WBMSCL without assigning any reason thereof.

26. Where an individual holds a digital certificate in his own name duly issued to him in respect of a bidder of which he is a director, such individual person shall,

while uploading the bid for and on behalf of such bidder, shall upload a copy of Power of Attorney.

27. The entire EMD/ Bid Security (both the Bank Guarantee component and the amount transferred by way of netbanking) of the bidder will be forfeited/ invoked in the following events: -

(a) If a bidder withdraws its bid during the period of bid validity, except as provided in ITB 17.2;

(b) If a bidder engages in a corrupt, fraudulent, coercive, collusive or restrictive practice as specified in ITB 3.1;

(c) If a bidder is declared disqualified in terms of ITB 4.3;

(d) If a bidder is otherwise in breach of the terms of the Bidding Documents, or

(e) In case of a Selected Bidder, if it fails or refuses to furnish the Performance Security within the scheduled time period as per ITB 38.1.

28. The EMD component transferred by way of netbanking to the designated bank account, details of which are provided in https://www.wbtenders.gov.in shall be refunded to the designated bank account of the unsuccessful bidders, upon issue of Notification of Award in favour of the Selected Bidder and submission of Performance Security by such Selected Bidder, whichever is later. The EMD component submitted by way of Bank Guarantee in favour of WBMSCL will be returned to the unsuccessful bidders, duly discharged, at the earliest upon issue of Notification of Award in favour of the Selected Bidder and submission of Performance Security by such Selected Bidder, whichever is later.

SECTION 2

Instructions to Bidders (ITB)

SECTION – 2

INSTRUCTIONS TO BIDDERS (ITB)

A. General

1. Scope of Bid

1.1 In connection with the Notice Inviting e-Tender for Planning, Design and Construction of 4 Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis of West Bengal Medical Services Corporation Limited having its registered office at Swasthya Sathi, GN- 29, Sector – V, Salt Lake, Kolkata - 700 091(hereinafter referred to as "the Employer") issues the present Bidding Documents for carrying out the Works as specified in Section - 5 (Employer's Requirements). The name, identification and number of contracts of the National Competitive Bidding (NCB) are given below. The tender is invited online and submission of tender will also be online as detailed in the e-NIT.

1.2 Throughout the Bidding Documents:

(a) the term "in writing" means communicated in written form and delivered against receipt;

(b) the terms 'bid' and 'tender' and their derivatives (bidder/tenderer, bid/tender, bidding/tendering, etc.) are synonymous.

(c) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and

(d) "day" means calendar day.

2. General guidance for e-tendering

2.1 Registration of bidder

Any bidder willing to take part in the process of e-tendering will have to be enrolled and registered with the State Government e-procurement system at https://wbtenders.gov.in. The bidder is to click on the link for e-tendering as given on the web portal and if required, may contact e-procurement Help Desk at Jalasampad Bhavan, 7th Floor, DVC Cell, Salt Lake, Kolkata, Phone: (033)2334-6098.

2.2 Digital Signature Certificate (DSC)

Each bidder is required to obtain a Class-II or Class-III Digital Signature Certificate (DSC) for submission of tenders, from the approved service provider of the National Informatics Centre (NIC). Details are available on the website https://wbtenders.gov.in. The DSC is given as a USB e-token.

Bidders can search and download the e-NIT and Bidding Documents electronically once it logs on to the website mentioned in Sl. No. 4 of the e-NIT. This is the only mode of collection of Bidding Documents.

Bidders are also advised to upload relevant documents well in advance under the "My Documents" Tab at https://wbtenders.gov.in so that those can later be selected and attached during bid submission. This is likely to ensure hassle free upload of bid documents.

The speed of upload is dependent on the memory available in the system as well as the network bandwidth used. In case there are space constraints, bidders are advised to

scan the documents in 75-100 DPI so that optimal clarity is maintained.

The Employer will not be responsible for any delay or difficulties faced during the submission of bids online by the bidders due to connectivity or other issues.

3. Corrupt Practices

3.1 The Employer requires that bidders observe the highest standard of ethics during the bidding process and during execution of such contract. In pursuance of this policy, the Employer:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice"/"bribery" means the offering, giving receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party or influencing the process procuring goods or services or executing contracts;

(ii) "fraudulent practice"/"fraud" means any act or omission, including a misrepresentation of information or facts, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation or to influence the process procuring goods or services or executing contracts, to the detriment of the Employer or other participants;

(iii) "coercive practice" means impairing or

harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party or designed to result in bids at artificial prices that are not competitive;

(v) "restrictive practice" means forming a cartel or arriving at any understanding or arrangement among bidders with the objective of restricting or manipulating a full and fair competition in the bidding process.

(b) will reject a proposal to award a contract if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or restrictive practices in competing for the contract in question; and

(c) will sanction a party or its successor, including declaring ineligible, either indefinitely or for a stated period of time, to participate in any tender/bidding process of the Employer if it at any time determines that the party has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or restrictive practices in competing for, or in

executing, a contract of the Employer.

(d) will cancel or terminate a contract if it determines that a bidder /party has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or restrictive practices in competing for, or in executing, a contract with the Employer.

(e) will normally require an agent of the Employer to allow the Employer or any person that the Employer may designate, to inspect or carry out audit of the bidder's accounting records and financial statements in connection with the contract.

4. Eligible Bidders

4.1 The prospective bidders shall have to meet the following eligibility criteria :

(a) The bidder shall be a registered WBPWD Class - I/ CPWD /reputed construction company /agency registered under the relevant laws in India / Public Sector Undertaking— subject to ITB 4.5, with a permanent office at Kolkata.

(b) Bidder(s) must have satisfactorily completed as a contractor:

A. For being qualified for a single package, minimum one multi-storied building construction project (non-residential) of Rs. 250 Crores or upto three multi-storied building construction projects totaling Rs. 250 Crores, out of which 1 shall be of a minimum value of Rs. 100 Crores all on **TURNKEY BASIS** (Planning,

Design & Execution) comprising from preparation of architectural plan and elevation, structural design and drawing and related inter-disciplinary services including internal and external electrification and fire-fighting works at any place(s) in India during the last 7 (seven) financial years ending on the last day of the month previous to the one in which the tender is invited.

B. For being qualified for both packages, minimum one multi- storied building construction project (non-residential) of Rs. 450 Crores or upto three multi-storied building construction projects totaling Rs. 450 Crores, out of which 1 shall be of a minimum value of Rs. 200 Crores all on **TURNKEY BASIS** (Planning, Design & Execution) comprising from preparation of architectural plan and elevation, structural design and drawing and related inter-disciplinary services including internal and external electrification and fire-fighting works at any place(s) in India during the last 7 (seven) financial years ending on the last day of the month previous to the one in which the tender is invited.

N.B. – (1) Partially completed works shall also be considered for determining the eligibility criteria in A and B above, if documentary evidence in support of

the fact that the value of the completed portion is Rs. 100 Crores or more (for single package) or Rs. 200 Crores (for both packages) can be produced.

(2) For projects both in the private and public sector, completion certificate along with TDS certificates evidencing payment of at least 60% of the completed similar works shall have to submitted, provided that the completed percentage of such similar works shall meet the minimum value specified in A and B above.

(3) Similar works/ works of similar nature shall mean works executed in India comprising of Design and Construction of RCC framed non-residential complex with all supporting facilities with works including Public Health, internal and external electrical works, Firefighting works, air-conditioning and mechanical ventilation system, Lift, Sewerage Treatment Plant, Internal Roads, Drains, Landscaping and installation of sub-station. Similar works/ works of similar nature shall exclude inter-alia Road/ Highway/ Airport/ Seaport/ Housing/ Industrial projects.

(4) Certificates of group / subsidiary/ parent/ holding company shall not be considered as a valid certificate of experience of the bidder, unless the same is supported by such documents that the group / subsidiary/ parent/ holding company and the bidder, have amalgamated/ merged into the same entity.

(5) Similar works shall not include any project

executed for group / subsidiary/ parent/ holding company.

(6) For determining the value of the projects, the Tendered Amount of the project will be considered for evaluation and not the Estimated Amount.

(c) Minimum Average Annual Turnover of Rs. 500 Crores during the last 3 (three) financial years (i.e. 2015-2016, 2016-2017 and 2017-2018), as certified by a Chartered Accountant, for being qualified for a single package. For being qualified for both packages, minimum Average Annual Turnover shall be Rs. 750 Crores.

(d) A bidder shall be a company within the meaning of the Companies Act, 2013 or any amendment, substitution thereof and shall operate in conformity with the provisions of laws in India.

(e) Participation in the form of Joint venture/Consortium / Special Purpose Vehicle will not be allowed to participate in the above e-NIT.

(f) The bidder is presently not barred/ blacklisted by any Department, Authority or body corporate under the Government of India or any State Government.

(g) The other eligibility criteria including eligibility criteria for technical personnel are described in Clause 1 of Section 3 – Evaluation and Qualification Criteria.

4.2 A bidder shall have to furnish the following documents:

(a) Professional Tax Registration Certificate, Professional Tax Deposit Challan, PAN Card, GST Registration Certificate/ letter recording GST identification number along with Income Tax Return Acknowledgement Receipt for financial year 2017-2018 (assessment year 2018-2019).

(b) Tax Audit Report in Form 3CD along with Balance Sheet & Profit and Loss A/c. for the financial years 2015-2016, 2016-2017 and 2017-2018, i.e. assessment years 2016-2017, 2017-2018 and 2018-2019.

(c) Financial Statement in Form 17 FIN - I of Section - 4 (Bidding Forms) digitally signed by the bidder.

4.3 The Employer considers a conflict of interest to be a situation in which a party has an interest that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations, and that such conflict of interest may contribute to or constitutes a prohibited practice by the Employer which requires that bidders, suppliers, and contractors under contracts with the Employer, observe the highest standard of ethics and will take appropriate actions if it determines that a conflict of interest has flawed the integrity of any procurement process. Consequently all bidders found to have a conflict of interest shall be disqualified. A bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited

to:

(a) they have controlling shareholders in common;

(b) they receive or have received any direct or indirect subsidy from any of them;

(c) they have the same legal representative for purposes of this bid;

(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another bidder, or influence the decisions of the Employer regarding this bidding process; or

(e) participation by a bidder in more than one bid (not meaning thereby more than one package) will result in the disqualification of all bids in which the party is involved.

4.4 A bidder that is under a declaration of ineligibility and/or blacklisting by the Employer in accordance with ITB 3 or by any Department, Authority or body corporate under the Government of India or any State Government, at the date of the deadline for bid submission or thereafter during process of evaluation, shall be disqualified provided such declaration of ineligibility and/or blacklisting has not been challenged by the bidder and such declaration is stayed and/or kept in abeyance and/or set aside by any competent court of law and/or by any other judicial authority.

4.5 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the

Employer shall reasonably request.

5. Eligible Personnel Materials, Equipment and Services

5.1 The bidder shall have the requisite number of Technical Personnel, Plants and Equipment as enumerated in Section - 3 (Evaluation and Qualification Criteria). The materials, equipment and services to be supplied under the Contract may have their origin in any country except prohibited by any statute.

5.2 For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

5.3 The bidders are cautioned to read the specifications carefully, as there may be special requirements. The specifications are the minimum requirements for the products. The products offered must meet or exceed requirements mentioned in the technical specifications. The products shall conform to strength, quality and workmanship to the accepted standards of the relevant industry. Modifications of or additions to basic standard products of less size or capability to meet these requirements will not be acceptable.

B. Contents of Bidding Documents

6. Sections of Bidding Documents

6.1 The Bidding Documents consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART I Bidding Procedures

Section 1 - Notice Inviting e-Tender (e-NIT)

Section 2 - Instructions to Bidders (ITB)

Section 3 - Evaluation and Qualification Criteria (EQC)

Section 4 – Bidding Forms (BDF)

PART II Requirements

Section 5 - Employer's Requirements (ERQ)

PART III Conditions of Contract and Contract Forms

Section 6 - General Conditions of Contract (GCC)

Section 7 - Contract Forms (COF)

6.2 The Employer is not responsible for the completeness of the Bidding Documents and their addenda/ corrigenda, if they were not obtained directly from the source stated by the Employer in the e-NIT.

6.3 The bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Documents. Failure to furnish all information or documentation required by the Bidding Documents may result in the rejection of the bid.

6.4 All the Sections forming part of the Bidding Documents are

to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance to Clause 1.5 of the GCC.

7. Clarification of Bidding Documents, Pre-Bid Meeting

7.1 A prospective bidder requiring any clarification of the Bidding Documents shall contact the Employer in writing by sending an e-mail to the Employer's e-mail address info@wbmsc.gov.in raise its queries during the pre-bid meeting if provided for in accordance with ITB 7.4 and 7.5. The Employer may upload in the website hosting the Bidding Documents, its responses to bidders' queries. Should the Employer deem it necessary to amend the Bidding Documents, as a result of a request for clarification, it shall do so following the procedure under ITB 8.

7.2 The bidder is advised to visit and examine the sites of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the site shall be at the bidder's own expense. The bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the bidder, its personnel and agents will release and indemnify the Employer and its 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 the inspection.

7.3 The bidder's designated representative is invited to attend a pre-bid meeting at Swasthya Sathi, GN-29, Sector - V, Salt Lake, Kolkata - 700 091. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.4 The bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.5 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be uploaded in the e-tender portal i.e. https://wbtenders.gov.in within 15 (fifteen) days from the date of pre-bid meeting. Any modification to the Bidding Documents that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of appropriate addendum/ corrigendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.

7.6 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

8. Amendment of Bidding Documents/ Extension of

8.1 Any addendum/ corrigendum issued shall be part of the Bidding Documents and shall be uploaded in the e-tender portal i.e. https://wbtenders.gov.in and also at www.wbmsc.gov.in.

	deadlines	8.2	To give prospective bidders reasonable time in which to take an addendum/ corrigendum into account in preparing their bids or for other causes and consideration, the Employer may, at its discretion, extend the deadline for the submission of bids.

C. Preparation of Bids

9.	Costs of Bidding	9.1	The bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
10.	Language of Bid	10.1	The bid, as well as all correspondence and documents relating to the bid exchanged by the bidder and the Employer, shall be written in English only. Supporting documents and printed literature that are part of the bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the bid, such translation shall be relied on.
11.	Documents comprising the Bid	11.1	Tenders are to be submitted online following the process mentioned in Sl. Nos. 7 of the e-NIT in two folders, one being the Technical Bid and the other being the Financial Bid before the prescribed date and time. The documents are to be uploaded scanned for viruses and duly digitally signed so that the documents will get encrypted (transformed into

non readable formats).

11.2 The Technical Bid shall comprise of the scanned copies of the following documents in one folder:

Statutory cover of Technical Bid containing:

To be filled in FORM folder:

(i) Letter of Technical Bid in form of Affidavit as given in Form - 1 of Section – 4 (Bidding Forms)

(ii) Declaration cum Experience profile of the bidder, as per format given in Form – 2 of Section - 4 (Bidding Forms)

(iii) Power of Attorney in favour of signatory of the bid, as per format given in Form – 5 of Section - 4 (Bidding Forms)

(iv) Qualification Information (duly filled in by the bidder), as per format given in Form –16 (Form ELI-1) of Section - 4 (Bidding Forms)

(v) Letter of Financial Bid, as per format given in Form – 3 of Section - 4 (Bidding Forms)

To be filled in DRAFT folder:

Copy of the Bank Guarantee towards payment of 90% of the Earnest Money Deposit (EMD)/ Bid Security as prescribed in the e-NIT, in favour of "West Bengal Medical Services Corporation Limited"

To be filled in e-NIT folder:

(i) Notice Inviting e-Tender (Section - 1) and Instructions to Bidders (Section - 2) (uploaded with digital signature).

(ii) General Conditions of Contract (Section - 6) (uploaded with digital signature).

(iii) Employer's Requirements (Section - 5) (uploaded with digital signature).

Non-statutory **(My Documents)** cover containing

To be filled in CERTIFICATE folder:

(i) Copy of Certificate of Incorporation, Memorandum and Articles of Association

(ii) Copy of GST Registration Certificate/ letter recording GST identification number

(iii) Copy of Professional Tax Registration Certificate

(iv) Copy of PAN Card

(v) Copy of document showing proof of permanent office in Kolkata

To be filled in FINANCIAL INFO folder:

(i) Copy of Income Tax Returns for the financial years 2015-2016, 2016-2017 and 2017-2018, i.e. assessment years 2016-2017, 2017-2018 and 2018-2019

(ii) Copy of latest Professional Tax Deposit Challan

(iii) Form FIN - 1 of Form- 17

(iv) Form FIN - 2 of Form- 17 (Annual Turnover during last three financial years)

(v) Form FIN-3 of Form – 17

(vi) Form FIN-4 of Form - 17

To be filled in P/L AND BALANCE SHEET 2015-2016 folder:

Profit & Loss Account and Balance Sheet for financial year 2015-2016 along with Tax Audit Return in Form 3CD

To be filled in P/L AND BALANCE SHEET 2016-2017 folder:

Profit & Loss Account and Balance Sheet for financial year 2016-2017 along with Tax Audit Form in Form 3CD

To be filled in P/L AND BALANCE SHEET 2017-2018 folder:

Profit & Loss Account and Balance Sheet for financial year 2017-2018

To be filled in CREDENTIAL 1 folder:

(i) Value of construction works of similar nature completed as per format in Form - 18 in Section – 4 (Bidding Forms) during the last 7 financial years supported by certificate by the client/ TDS certificates

(ii) Form – 10 (Site Organisation)

(iii) Form – 11(Method Statement)

(iv) Form – 12 (Mobilisation Schedule)

(v) Form – 13 (Construction Schedule)

To be filled in MANPOWER folder:

(i) Details of personnel in the payrolls of the bidder comprising of the in-house design department with experience profile of such personnel or in the

alternative, copy of the agreement with reputed design engineering firm(s) with 20 years of experience in the domain along with proof of empanelment of such firm before any municipal body(ies) alongwith experience profile of such personnel, as required in Section – 3 (Evaluation and Qualification Criteria)

In case of failure to submit any of the above mentioned documents (for both statutory and non-statutory cover) in respective folders, the Employer shall be entitled to summarily reject the bid.

11.3 The Financial Bid for each package shall comprise of : (i) Bill of Quantity (BOQ) in the specified format in respect of the package(s), the bidder is submitting bid for, being the cost for planning, designing and construction including supply, installation, testing, commissioning and training of personnel pertaining to specified electrical, mechanical and electromechanical and medical equipment and furniture (supply and installation only) inclusive of all taxes and charges in respect of all the sites in the package taken together, which are sub-categorised in the BOQ as follows:

1. Academic Building
2. Hostel Block
3. Staff Quarter
4. Out Patient Department (OPD) Building
5. Other Buildings
6. Furniture for Package (Sum for 2 Medical Colleges)

7. Medical Equipment for Package (Sum of Schedule – I for 2 medical colleges)

8. Medical Equipment for Package (Sum of Schedule – II for 2 medical colleges)

The total area in sq. m. for each of the sub-categories of buildings to be constructed in all the sites comprising the package has been provided in the BOQ and the bidder will be required to quote its rate on per sq. m. basis for the above sub-categories. For the sub-categories of medical equipment and furniture, the bidder will be required to quote its gross rate for the 2 medical colleges comprising the package.

(ii) Following documents (in PDF): -

(a) Cost of individual medical equipment as specified in the format being Forms 6 and 7 of Section - 4 (Bidding Forms) as may be applicable.

(b) Cost of individual items of furniture as specified in the format being Form – 8 of Section - 4 (Bidding Forms) as may be applicable.

N.B. – (1) The bidder is to quote the rate online in the space marked for quoting rate in the BOQ.

(2) Only downloaded copies of the above documents are to be uploaded, virus scanned and digitally signed by the bidder.

(3) If a bidder is bidding for both the packages, the documents referred to in the Statutory Cover folder of the Technical Bid documents and the Financial Bid documents

are required to be submitted separately for both the packages.

(4) The rate quoted per sq. m. basis should also include costs of roads, covered pathways, suitable drainage system upto the nearest outfall of the Municipality/ Panchayat, necessary development of lands, playgrounds, street lights and allied facilities as may be required and directed by the Employer. In other words, no money over and above the total rate quoted on per sq. m. basis of all the sub-categories of buildings in the BOQ taken together will be paid by the Employer to the Selected Bidder/ Contractor and the bidder should accordingly bid for the Project. Roads shall mean and refer to both internal and external roadways. Internal roadways (including peripheral roads) shall have to be constructed so as to establish connectivity between all the buildings and to allow free movement of vehicular traffic and fire tenders within the medical college premises. Storm water drainage network for the entire medical college premises shall be connected with municipality drain, if any, or to the nearest natural outfall where municipality drain is not available. Connectivity of external roadways shall extend upto nearest National Highway/ State Highway/ Major District Road along with storm water drainage system and pathways inside premises of the medical college. Both internal and external roadways shall be illuminated by street lights.

(5) The evaluation of Financial Bid will only be based on the basis of evaluation of the BOQ.

12. Letters of Technical Bid and Schedules

12.1 The Letters of Technical Bid shall be prepared using the relevant forms furnished in Section - 4 (Bidding Forms). The forms must be completed without any alterations to the text and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

13. Bid Prices

13.1 The prices quoted by the bidder in the Financial Bid shall conform to the requirements specified below.

13.2 The prices to be quoted in the Financial Bid, in accordance with ITB 11.3, shall be the total price of the bid.

13.3 The price quoted by the bidder is not subject to any discount or adjustment.

13.4 All duties, taxes, and other levies payable by the Selected Bidder under the Contract, or for any other cause, shall be considered to be included in the prices and the total Bid Price submitted by the bidder. The Bid Price quoted by the bidder shall be final and shall not be adjusted and/or increased for change in any duty / tax / other levies or outgoings and/or any levy of any additional duty or tax or other levies which are not earlier payable In other words, the Selected Bidder will not be paid anything more than the Bid Price, which is all inclusive.

However, the Employer will assist (on a no recourse basis and in good faith, based on the Selected Bidder's representations and in good faith thereof) the Selected Bidder / Contractor to obtain any lawful exemptions from payments of Duties or Taxes on Plant and Materials which

are to be incorporated as a part of the Permanent Works by issue of an appropriate certificate in the requisite format certifying the estimated quantities of Plant/ Materials that are to be incorporated into the Works. The responsibility for obtaining any such exemptions from the competent authority will remain with the Selected Bidder and the Employer shall in no way be responsible for admissibility of the claims or eligibility of the Selected Bidder.

13.5 Any disclosure of any information or documents required to be submitted in the Financial Bid by the bidder, whether inadvertent or not, will disqualify the bidder and render its bid non-responsive and rejected.

14. Currencies of Bid and Payment

14.1 The rate shall be quoted by the bidder entirely in Indian National Rupees (INR) only. The Employer shall be entitled to reject any bid, if the same has been submitted in any other currency.

15. Documents Comprising the Technical Proposal

15.1 To establish its qualifications to perform the Contract, the bidder shall furnish as part of the Technical Bid, a technical proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section – 4 (Bidding Forms) in sufficient detail to demonstrate the adequacy of the bidder's proposal to meet the work requirements and the completion time.

15.2 To establish the conformity of the goods and related services to the Bidding Documents, the bidder shall furnish

as part of its bid, the documentary evidence that the Goods / Products conform to the technical specifications and standard specified in Section - 5 (Employer's Requirements).

16. Documents Establishing the Qualifications of the Bidder

16.1 To establish its qualifications to perform the Contract in accordance with Section - 3 (Evaluation and Qualification Criteria) the bidder shall provide the information requested in the corresponding information sheets included in Section - 4 (Bidding Forms).

17. Period of Validity of Bids

17.1 Bids shall remain valid for a period of 180 days after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.

17.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. A bidder may refuse the request without forfeiting its Bid Security. A bidder granting the request shall not be required or permitted to modify its bid.

18. Bid Security

18.1 The bidder shall as part of its bid, make payment of an amount of Rs. 80,00,000/- (Rupees Eighty Lakhs only) out of the Earnest Money Deposit (EMD) /Bid Security of Rs. 8,00,00,000/- (Rupees Eight Crores only) for each package,

by way of netbanking, in the website www.wbtenders.gov.in. The balance amount of Rs. 7,20,00,000/- (Rupees Seven Crores Twenty Lakhs only) shall be provided by way of Bank Guarantee, issued by a scheduled bank, scanned copy of which shall be uploaded in the relevant folder.

18.2 No valid bid can be uploaded in the website www.wbtenders.gov.in, unless payment of 10% of the Bid Security has been made in the said website www.wbtenders.gov.in and scan copy of Bank Guarantee pertaining to balance 90% of the Bid Security uploaded in the relevant folder. The original part of online submission of the bank guarantee comprising 90% of the Bid Security shall be submitted physically at the office of WBMSCL under sealed cover within the prescribed date and time limit stated in Sl. 10 of this e-NIT. However, WBMSCL will not be held responsible for late delivery or loss of the Bank Guarantee so mailed through post/courier.

18.3 The EMD component transferred by way of netbanking to the designated bank account, details of which are provided in https://www.wbtenders.gov.in shall be refunded to the designated bank account of the unsuccessful bidders, upon issue of Notification of Award in favour of the Selected Bidder and submission of Performance Security by such Selected Bidder, whichever is later. The EMD component submitted by way of Bank Guarantee in favour of WBMSCL will be returned to the unsuccessful bidders, duly discharged, at the earliest

upon issue of Notification of Award in favour of the Selected Bidder and submission of Performance Security by such Selected Bidder, whichever is later.

18.4 The entire EMD/ Bid Security (both the Bank Guarantee component and the amount transferred by way of netbanking) of the bidder will be forfeited/ invoked in the following events: -

(a) If a bidder withdraws its bid during the period of bid validity, except as provided in ITB 17.2;

(b) If a bidder engages in a corrupt, fraudulent, coercive, collusive or restrictive practice as specified in ITB 3.1;

(c) If a bidder is declared disqualified in terms of ITB 4.3;

(d) If a bidder is otherwise in breach of the terms of the Bidding Documents, or,

(e) In case of a Selected Bidder, if it fails or refuses to furnish the Performance Security within the scheduled time period as per ITB 38.1.

19. Format and Signing of Bid

19.1 The bid shall be digitally signed by a person or persons duly authorized to sign on behalf of the bidder as stated in Sl. No. 26 of the e-NIT.

D. Submission and Opening of Bids

20. Submission of Bids

20.1 Bids are to be submitted online as stated in Sl. Nos. 6, 7 and 8 of the e-NIT in two folders at a time, one being Technical Proposal / Technical Bid and the other being Financial Bid before the prescribed date and time with Digital Signature

Certificate (DSC). For submitting the Technical Bid, whether the bidder is bidding for one package or more than one package, it shall suffice if the documents comprising the Statutory Folder of the Technical Bid are uploaded once. The documents are to be uploaded scanned for viruses and duly signed, digitally so that the documents will get encrypted (transformed into non readable formats).

In addition, the bidders shall submit a physical copy of all documents so uploaded, at the office of the Employer before the bid submission date, to facilitate evaluation of the bids. The physical copies of the Technical Bid documents should be submitted in one envelope and the Bid Security shall be submitted in another envelope.

21. Deadline for Submission of Bids

21.1 Complete bids (including Technical and Financial) must be uploaded in the e-tender website i.e. https://wbtenders.gov.in not later than the date as mentioned in the e-NIT under Sl. 10.

21.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Documents in accordance with ITB 8, in which case all rights and obligations of the Employer and bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

22. Bid Opening

22.1 The Technical Bid will be opened online by the authority receiving tenders or by its authorized representative at

time, date and the place specified in the e-NIT under Sl. 10 in the manner specified in the e-NIT. The authority receiving tenders or its authorized representative shall decrypt all Technical Bids submitted by the bidders and copy it in any storage device such as a compact disc, pen drive or hard drive. The manner of online opening of Financial Bid will be same as Technical Bid opening.

22.2 All folders containing the Technical Bids shall be opened one at a time, and the following recorded:

(a) the name of the bidder;

(b) the presence of a Bid Security,

(c) the presence of e-NIT Acceptance Form as per Form - 19 in Section – 4 (Bidding Forms) and

(d) any other details as the Employer may consider appropriate.

Only Technical Bids recorded at bid opening shall be considered for evaluation.

22.3 If the e-NIT Acceptance Form is not present as part of the Technical Bid of any bidder, the Employer will not go into detailed evaluation of the Technical Bid of such bidder and will summarily reject such Technical Bid. The Employer shall prepare a record of the opening of Technical Bids. A copy of the record shall be uploaded on the website https://wbtenders.gov.in and also at www.wbmsc.gov.in and www.wbhealth.gov.in.

22.4 At the end of the evaluation of the Technical Bids, the Employer will upload on the website https://wbtenders.gov.in and also at www.wbmsc.gov.in

and www.wbhealth.gov.in the name of the bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award in terms of ITB 35.

22.5 The Employer shall conduct the opening of the Financial Bid of all bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified in terms of ITB 27. All folders containing Financial Bids shall be opened one at a time and the following recorded:

(a) the name of the bidder;

(b) the Financial Bid;

(c) any other details as the Employer may consider appropriate.

Only Financial Bids recorded during the opening of Financial Bids shall be considered for evaluation. No bid shall be rejected at the time of opening of Financial Bids except when the Financial Bid is not in accordance with the Bidding Documents.

E. Evaluation and Comparison of Bids

23. Confidentiality

23.1 Information relating to the examination, evaluation, comparison, and post qualification of bids and recommendation of Award, shall not be disclosed to bidders or any other persons not officially concerned with such process until information on Award of contract is communicated to all bidders.

23.2 Any attempt by a bidder to influence the Employer in the evaluation of the bids or contract award decisions may result in the rejection of its bid.

24. Clarification of Bids

24.1 To assist in the examination, evaluation and comparison of the Technical and Financial Bids, the Employer may, at its discretion, ask any bidder for a clarification of its bid. Any clarification submitted by a bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid, or, prices in the Financial Bid shall be sought, offered, or permitted.

24.2 If a bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

25. Deviations, Reservations, and Omissions

25.1 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. Preliminary Examination of Technical Bids

26.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the bid may be rejected.

27. Responsiveness of Technical Bid

27.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.

27.2 A substantially responsive Technical Bid is one that 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 contract; or

(ii) limit in any substantial way, inconsistent with the Bidding Documents, the rights of the Employer or the Department of Health & Family Welfare, Government of West Bengal, 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.

27.3 The Employer shall examine the technical aspects of the bid submitted to confirm that all requirements have been met without any material deviation or reservation.

27.4 If a bid is not substantially responsive to the requirements

of the Bidding Documents and is rejected by the Employer, it may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

28. Nonconformities, Errors, and Omissions

28.1 The Employer may waive any nonconformity in the bid that does not constitute a material deviation, reservation or omission.

28.2 The Employer may request that the bidder submit information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Financial Bid. Failure of the bidder to comply with the request of the tendering authority may result in the rejection of its bid.

29. Qualification of the Bidder

29.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether bidders meet the qualifying criteria as specified in the Bidding Documents.

29.2 The determination shall be based upon an examination of the documentary evidence of the bidder's qualifications submitted by the bidder, pursuant to ITB 11.2.

30. Evaluation Criteria

30.1 The bidders who meet the qualifying criteria shall be treated equally and all the technically qualified bidders shall be at par while considering their Financial Bid.

The Financial Bid of bidders, who do not meet the

qualifying criteria prescribed in ITB 4.1 will not be opened.

31. Preliminary Examination of Financial Bids

31.1 The Employer shall examine the Financial Bids to confirm that all documents and schedules requested in ITB 11.3 have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the bid may be rejected.

32. Evaluation of Financial Bids

32.1 The Employer shall only consider the amount quoted in the BOQ, for evaluation of the Financial Bid of the technically qualified bidder. Though bidders are required to upload in a separate PDF, the breakup of the various sub-categories in terms of ITB 11.3 (ii), such as price quotations in respect of each item of furniture and medical equipment, such breakup shall not be considered at the time of evaluation of Financial Bids. No other evaluation criteria or methodology shall be permitted.

33. Comparison of Financial Bids

33.1 All technically qualified bidders shall be at par.

33.2 The Employer shall compare the Financial Bids of technically qualified bidders of each package to determine the lowest Financial Bid.

33.3 The Financial Bids will be opened *in seriatim*, i.e. firstly Package A followed by Package B. Upon decryption of the price quotations for all packages a table shall be prepared containing particulars of Financial Bids submitted for all the packages.

34. Employer's right to accept any bid, and to reject any or all bids

34.1 The Employer reserves the right to accept or reject any bid and to annul the bidding process and reject all bids at any time prior to Award, without thereby incurring any liability to bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly refunded to the bidders.

F. Award of Contract

35. Award Criteria

35.1 The Employer shall award one Contract in respect of each of the packages or in its sole discretion (based on the recommendation of the TEC), separate contract in respect of each of the sites comprised in a package, to the bidder whose offer has been determined to be the lowest evaluated bid (L1 bidder) for each of the packages and which is substantially responsive to the Bidding Documents, provided further that the bidder is determined to be qualified to perform the Contract satisfactorily.

35.2 In the event, the Financial Bids of 2 (two) or more L1 bidders in a particular package, who are qualified and whose Technical Bids are at par, are the same (the "**tie bidders**"), the Employer shall at its discretion:

(a) Either hold an *inter se* auction amongst such tie bidders to quote further lower bids and shall declare such of them who has offered the lowest bid in such auction to be the Selected Bidder. Bidders' representatives who choose to attend the Financial Bid opening should therefore be duly authorized to participate in such auction. In the event, a tie bidder

is not represented on the Financial Bid opening date or the authorized representative of such bidder does not or is unwilling to participate in such auction, the auction would be held amongst the remaining tie bidders and if there be only one remaining tie bidder, the latter will be declared as the Selected Bidder provided that such remaining tie bidder offers a lower bid than that already offered in its Financial Bid. In the event the lowest bidder withdraws or is not declared as the Selected Bidder, the Employer may invite fresh bids for the package; or

(b) Invite fresh bids, without holding any *inter se* auction amongst such tie bidders or splitting the package in question.

35.3 In the event, all the Tie Bidders for a package happen to be Selected Bidder for any earlier package already opened, all such Tie Bidders generally will not be allowed to participate in the spot-auction and the next lowest bidder will be given an opportunity to match the price of the Tie Bidders and the procedure laid down in ITB 35.1 shall be followed.

36. Notification of Award

36.1 The bidder whose bid has been accepted will be notified of the award by the Employer prior to expiration of the bid validity period by uploading in the e-tender portal and www.wbmsc.gov.in or by e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of

Acceptance/Notification of Award") will state the sum that the Employer will pay the Contractor in consideration of the execution of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Tendered Amount") in respect of each package.

36.2 The Employer, may in its sole discretion, instead of awarding one contract to the L1 bidder for a package, award separate contracts to the L1 bidder respect of each sites comprised in a package separately. If the Employer decides to do so, the Employer will state the sum that the Employer will pay to such Selected Bidder in consideration of the execution, completion, and maintenance of the Works by the Selected Bidder in respect of each site, which shall be equal to the quoted price in respect of each site contained in the Financial Bid of the Selected Bidder. It is clarified that aggregate of contract price in respect of all sites contained in a single package, shall be the Financial Bid of the Selected Bidder in respect of the entire package.

36.3 Until a formal contract is prepared and executed in respect of each package or each site, as the case may be, the Notification of Award shall constitute a notification of commencement of Works, subject only to the furnishing of a Performance Security in accordance with the provisions of ITB 38.1, whereupon the Contract shall come into force.

The Employer shall hand over the sites to the Selected

Bidder in respect of each of the packages, within 15 days from the Letter of Acceptance.

37. Signing of Contract

37.1 Promptly after notification, the Employer shall send the Selected Bidder in respect of each package, the Form of Agreement either to be executed for each package or site wise. Each page of the Agreement should be signed by the Employer's Representative and the Contractor's authorized signatory. If there are any corrections, cuttings, omissions, over writings, insertions, etc. (after issue of Bidding Documents) their number should be clearly mentioned on each page of the Agreement before signing.

37.2 Within 21 days of receipt of the Form of Agreement, the Selected Bidder in respect of each of the packages shall sign with date separate contracts, for each package or for each of the sites, as the case may be and return it to the Employer. The Contract shall only come into existence, when the Performance Security is furnished in terms of ITB 38.1.

37.3 No payment for the Works done will be made to the Selected Bidder till the Agreement is signed by the Selected Bidder and Performance Security along with the Manufacturer's Authorization Forms, duly filled in and signed have been submitted by the Selected Bidder.

38. Performance Security

38.1 Within 14 days of the receipt of Notification of Award from the Employer, the Selected Bidder for each of the packages shall furnish the Performance Security in accordance with

the conditions of contract, using for that purpose the Performance Security Form included in Section - 7 (Contract Forms), or another form acceptable to the Employer. If separate contracts are awarded in respect of each site comprised in a package to the Selected Bidder of such package, then the Selected Bidder has to submit Performance Security separately for each of the sites.

38.2 Failure of the Selected Bidder to submit the above mentioned Performance Security or to sign the Agreements in respect of each package, shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event, the Employer may award the Contract to the next lowest evaluated bidder (L2 bidder) whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily at the price quoted by the L2 bidder or the Employer, may, at its discretion go in for fresh tenders.

39. Mobilisation Advance

39.1 Mobilisation Advance not exceeding 10% of the Contract Price may be given, if requested by the Selected Bidder/Contractor in writing within 30 days of the issue of Notification of Award. The Employer shall pay the Mobilisation Advance to the Contractor, in the following 2 tranches, upon completion of the following events :-

(a) First tranche of 5% of the Mobilisation Advance shall be paid by the Employer, upon completion of the following events/ activities:

(i) Construction of labour camp, Contractor's site office and making arrangements for water supply

(ii) Construction of the Employers' temporary site office at the site.

(iii) Obtaining a Mobilisation Advance Bank Guarantee from a scheduled bank as per form given in Section - 7 (Contract Forms) aggregating to the full amount of Mobilization Advance (including both tranches) in favour of the Employer and submission of such Bank Guarantee to the Employer.

(b) Second tranche of 5% of Mobilisation Advance will be released by the Employer to the Contractor, upon completion of payment by the Employer, of 15% of the total Tendered Amount.

The Mobilisation Advance above shall bear simple interest @ 10% per annum. Repayment of the Mobilisation Advance shall commence from payment of the Running Account Bill first raised after disbursement of first tranche of the Mobilisation Advance and shall be entered as a deduction from Interim Payment (@ 10% of the value of all the Running Account Bills paid so far + simple interest @ 10% of the total Mobilisation Advance amount). For subsequent Running Account Bills, Mobilisation Advance shall be deducted from the interim payment @ 10% of the value of such subsequent Running Account bill + simple

interest @ 10% of the unadjusted Mobilisation Advance. Such deduction of Mobilisation Advance shall continue until the total amount of advance loan has been repaid by the contractor, provided that the complete recovery of the Mobilisation Advance shall be made before completion of 90% of the Works.

Recovery of advance at any intermediate stage shall be effected, if necessary, by encashment of part Bank Guarantees if the appropriate pro-rata amount of advance is not available from the Works done by the Contractor.

If the circumstances are considered reasonable by the Employer, the period mentioned for request by the Contractor in writing for grant of Mobilisation Advance may be extended in the discretion of the Employer.

The said Bank Guarantees for advances shall initially be made for the full amount and valid for the Contract period, and be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

STATUTORY COVER:

FORM folder:

(i) Form - 1

(ii) Form – 2

(iii) Form – 5

(iv) Form –16 (Form ELI-1)

(v) Form – 3

DRAFT folder:

Copy of the Bank Guarantee towards payment of 90% of the Earnest Money Deposit (EMD)/ Bid Security

e-NIT folder:

(i) Notice Inviting e-Tender (Section - 1) and Instructions to Bidders (Section - 2)

(ii) General Conditions of Contract (Section - 6)

(iii) Employer's Requirements (Section - 5)

NON-STATUTORY (MY DOCUMENTS) COVER

CERTIFICATE folder:

(i) Certificate of Incorporation, Memorandum and Articles of Association

(ii) GST Registration Certificate/ letter recording GST identification number

(iii) Professional Tax Registration Certificate

(iv) PAN Card

(v) Proof of permanent office in Kolkata

FINANCIAL INFO folder:

(i) Income Tax Returns for the financial years 2015-2016, 2016-2017 and 2017-2018, i.e. assessment years 2016-2017, 2017-2018 and 2018-2019

(ii) Professional Tax Deposit Challan

(iii) Form FIN - 1 of Form- 17

(iv) Form FIN - 2 of Form- 17

(v) Form FIN-3 of Form – 17

(vi) Form FIN-4 of Form - 17

P/L AND BALANCE SHEET 2015-2016 folder:

Profit & Loss Account and Balance Sheet for financial year 2015-2016 along with Tax Audit Return in Form 3CD

P/L AND BALANCE SHEET 2016-2017 folder:

Profit & Loss Account and Balance Sheet for financial year 2016-2017 along with Tax Audit Form in Form 3CD

P/L AND BALANCE SHEET 2017-2018 folder:

Profit & Loss Account and Balance Sheet for financial year 2017-2018

CREDENTIAL 1 folder:

(i) Form – 18 (Experience Profile)

(ii) Form – 10 (Site Organisation)

(iii) Form – 11(Method Statement)

(iv) Form – 12 (Mobilisation Schedule)

(v) Form – 13 (Construction Schedule)

MANPOWER folder:

Details of personnel in the payrolls of the bidder comprising of the in-house design department with experience profile of such personnel or in the alternative, copy of the agreement with reputed design engineering firm(s) with 20 years of experience in the domain along with proof of empanelment of such firm before any municipal body(ies) alongwith experience profile of such personnel, as required in Section – 3 (Evaluation and Qualification Criteria)

BOQ FOLDER

(i) BOQ

(ii) Form - 6

(iii) Form - 7

(iv) Form – 8

SECTION 3

Evaluation and Qualification Criteria (EQC)

SECTION – 3

EVALUATION AND QUALIFICATION CRITERIA (EQC)

- Without Prequalification –

This Section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders. In accordance with the ITB, no other method, criteria and factors shall be used. The bidder shall provide all the information requested in the forms included in Section - 4 (Bidding Forms).

1. Qualification Eligibility

1.1 Eligibility

Criteria Requirement	Compliance Requirements	Documents Submission Requirements

1.1.1 Nationality

Nationality in accordance with ITB 4.1	Must meet requirement	Form ELI-1 with attachments

1.1.2 Conflict of Interest

No conflict of interest in accordance with ITB 4.3	Must meet requirement	Letter of Technical Bid

1.1.3 Eligibility

Not having been declared ineligible by any Department,	Must meet requirement	Letter of Technical Bid

Authority or body corporate of Government of India or any State Government, as described in ITB 4.4		

1.2 Financial Situation

Criteria Requirement	Compliance Requirements	Documents Submission Requirements

1.2.1 Historical Financial Performance

Submission of audited balance sheets, other financial statements for the last three years to demonstrate the current soundness of the bidder's financial position and its prospective long term profitability. Using Forms FIN – 1 in Section 4 (Bidding Forms) the bidder must demonstrate that the bidder's net worth is positive	Must meet requirement	Forms ELI-1, with attachments of Section 4

1.2.2 Average Annual Turnover

Minimum Average Annual Turnover of INR 500 Crores within the last	Must meet requirement	Form FIN-2 of Form – 17

3(three) years (if bid is submitted in respect of a single package)		
Minimum Average Annual Turnover of INR 750 Crores within the last 3(three) years (if bid is submitted in respect of both packages)	Must meet requirement	Form FIN-2 of Form – 17

1.2.3 Financial Resources

The bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet the overall cash flow requirement.	Form FIN- 2 of Form – 17

1.3 Experience

Criteria Requirement	**Compliance Requirements**	**Documents Submission Requirements**

1.3.1 General Construction Experience

Experience under construction contracts in the role of contractor for at least last 10 (ten) years prior to the application submission deadline in the field of construction of buildings	Must meet requirement	Form EXP-1 of Form 18

1.3.2 Specific Construction Experience Contracts of Similar Size and Nature

Participation as contractor in Similar Works as per ITB 4.1	Must meet requirement	Form 2 of Section 4

1.4 Personnel

The bidder shall preferably have an in-house Design Department with qualified and experienced Architects, Structural Engineers and Electro-Mechanical Engineers to carry out the detailed Engineering Works. In case a bidder does not have an in-house design engineering capability covering all engineering disciplines, then they need to have a formal tie up with any specialized design engineering agency /agencies having the requisite experience, capability and proven track record for providing Design and Engineering Services on the day of submission of bid. Such design engineering agency /agencies shall have a minimum of 15 years of experience in the domain, executed 1 similar project (as described in ITB 4.1) of a minimum value of Rs. 60 Crores within the last 5 years and empanelled with any metropolitan municipal body of India. Copy of the Agreement with such reputed design engineering agency/ agencies along with proof of empanelment of such agency before any municipal body(ies) and its work experience credentials should be uploaded in the relevant folder.

Mandatory list of personnel, not for evaluation purpose

The bidder shall have the following technical personnel at each site, in its pay-rolls, who shall be deployed on full-time basis.

Sl. No.	Personnel	Qualification	No. of Personnel
1.	Project Manager	B.E. (Civil) with 15 years experience in Building Construction work.	1
2.	Architect	Diploma Architect with 7years experience after completion of frame work till completion of the work.	1
3.	Safety Officer	Diploma in Environment, Health and Safety (EHS) with 5 years experience.	1
4.	Plant Engineer cum Site Engineer Mechanical	B.E (Mechanical) with 5 years experience or Diploma in Mechanical Engineering with 7 years experience.	1
5.	Planning Engineer	B.E. (Civil) with 5 years experience or Diploma in Civil Engineering with 7 years experience.	1
6.	Quality Engineer (Civil)	B.E.(Civil) with 5 years experience or Diploma in Civil Engineering with 7 years experience.	1
7.	Quality Engineer (MEP Works)	B.E. (Electrical) with 5 years experience or Diploma in Electrical Engineering with 7 years experience.	1
8.	Civil Engineer (Specialized in Soil Mechanics)	M.E./B.E. (Civil) With 7 years experience	1
9.	Civil Engineer (Specialized in Structural Design)	M.E./B.E. (Civil)with 5 years experience	1
10.	MEP Engineer (Electrical)	B.E. (Electrical) with 7 years experience or Diploma in Electrical Engineering with10 years experience.	1
11.	Site Engineer (Electrical)	B.E. (Electrical) with 3 years experience or Diploma in Electrical Engineering with 7 years experience in Building & Substation work.	2
12.	Site Engineer (Mechanical)	B.E. (Mechanical) with 7 years experience or Diploma in Mechanical Engineering with 10 years experience in HVAC works for HVAC installation work.	1
13.	Site Engineer (Civil)	Diploma in Civil Engineering with 3 years experience in Building Construction Work.	5

Apart from engineers cited above to be deputed at site for overseeing different phases of construction, a team of Key Personnel of the following criteria is also a pre-requisite.

A. Lead Project Engineer :

A Graduate in Civil Engineering with 20 years experience in construction, planning and management. One engineer to be deployed on per package basis by the Contractor for day to day interactions with the representative(s) of the Employer for execution and supervision of the Works.

B. Principal Structural Engineer :

A Post Graduate in Structural Engineering (Civil) with 20 years experience in design and supervision of building works and thorough experience in RCC / PSC / steel-concrete composite superstructure with different types of foundation including pile foundation for buildings.

C. Soil Mechanics & Foundation Engineer :

A Post Graduate degree in Soil Mechanics & Foundation Engineering having 20 years experience out of which at least 5 years experience in supervising soil mechanics and foundation work for major building works, design of foundations of all types including pile foundation for building structures and construction of major buildings.

D. Principal Architect :

A Graduate Architect having 20 years experience out of which 5 years experience for preparation of building planning and detailing for major buildings.

E. Principal MEP Engineer :

A Graduate Electrical Engineer having 20 years experience in electrical designing in building projects.

1.5 Equipment (not for evaluation purposes)

Availability (either owned or leased having validity for the period till completion of project) of the following **key and critical equipment** is required for a single site of a package:

Sl. No.	Type of Equipment	Maximum age on 30.12.2018	Requirement
1.	Dozer	10 years	1 no
2.	Front end Loader	5 years	3 nos.
3.	Vibratory Roller	5 years	2 nos.
4.	Water Tanker	5 years	2 nos.
5.	Concrete Batching and Mixing Plant (min 15 cum/hour)	3 years	1 no.

Sl. No.	Type of Equipment	Maximum age on 30.12.2018	Requirement
6.	Moveable Crane	5 years	1 no.
7.	Transit Mixer	3 years	5 nos.
8.	Tractor and Trailer	5 years	3 nos.
9.	Concrete Pump	5 years	3 nos.
10.	Construction Elevator	5 years	10 nos.
11.	Rig for piling work	5 years	40 nos.
12.	Auto Level Machine	5 years	3 nos.
13.	Total Station	3 years	1 no.
14.	Vibrator Equipment (Electrical and Fuel type)	3 years	15 nos.
15.	Mechanical Excavator (Crawler Mountain)	3 years	1 no.
16.	Steel Staging and shuttering Material Set	5 years	15000 Sqm.
17.	Reinforcement cutting and bending machine	5 years	3 nos.

N.B. - The above list of equipment reflects the minimum requirement for carrying out the Works and is not an exhaustive list of the equipment required to be deployed

SECTION 4

Bidding Forms (BDF)

SECTION – 4

BIDDING FORMS (BDF)

FORM 1

LETTER OF TECHNICAL BID IN FORM OF AFFIDAVIT

(To be affirmed on Non-Judicial Stamp Paper of Rs.10/- duly attested by Notary / Magistrate)

Name of Contract:

Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis

Managing Director,
West Bengal Medical Services Corporation Ltd,
Swasthya Sathi,
GN- 29, Sector – V, Salt Lake,
Kolkata-700 091

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.

(b) We offer to execute in conformity with the Bidding Documents the following works:

_____

(c) Our Bid consisting of the Technical Bid and the Financial Bid shall be valid for a period of 180 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(d) If our bid is accepted, we commit to obtain a Performance Security in accordance with the Bidding Documents.

(e) Our company has been incorporated in accordance with the laws of India and governed by them.

(f) Our company, including its suppliers, do not have any conflict of interest in accordance with ITB 4.3.

(g) Our company is participating as a bidder having satisfied the eligibility criteria in accordance with ITB 4.1.

(h) Our company, its affiliates or subsidiaries, including any suppliers for any part of the contract, has not been declared ineligible by WBMSCL, any Department, Authority or body corporate under the Government of India or any State Government.

(i) We agree to permit WBMSCL or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the WBMSCL.

(j) We understand that:

(i) WBMSCL can amend the scope and value of the contract bid under this project.

(ii) WBMSCL reserves the right to reject any application without assigning any reason.

(k) All the statements made in the attached documents are true and correct. In case of any information submitted proved to be false or concealed, the application may be rejected and no objection /claim will be raised by the bidder company.

Enclo:

1. Statutory Documents
2. Non Statutory Documents
3. Forms & Annexure duly filled up, signed & notarized (where applicable)

Date:
Place:

For……..(name of bidder)
(Signature)
…….(name of authorized signatory)
……..(designation)

FORM 2

DECLARATION BY THE BIDDER

(Affidavit on Non-Judicial Stamp Paper of Rs.10/- duly attested by Notary / Magistrate)

This is to certify that We, M/s. _____, in submission of this offer confirm that:-

We have inspected the site of work and have made myself/ourselves fully acquainted with local conditions in and around the site of work. We have carefully gone through the Instructions to Bidders (ITB) and all the documents, Forms & Annexures, etc. mentioned therein alongwith the drawing attached. We have also carefully gone through the ITB, Employer's Requirements, General Conditions of Contract, Forms & annexures etc. to be submitted duly filled up & notarized in the form of Affidavit, where applicable, and time of completion (which is sacrosanct) of work: "Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis"

i) Our bid is offered taking due consideration of all factors including site information and conditions of each and every proposed location of the upcoming medical college stated in the detailed Instructions to Bidders to execute the work up to the standards as laid out in Employer's Requirements and other sections of ITB.
ii) We understand that the work being done on Turnkey Basis (Planning, Design & Construction) alongwith supply, installation, testing and commissioning of medical equipment and furniture, though we require approval at different stages of the work starting from concept plan and design to implementation of the work from the Employer / Employer's Representative, such approval do not absolve owning up of responsibility incumbent to us for adequacy of design, standard of work & its safety, maintaining prescribed specification of the work and upholding secured movement of all the stakeholders inside the premises of existing hospital.
iii) We promise to abide by all the stipulations of the Contract documents and carry out and complete the work to the satisfaction of the Employer.
iv) We also agree to procure Plants and Machineries at our cost required for the work. We also submit that we have Organizational Structure comprising adequate Technical Personnel in the line of requirement of ITB. We also agree to accomplish the job entrusted to us in the stipulated time laid out in ITB except situations not under our control.

v) We have not made any misleading or false representation in the forms, statements and attachments in proof of the qualification requirements;

vi) We do not have records of poor performance such as abandoning the work, not properly completing the contract, inordinate delays in completion, litigation history or financial failures etc.

vii) There is no subsisting order of ban/ blacklisting passed by any Department, Authority or body corporate of the Government of India or any State Government.

viii) We have submitted all the supporting documents and furnished the relevant details as per prescribed format.

ix) List of Similar Works satisfying Qualification Criterion as indicated hereinafter, does not include any work which has been carried out by us through a subcontractor on a back to back basis.

x) The information and documents submitted with the bid by us are correct and we are fully responsible for the correctness of the information and documents submitted by us.

xi) We understand that in case any statement/information/document furnished by us or to be furnished by us in connection with this offer, is found to be incorrect or false, appropriate proceedings for debarment and/ or blacklisting may be commenced against us.

Date:
Place:

For……..(name of bidder)
(Signature)
……(name of authorized signatory)
……..(designation)

PROFORMA

	Similar nature of work done			**Work in progress**			
Sl. No.	Name of the work with Tender No.	Employer & Contact no	Estimated Amount	Sl. No.	Name of the work with Tender No.	Employer & Contact no	Estimated Amount

Note:

1. In support of having completed above works attach self-attested copies of the completion certificate from the owner/client indicating the name of work, the description of work done by the bidder, date of start, date of completion (contractual & actual), value of contract as awarded and as executed by the bidder and value of material supplied free by the client.
2. Such credential certificates issued by Govt. Organizations/ Semi Govt. Organizations / Public Sector Undertakings / Autonomous Bodies / Municipal Bodies / Public Ltd. Cos. shall only be accepted for assessing the eligibility of a bidder. For projects in private sector, appropriate TDS Certificates evidencing the value of work, must be submitted.
3. Information must be furnished for works carried out by the bidder in his own name as a prime contractor or proportionate share as member of a joint venture. In the latter case, details of contract value including extent of financial participation by partners in that work should be furnished.
4. If a bidder has got a work executed through a subcontractor on a back to back basis, the bidder cannot include such a work for his satisfying the Qualification Criterion even if the client has issued a Completion Certificate in favour of that bidder.
5. Only similar works completed during the previous years which meet the Qualification Criteria need be included in this list.

Date: For……..(name of bidder)
Place: (Signature)
……(name of authorized signatory)
…… (designation)

FORM 3

LETTER OF FINANCIAL BID

Name of Contract:

Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis

Managing Director,
West Bengal Medical Services Corporation Ltd (WBMSCL),
Swasthya Sathi,
GN- 29, Sector – V, Salt Lake,
Kolkata-700091, West Bengal

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with instructions to Bidders (ITB) 8;

(b) The total price of our bid is the sum total of the costs mentioned in the Bill of Quantities;

(c) Our bid shall be valid for a period of 180 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(e) If our bid is accepted, we commit to obtain a Performance Security in accordance with the Bidding Documents.

(f) We understand that this bid, together with your written acceptance thereof included in your Notification of Award, shall constitute a binding contact between us, until a formal contract is prepared and executed; and

(g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Date:
Place:

For……..(name of bidder)
(Signature)
…….(name of authorized signatory)
……..(designation)

FORM 4

BID SECURITY BANK GUARANTEE

[Bank's Name and Address of Issuing Branch or Office]

Beneficiary:	West Bengal Medical Services Corporation Limited, having its registered office at Swasthya Sathi, GN- 29, Bidhannagar, Sector – V, Salt Lake, Kolkata-700 091
A/c. No.:	105605003391
Name of account holder:	West Bengal Medical Services Corporation Limited
Bank name and branch:	ICICI Bank, Bidhan Nagar Branch
IFS Code:	ICIC001056

Date: Bid Security No:

We have been informed that .....name of the bidder..... (hereinafter called "the Bidder") has submitted to you its bid dated..... (hereinafter called "the Bid") for the execution of contract for Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis (the "NIT").

Furthermore, we understand that, according to your conditions, bids must be supported by a Bid Security.

At the request of the bidder, we [Bank] hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of Rs. 7,20,00,000/- (Rupees Seven Crores Twenty Lakhs only) upon receipt by us of your first demand in writing accompanied by a written statement stating that the bidder is in breach of its obligation(s) under the bid conditions, because the bidder :

(a) If a bidder withdraws its bid during the period of bid validity, except as provided in ITB 17.2;

(b) If a bidder engages in a corrupt, fraudulent, coercive, collusive or restrictive practice as specified in ITB 3.1;

(c) If a bidder is declared disqualified in terms of ITB 4.3;

(d) If a bidder is otherwise in breach of the terms of the Bidding Documents, or,

(e) In case of a Selected Bidder, if it fails or refuses to furnish the Performance Security within the scheduled time period as per ITB 38.1.

This guarantee will expire: (a) if the bidder is the Selected Bidder, upon receipt of copies of the Agreement signed by the Bidder and the Performance Security issued to you upon the instruction of the Bidder, and (b) if the Bidder is not the Selected Bidder, upon the earlier of (i) our receipt of a notice from you that the Performance Security has been received from the Selected Bidder, or (ii) 180 days from the date hereof.

This Guarantee will not be discharged due to the change in the constitution of the Bank or the Bidder.

This Guarantee will neither be cancelled nor revoked by the Bank without the written authorization of West Bengal Medical Services Corporation Limited.

Consequently, any demand for payment under this Guarantee must be received by us at the office on or before that date.

[Bank's seal and authorized signature(s)]

FORM 5

POWER OF ATTORNEY IN FAVOUR OF SIGNATORY OF THE BID

(To be executed on non-judicial stamp paper of appropriate value)

KNOW ALL MEN BY THESE PRESENTS THAT WE, ……[insert the name of the bidder]…… a company within the meaning of the Companies Act, 2013 and having its registered office at ……[insert address] ……(hereinafter referred to as the bidder) acting through ……[insert name of the person giving the Power of Attorney]…….presently holding the position of …… (insert designation of the person giving the Power of Attorney) having been authorized by the Board of Directors of the company, inter alia, to execute contracts in the name of and for and on behalf of the company do hereby constitute, appoint and authorize …… (insert name, designation and residential address of the person to whom the Power of Attorney is being given)…… as our true and lawful attorney to do in our name and on our behalf all such acts, deeds, things necessary and incidental for submission of our bid against Bid Reference No. WBMSCL/NIT-239/2018 dated 21/12/2018 floated by WBMSCL. We hereby further authorize the above attorney for signing and submission of the bid and all other documents, information related to the bid including undertakings, letters, certificates, declarations, clarifications, acceptances, guarantees, any amendments to the bid and such documents related to the bid, and providing responses and representing us in all the matters before WBMSCL in connection with the bid for the said tender till the completion of the bidding process. We accordingly hereby nominate, constitute and appoint abovenamed person, as the lawful attorney to do all or any of the acts specifically mentioned immediately herein above.

We do hereby agree and undertake to ratify and confirm whatever either of the said Attorney shall lawfully do or cause to be done under and by virtue of this Power of Attorney and the acts of the attorney to all intents and purposes are done as if the same had been done on behalf of the company if these presents had not been made.

IN WITNESS WHEREOF WE, _____ , THE ABOVE NAMED PRINCIPAL

HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS _____ DAY OF _____ ,

20**.

For_____

(Signature, name, designation and address)

Witnesses:

1.

2.

[Notarised]

Accepted

_____

(Signature)

(Name, Title and Address of the Attorney)

Form - 6

Schedule - I

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Mortuary cooler with arrangement to keep 8 bodies	1		
2	Embalming Machine	3		
3	Microtomes, rotary	1		
4	Incubators	1		
Name of the Discipline: BIOCHEMISTRY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Shaking Machine	2		
2	Digital Colorimeters	5		
3	Thin Layer Chromatograph	2		
4	Horizontal Electrophoresis Unit	1		
5	Vertical Slab Gel Electrophoresis Unit with Power supply	2		
6	Analytical Balance	2		
7	Digital Spectrophotometer (UV vis Spectrophotometer)	1		
Name of the Discipline: COMMUNITY MEDICINE				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Haemoglobinometer	5		
2	Centrifuge clinical	1		
3	Spirometer	3		
Name of the Discipline: FORENSIC MEDICINE				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Digital Spectrometer	2		
2	Automatic tissue processing machine	2		
3	Microtome	2		
4	Cold storage for 6 dead bodies	1		
5	Binocular Research type microscope with attachment for camera	4		
6	Deep Freezer	1		
Name of the Discipline: MICROBIOLOGY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Single pan digital balance	2		
2	Serum inspissators	1		
3	Biosafety Cabinet Type - 2A	1		
4	Biosafety Cabinet Type - 2B	1		
5	BOD Incubator	1		

Schedule - I

Name of the Discipline: ANATOMY				
6	Elisa Reader	1		
Name of the Discipline: PATHOLOGY				
Sl. No. (A)	**Name of the Equipments (Item) (B)**	**Qty. required for 1(one) MCH (C)**	**Rate (D)**	**Total (E) = (C) * (D)**
1	Automated Rotary Microtome	1		
2	Electrophoresis Set Up	1		
3	Five Part Hematology Analyzer	1		
4	Automatic Hematology Slide Stainers	1		
5	Coagulometer (Fully automated)	1		
6	Penta Head Microscope with High end Optics with HDMI Multi output Photographic camera (> 5 MP) including Software	1		
7	For every Tutor – Binocular Microscope with suitable high end lenses	4		
8	For every Professor, Associate & Assistant Professor : Binocular Microscopes with High end Semiapochromatic Optics of international standard.	4		
9	For Diagnostic & Research Work - Trinocular head Microscope with Bright field,	1		
10	Manual Rotary Microtome	2		
11	Cryostat	1		
12	Automated Tissue Processor –Vaccum	1		
13	Autoclave	2		
Name of the Discipline: PHARMACOLOGY				
Sl. No. (A)	**Name of the Equipments (Item) (B)**	**Qty. required for 1(one) MCH (C)**	**Rate (D)**	**Total (E) = (C) * (D)**
1	Instruments Sterilliser Electric size 12"x8"x6"	1		
2	Tread Mill Machine	1		
3	Autoclave Electric	1		
4	Portable digital ECG	4		
Name of the Discipline: PHYSIOLOGY				
Sl. No. (A)	**Name of the Equipments (Item) (B)**	**Qty. required for 1(one) MCH (C)**	**Rate (D)**	**Total (E) = (C) * (D)**
1	Large extension KYMOGRAPH	1		
2	PHYSIOGRAPH WITH 3 CHANNEL WITH STANDARD ACCESSORIES	1		
3	Calorimeter	2		
4	PERIMETER	2		
5	Thermo-aesthesiometer	10		
6	Laboratory Centrifuge machine	2		
(a) Total Cost of equipment for One (01) MCH :				
(b) Total Cost of equipment for Five (02) MCHs [i.e. 2 X (a)] : (to be fed in the designated cell in the BOQ)				

Form - 7

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
1	Drill machine	2		
2	Hand saw, preferably metal	3		
3	Band saw for sectioning body and limbs	1		
4	Storage tank to hold 10 cadavers, static/movable, durable tank with input and output facility with lid	3		
5	Movie camera with projection screen	1		
6	Computer with internet connection, & video CD library	2		
7	Dissecting instruments for cadaveric dissection	20		
8	Meat cutting machine for thin body sections (trans and vertical) for gross anatomy sectional study	1		
9	Microtomes, Sledge, large cutting	1		
10	Paraffin embedding bath	1		
11	HISTILOGY laboratory Table	8		
12	Laptop	1		
13	Dissection microscope	3		
14	Photocopier and Scanner	1		
15	Koplin jar (Different Size)	25		
16	Brain Knife	2		
17	Glass jar with lid (200ml)	50		
18	Computer set with printer	1		
Name of the Discipline: BIOCHEMISTRY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total (E) = (C) * (D)
1	Constant temperature water bath Tank	1		
2	pH meters of wide range digital	5		
3	Fixed volume pipettes	5		
4	Vortex mixers	2		
5	Boiling Water baths	2		
Name of the Discipline: COMMUNITY MEDICINE				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH	Rate (D)	Total (E) = (C) * (D)
1	Barometer (Mercury based instruments to be replaced with other alternatives)	1		
2	Filter, Pasteur Chamberland, complete set	1		
3	Filter, Berkefeld	1		
4	Hydrometres, Spirit	2		
5	Hydrometres, milk	2		
6	Hydrometers, wet and dry bulb	1		
7	Balance for weighing food stuff (Capacity 2 Kg)	1		
8	Salters Baby weighing machine	2		
9	Harpender Calipers (for skinfold thickness)	3		
10	Height measuring stand	3		
11	Chloroscope	10		
12	Horrock's Apparatus	3		
13	MUAC tapes	10		
14	Kata Thermometer	3		
15	Globe Thermometer	3		
16	Anemometer	3		

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
17	Sound level meter	3		
18	Soil testing kit	1		
19	Vaccine carrier	5		
20	Glucometer	10		
21	Solar radiation thermometer	3		
22	First Aid Kit	1		
23	Otoscope	1		
24	Ophthalmoscope	1		
25	Balance Analytical 200 gm.	2		
26	Dissecting microscope	20		
27	Laptop	1		
28	Computer with printer, scanner and photocopier and Internet facility	3		
29	Oil immersion Microscope	1		
Name of the Discipline: FORENSIC MEDICINE				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Stop Watch	2		
2	Anthropometric set	2		
3	Digital pH meter	2		
4	Chemical Balance	2		
5	Paraffin bath embedding	2		
6	Weighing machine for dead bodies	1		
7	Autopsy Table	2		
8	Autopsy saw, with accessories	3		
9	Weighing machine for organs	2		
10	Magnifying Glass	4		
11	Rectal Thermometer	2		
12	Portable X-Ray Machine	2		
13	Dissection Set	70		
14	Water Bath for Tissue floatation	2		
15	Hacksaw	4		
Name of the Discipline: MICROBIOLOGY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Anaerobic apparatus (Gas pak)	1		
2	Distilled water Plant	1		
3	Dropping bottles	500		
4	Dispenser Dropper 2ml	50		
5	Wash Bottles 500ml	50		
6	Concavity Glass Slide, 1 & 3 Cavity	110		
7	Koplin Jar	4		
8	Staining Troughs	60		
9	Sterilsation Indicator	2		
10	Regent Bottles With Stopper, 2000,1000,500,250,100cc	100		
11	Lab Refrigerator	5		
12	Tissue Homogenizer with Pestle	6		
13	Laminar flow (table/Cabinet)	1		
14	Micrometer eye pieces	2		
15	Single pan digital balance	2		

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
16	Micrometer stage	2		
17	Needle and Syringe Destroyer	2		
18	Durham's Tube	500		
19	Glass Beads	100		
20	Autoclaving Busket	10		
21	Sterilizing pans	10		
22	Antibiotic Zone scale	3		
23	Petri Dish Carrier 10&6	10		
24	Hand Lens	2		
25	Computer Unit	1		
26	Printer	1		
27	Scanner	1		
28	Macntosh Fildes Jar	2		
29	Cryo Marker	2		
30	Slit air sampler System	1		
31	Chemical Balance-ordinary Apothecary"s	2		
32	Calibrated weight	1		
33	PH determination apparatus	2		
34	Vortex Mixer	2		
35	Complete Electrophoresis apparatus with power supply (Paper, PAGE, agarose)	2		
36	Nichrome Inoculating Loop	60		
37	Nichrome Inoculating Wire Straight	10		
38	Tongue Depressor	4		
39	Nasal Speculum	2		
40	Micropipettes – Multi channel & Single channel	31		
41	Autoclave	5		
42	Deep Freeze -20° C	1		
43	Deep Freezer -80° C	1		
44	Water bath with variable temperature	2		
Name of the Discipline: PATHOLOGY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Ultrapure water solutions - Distilled water plant	1		
2	Single pan digital balance	2		
3	Stand alone cold plate	1		
4	Troughs for staining	20		
5	Coplin jars	20		
6	Digital Tissue Floatation bath	2		
7	Paraffin Dispenser***	2		
8	Single Pan Digital Balance, Chemical	2		
9	Band saw	1		
10	Saws, Wire for cutting bones	6		
11	Microscopics Slide Cabinet (Closed Pack Manner)	10		
12	Automatic timer	5		
13	X-ray viewing box (LED)	2		
14	Lab Refrigerator (minimum 400 litres)	2		
15	Sternal puncture needle adult size	6		
16	Sternal puncture needle child size	6		
17	Stop watch reading at 1/5 second	5		
18	pH Meter electric	5		
19	Surgical instruments	5		
20	Automatic Urine Analyzer	2		
21	Sp. Gravity Measure	2		

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
22	PH meter	2		
23	Needle and Syringe Destroyer	2		
24	Instrument Steriliser	2		
25	Tissue Cassettes, metal & Plastic	10		
26	Leukart's L plate, brass	5		
27	Metal & Plastic moulds for embedding	5		
28	Microscopics Slide Cabinet (Horizontal Manner)	40		
29	Aluminum slide trays	6		
30	Haemacytometers with red and white pipettes	90		
31	Urinometers (Mercury based instruments to be replaced with other alternatives)	10		
32	Pipettes of various sizes with disposal tips	10		
33	Haemoglobinometer	10		
34	Albuminometer	10		
35	Centrifuge tube graduated	40		
36	Cytocentrifuge	2		
37	Three Part Fully Automated Cell Counter	1		
38	**Grossing Station** - Stainless steel, with Control panel, air filtration system, Track mounted adjustable computer arm with articulation, LED lights that are color and intensity, Dedicated USB ports for camera control and data transfer adjustable, Integrated pathology camera system, Instrument Set (High quality) Height Adjustable Stainless Steel Chairs With Split AC of appropriate capacity	1		
39	Cold Plate for Modular Tissue Embedding System	1		
40	Single pan Analytical balance	2		
41	Water bath (Tissue Floatation)	2		

Name of the Discipline: PHARMACOLOGY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Stop watch	20		
2	Pupillometer	10		
3	Sherrington Starling kymograph (electrically driven)	3		
4	Starling's long extension Kymographs with time markers	3		
5	The ideal Respiration Pump (500cc. CAP)	3		
6	Refrigerators	2		
7	Automatic electric recording drums	4		
8	Colorimeters	3		
9	Canulas (different types)	48		
10	Smoking Burners Palmer A-291 and a-265	1		
11	Tracheal Canula Metal Palmer E-76	4		
12	Animal weighing machine for small animals like rats and gunea pig	6		
13	Dissection instruments	10		
14	Distillation apparatus	4		
15	Chemical Balance-ordinary Apothecary"s	2		
16	Chemical Balance-Sensitive	2		
17	Actophotometer	1		
18	Animal cage	4		
19	Digital pH meter	1		
20	DIGITAL PLETHYSMOMETER	1		
21	Antihistamine Chamber with manometer	1		

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
22	Disection instrument set (Plethysmograph assorted 4 Pneumograph Palmer E 1 Piston Recorder Palmer C.51 1 Tambours mareys Palmer C.5 & C.11 4 Tetanus Set Palmer H2O 1 Stop Watches Jacquets 12 Oxygen Cylinders with Trolleys 20 cu.ft 4 Carbon-di-oxide cylinder 2 Operating lamps-Phillips 4 Animal trolley with 12 cages)	4		
23	Digital Sphygmomanometer	20		
24	Critical Flicker Fusion Apparatus	10		
25	Bicycle Ergometer	1		
26	Dale's Isolated organ bath	4		
27	Rotarod Assembly	1		
28	Cook's Pole Climbing Apparatus	1		
29	Electro-Convulsiometer	1		
30	Water bath	4		
Name of the Discipline: PHYSIOLOGY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate (D)	Total (E) = (C) * (D)
1	Phacoscope	1		
2	Hand grip dynamometer	2		
3	Tuning fork – 128 Hz	7		
4	Tuning fork- 256 Hz	7		
5	Tuning fork- 512 Hz	7		
6	Animal Weighing scale	2		
7	Double demonstration eye piece	3		
8	Maddox rod	1		
9	Marey' Tambour	20		
10	Schematic eye	1		
11	NEWTON'S COLOUR WHEEL	1		
12	Stage Incubator	1		
13	COLORIMETER	1		
14	ANAESTHESIA INSTRUMENTS	1		
15	DALE'S BATH FOR INTERNAL ORGANS	10		
16	SAHLI (SAHLI- ADAMS) HAEMOGLOBINOMETER OR HAEMOMETER	36		
17	Smoke out fit with fume cupboard	1		
18	Vernishing Outfit	1		
19	Compass Aesthesiometer	10		
20	Water Distillation Unit Plant	1		
21	All glass distillation apparatus double stage	1		
22	MOSSES ERGOGRAPH	6		
23	Knee hammer	20		
24	Venus and arterial canula	12		
25	Surgical instrument for operative procedure	1		
26	Douglas Bag	2		
27	Instrument trolley	1		
28	Stethograph	6		
29	Electric time marker 100/sec	6		
30	BICYCLE ERGOMETER	2		
31	Nasal Field Olfactometer	1		
32	Edridge-Green Colour Perception Lantern	1		
33	Digital Stopwatch	10		
34	Refrigerator	2		
35	Voltage Stabilizer	3		
36	Stepdown transformer	1		
37	Laptop	1		

Schedule - II

Name of the Discipline: ANATOMY				
Sl. No. (A)	Name of the Equipments (Item) (B)	Qty. required for 1(one) MCH (C)	Rate inclusive of GST (D)	Total inclusive GST (E) = (C) * (D)
38	Photocopier	1		
39	Basal Metabolism Apparatus	1		
40	Opthalmoscope	1		
41	Spirometer Ordinary	6		
(a) Total Cost of equipment for One (01) MCH :				
(b) Total Cost of equipment for Five (02) MCHs [i.e. 2 X (a)] : (to be fed in the designated cell in the BOQ)				

Form -8

Schedule of Furniture				
Sl. No.	**Items of Furniture**	**Nos. Required for 1 (one) no. MCH**	**Rate (in Rupees)**	**Total (in Rupees)**
(A)	**(B)**	**(C)**	**(D)**	**(E = C x D)**
Academic Building:				
1	Conference Table - 24 seater with chairs	1		
2	4 seater Dining Table with chairs	15		
3	Examination Table	4		
4	Principal's & MSVP's Table	2		
5	Principal's & MSVP's Chair	2		
6	Visitor's Chair for Principal & MSVP	20		
7	Office Table	80		
8	Officer's Chair	80		
9	Teacher's Table	45		
10	Teacher's Chair	45		
11	Visitor's Chair	250		
12	HOD's Chair	15		
13	HOD's Table	15		
14	Visitor's Chair for HODs	60		
15	SS Waiting Chair-3 seater	50		
16	Disection Table	20		
17	Computer Table with Chair	15		
18	Lecture Hall Table + Seating Bench-2seater	470		
19	Chair with Desk Arm	1800		
20	Book Storage Rack - Type -1	40		
21	Book Storage Rack - Type -2	40		
22	Almirah Steel	150		
23	Laboratory Table with Sink	500		

Form -8

Schedule of Furniture				
Sl. No.	**Items of Furniture**	**Nos. Required for 1 (one) no. MCH**	**Rate (in Rupees)**	**Total (in Rupees)**
(A)	**(B)**	**(C)**	**(D)**	**(E = C x D)**
24	Laboratory Table without Sink	150		
25	Lab. Table Seating Stool	1300		
26	Student's Chair	500		
27	Table Type -6 seater for library	40		
28	Table Type -2 seater for library	40		
29	Locker For Stuents	8		
30	Notice Board	6		
31	Black Board	6		
32	White Board	20		
33	Musium Rack single sided			
34	Musium Rack double sided			
Hostel Block:				
1	4 seater Dining Table with seating arrangement	88		
2	Study Table	230		
3	Study Chair	230		
4	Single Steel Bed without Matress	230		
5	Visitor 's Chair 3 seater	12		
6	Teacher's Table	2		
7	Teacher's Chair	2		
8	Almirah Steel	230		
OPD Building:				
1	Examination Table with Matress and steps	100		
2	Hospital Bed with Matress & accessories	60		
3	Doctor's Table	150		
4	Doctor's Chair	500		

Form -8

Schedule of Furniture				
Sl. No.	**Items of Furniture**	**Nos. Required for 1 (one) no. MCH**	**Rate (in Rupees)**	**Total (in Rupees)**
(A)	**(B)**	**(C)**	**(D)**	**(E = C x D)**
5	Visitor's Chair	500		
6	Faculty's Chair	10		
7	Faculty's Table	10		
8	SS Waiting Chair-3 seater	500		
9	Computer Table with Chair	15		
10	Almirah Steel	20		
11	SS Seating Stool	1200		
Total Cost of Furniture for 1 (One) MCH (a) =				
Total Cost of Furniture for 2 (Two) MCH (ie. 2 x a) to be fed in the designated cell in the BOQ =				

FORM 9

(FORM OF NOTIFICATION OF AWARD)

(BY SPEED POST / ACK. DUE)

(On the letter head of WBMSCL)

No. : _____ / Dated :

To

Name & Address of the bidder

Dear Sirs,

Sub: Bid Reference No.: WBMSCL/NIT-239/2018 dated 21.12.2018 for Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis

Ref: Your tender dated _____ .

This is to notify you that your bid for the work under reference has been accepted by the Competent Authority of _____ for a Tendered Amount/ Contract value of Rs. _____/- (Rupees _____ only).

Pursuant to clause 6.2 of the GCC, you are required to furnish irrevocable Performance Security for an amount equivalent to 10% (ten percent) of the Tendered Amount/ Contract value. The Performance Security of an amount of Rs. _____/- (Rupees _____ only) is thus required to be submitted within 10 days of issue of this Notification of Award.

The time of 24 months allowed for execution of the Project will be reckoned from the date of this Notification of Award.

You are requested to contact _____ (complete designation and address of the project-in-charge/ Employer's Representative) for execution of the contract.

The Form of Agreement to be executed is being sent to you shortly. Kindly ensure that the same is returned to us duly signed at the earliest and not later than 21 days from the receipt of the form of Agreement. It may be noted that no payment shall be made for any work carried out by you till the Agreement is executed and till such time the Performance Security has been submitted by you.

This Notification of Award is being sent to you in duplicate and you are requested to return without delay one copy of the letter duly signed and stamped, in token of your acknowledgement.

Kindly note that this Notification of Award shall constitute a binding contract between us pending execution of formal Agreement.

Your letter referred to above shall form part of the Contract.

Yours faithfully,

For West Bengal Medical Services Corporation Ltd.

Managing Director

FORM 10

SITE ORGANISATION

(to be provided by the bidder)

FORM 11

METHOD STATEMENT

(to be provided by the bidder)

FORM 12

MOBILIZATION SCHEDULE

(to be provided by the bidder)

FORM 13

CONSTRUCTION SCHEDULE

(to be provided by the bidder)

FORM 14

MANUFACTURER'S AUTHORISATION FORM

(to be provided by the Contractor only for Medical Equipment – Schedule I)

Tender No. ---------- Date: ----------

WHEREAS _____ who are official manufacturers of _____ and having production facilities at _____ do hereby authorize _____ located at _____ (hereinafter, the "bidder") to supply the following Products produced by us, the makes/ categories/sub-categories of which has been approved by the Employer for the Supply Requirements.

[**Note : Please Specify the Product Name & Model No here.]**

When resold by _____ these products are subject to applicable warranty terms of your Bidding Documents/ ToR.

We assure you that in the event of _____ not being able to fulfill its obligation as our Sales & Service Provider in respect of your Bidding Documents/ ToR, we would continue to meet our the terms stated in the abovementioned Bidding Documents/ ToR through alternate arrangements.

We also confirm that_____(name of the Service Provider) is our authorized service provider and can hence provide maintenance and upgrade support for our products.

Name In the capacity of

Signed

Note: This authorization letter must be on the letterhead of the manufacturer, must be signed by a person competent and having the Power of Attorney (Notarized copy to be attached) to bind the Manufacturer.

FORM 15

INDEMNITY BOND

(to be executed on a non-judicial stamp paper of Rs. 100/- and notarized)

This Indemnity Bond (this "**Indemnity Bond**") is made on this [●] day of [●], 20[●], between [●], a company within the meaning of the Companies Act, 2013, having its registered office at [●],[●] (hereinafter referred to as the "**CONTRACTOR**", which expression shall, unless repugnant to the context thereof, be deemed to include its successors and permitted assigns);

IN FAVOUR OF

WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED, a company within the meaning of the Companies Act, 2013, wholly owned by the Government of West Bengal, having its registered office at Swasthya Sathi, GN-29, Salt Lake, Kolkata – 700 091, (hereinafter referred to as the "**EMPLOYER**", which expression shall, unless repugnant to the meaning or context thereof, be deemed to include its successors and permitted assigns)

Contractor and the Employer are hereinafter collectively referred to as the "**Parties**" and individually as a "**Party**".

WHEREAS:

As per directions of the Health & Family Welfare Department, Government of West Bengal, the Employer has invited bids for Planning, Design and Construction of 4 Government Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis in 2 packages by Bid Reference No. WBMSCL/NIT-239/2018 dated 21.12.2018 and upon evaluation of the bids, [●] has been selected as the Selected Bidder/ Contractor in Package - [●] and has been issued the Notification of Award for planning, designing and construction of the medical colleges as per specifications given in the Employer's Requirements at the sites comprising the package, in accordance with the terms and conditions specified in the Notification of Award;

A. As per the terms of the Bidding Documents, the Contractor has to supply several electrical, mechanical, electro-mechanical and medical equipment which shall be required to be installed and commissioned at the sites at several phases during phase-wise construction at the sites;

B. In terms of the Bidding Documents, the Employer has directed the Contractor to issue equipment-specific indemnity bond undertaking the safe custody and protection of the equipment till Taking Over of Works is carried out by the Employer at such sites and the Employer has by letter dated [●] at present directed the Employer to furnish indemnity bond with respect to [●] (name and description of equipment) which the Contractor has already supplied/ shall supply by [●].

NOW, THEREFORE, in consideration of the premises set forth above and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. UNDERTAKING

The Contractor hereby unconditionally and irrevocably agrees and undertakes to the Employer that it or its men and agents shall not destroy, remove, deface or damage the equipment and/ or any part thereof or shall not impair it in any manner so as to render its non-functional or not properly functional. This undertaking shall also extend to any user manual, warranty card or any device pertaining to the equipment which had been supplied along with the equipment.

The Contractor further confirms the following:

(i) it shall store the equipment in such a manner that does not any way impede the functionality of the equipment;

(ii) it shall store the equipment in a manner, as may be specified in the user manual or as such equipments are generally stored as per industrial practices; and

(iii) if the conditions for storage provided by the Employer may in the opinion of Contractor adversely affect the equipment, then it shall be the duty of the Contractor to bring the same to the notice of the Employer, at the earliest.

The Contractor further confirms that till such time the Taking Over Certificate with respect to the Project is issued, or any Taking Over of Sections of the Project takes place, which includes Taking Over such equipment, the safety and security of such equipment shall be the duty of the Contractor and in case any such equipment is stolen or gets destroyed, damaged or requires to be repaired, the Contractor shall be liable to reimburse the Employer, the cost incurred for purchasing a replacement equipment or the expenditure incurred by the Employer for repairing such instrument and the Employer shall be at full liberty to adjust such costs and expenses from the monthly bills raised by the Contractor on the Employer or may be recovered by the Employer, by way of invocation of the Performance Security or the Mobilisation Advance Bank Guarantee, as the case may be, which shall be at the discretion of the Employer. The invocation of the Performance Security or the Mobilisation Advance Bank Guarantee shall not in manner affect the rights of the Employer under such Indemnity Bond.

2. INDEMNIFICATION

The Contractor hereby agrees to indemnify, defend and hold harmless the Employer, their respective directors, officers, representatives, employees and agents (collectively, the "**Indemnified Persons**") from and against any and all claims, actions, demands, losses, damages, liability and/or judgments including such costs, attorney's fees and expenses asserted against or incurred by the Indemnified Persons, as a result of, arising from, or in connection with or relating to any matter inconsistent with, or any breach or inaccuracy of any representation, warranty, covenant or agreement made or failure to perform (whether in whole or part) any obligation required to be performed by the Contractor pursuant to this Indemnity and/ or the Agreement.

The indemnification rights of the Indemnified Persons under this Indemnity Bond are independent of, and in addition to, such other rights and remedies as the Employer may have at law or in equity or otherwise, including the right to seek specific performance, rescission or other injunctive relief, none of which rights or remedies shall be affected or diminished thereby.

3. TERM AND TERMINATION

This Indemnity Bond shall become effective from the date, the same is executed and shall be valid till the end of the Defects Liability Period as per the terms of the General Conditions of Contract.

4. GENERAL

If any provision of this Indemnity Bond is invalid, unenforceable or prohibited by law, the Indemnity Bond shall be considered divisible as to such provision and such provision shall be inoperative and shall not be part of the consideration moving from either Party hereto to the other, and the remainder of this Indemnity Bond shall be valid, binding and of like effect as though such provision was not included herein.

The person signing this Indemnity Bond on behalf of the Contractor represents and covenants that he/ she has the authority to sign, execute and perform this Indemnity Bond in favour of the Employer.

SIGNED and DELIVERED for and on behalf of

CONTRACTOR

By:

Name:

Title:

FORM 16

BIDDERS QUALIFICATION

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI – 1 :Bidder's Information Sheet

	Bidder's Information
Bidder's legal name	
Bidder's year of constitution	
Bidder's Registered address	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents. ❑ 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2	

❑	2.	Authorization to represent the company named in above, in accordance with ITB 20.2.
❑	3.	In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.

FORM 17

Form FIN-1 : Financial Situation

Each bidder must fill in this form

		Financial Data for Previous 3 years		
		Year 1	Year 2	Year 3
	Information from Balance Sheet			
1.	Total Assets			
2.	Total liabilities (secured loans, unsecured loans and current liabilities)			
3.	Misc. expenditure to the extent not written off			
4.	**Net worth (1-2—3)**			
A.	**Investments**[1]			
B.	**Current Assets**			
i.	Inventories			
ii.	Sundry debtors			
iii.	Cash & Bank and other current assets[2]			
iv.	Loans & Advances[3]			
	Total Current Assets			
C.	**Current liabilities and provisions**			
i.	Current liabilities and provisions			
ii.	Provisions			
iii.	Unsecured loans[4]			
	Total Current liabilities and provisions			
D.	**Working Capital Limits and**			

	Utilisation			
1.	Fund based Limit[5]			
2.	Non Fund based Limit[6]			
	Utilised as on last day of Financial year[7]			
3.	Fund based Limit			
4.	Non Fund based Limit			
5.	Fund based limit available (1 – 3)			
6.	Non Fund based limit available(2-4)			
7.	Total Working Capital Limit Available (5 + 6)			
E.	**Total Cash Flow available (A+B – C+D)**			
	Information from Income Statement			
	Total Revenue			
	Profit before taxes			
	Profits after taxes			
1.	Investments shall include only those investments which are unencumbered as certified by the Statutory Auditor.			
2.	Cash & Bank and other current assets will not include margin money deposit, earnest money deposit, retention money, money lying in any escrow account, unbilled revenue.			
3.	Loans and advances shall not include tax deducted at source and advance tax, deposits lying with statutory authorities or deposits lying under any judicial order.			
4.	Amounts repayable within one year shall be included.			
5.	Secured loans, lease rentals payable within one year and debentures, preference shares payable within one year shall be included.			
6.	Credit Limits should supported by Certificate from the Lead Bank			
7.	Utilisation of working capital limits should be supported by certificate of the Statutory Auditor.			

	Attached are copies of financial statements (balance sheets including all related notes and income statements) for the last 3 years as indicated above, complying with the following conditions.
	All such documents reflect the financial situation of the bidder or partner to a JV and not sister or parent company
i)	Historical statements must be audited by a certified accountant
ii)	Historical statements must be complete, including all notes to the Financial Statements.
iii)	Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Form FIN-2 : Average Annual Turnover

Each bidder must fill in this form

Annual Turnover Data for the last 3 years			
Year			**Amount in INR**
Average Annual Turnover			

The information supplied should be the Annual Turnover of the bidder in terms of the amounts billed to clients for each year for work in progress or completed, converted to INR at the rate of exchange at the end of the period reported.

We further certify that the said turnover have been calculated in accordance to the formula specified in the Bidding Documents.

We further certify that the bidder has a positive net worth, as on the date of submission of the bid, as per the formula provided in the Bidding Documents.

Name of Chartered Accountant:

Seal of Chartered Accountant:

[Signature]
[Name of Chartered Accountant]
{Registration No.]

Form FIN-3: 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 indicated in Section 3 (Evaluation and Qualification Criteria)

Financial Resources		
No.	Source of Financing	Amount (INR equivalent)
1.		
2.		
3.		

Form FIN-4:

Current Contract Commitments/Works in Progress

Bidders 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 Contract Address, Tel, Fax	Value of Outstanding Work [Current INR Equivalent]	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months [INR/month)]
1					
2					
3					
4					
5					

Note: If bidders are bidding for more than one package in terms of ITB 4.1, then financial capacity for such bidding, may be appropriately indicated in the forms FIN -1, FIN – 2, FIN – 3 and FIN – 4.

FORM 18

Form EXP-1: General Construction Experience

Each bidder must fill in this form

General Construction Experience				
Starting Month Year	Ending Month Year	years	Contract Identification and Name, Name and Address of Employer, Brief Description of the Works Executed by the bidder and the Value of the Contract	Role of bidder

FORM 19

e-NIT ACCEPTANCE FORM

(To be affirmed on non-judicial stamp paper of Rs. 10/- before Notary/ Magistrate)

AFFIDAVIT

This is to certify that we, M/s. _____, in submission of this bid confirm that all the terms and conditions of the Bidding Documents (Bid Reference No. WBMSCL/ NIT-239/2018 dated 21.12.2018) and all its Sections, viz. the e-NIT, the ITB, the Employer's Requirements, the Bidding Forms, the GCC, the Contract Forms and all Corrigenda and clarifications issued to the Bidding Documents are read and accepted without any modification or conditions.

For [Name of bidder]

Place: [Name of authorized signatory] [Designation]
Affix rubber stamp of bidder]
[Date]

[Note: Technical evaluation of the bid will only be taken up after scrutiny of Form – 19 duly notarized]

SECTION 5

EMPLOYER'S REQUIREMENT

Section - 5:

Employer's requirement.

Section 5.1	List of Packages
Section 5.2(a)	Topographical Map of the sites
Section 5.2 (b)	Proposed infrastructure
Section 5.2 (c)	Indicative Geotechnical Investigation Reports
Section 5.3	Site-wise Area & Floor Statement of the 4 (Four) Medical Colleges
Section 5.4A	Schedule of finishes
Section 5.4B	Schedule of finishes (Common items)
Section 5.4C	Item-wise specification
Section 5.5	Scope & Specification of Civil works
Section 5.6	Scope and Specification of Electrical works
Section 5.7	Payment schedule
Section 5.8	Employer's requirements for procurement of Medical Equipment
Section 5.8A	List of Medical Equipment (Schedule- I)
Section 5.8B	List of Medical Equipment (Schedule- II)
Section 5.9	List of Furniture

SECTION 5.1

List of Packages

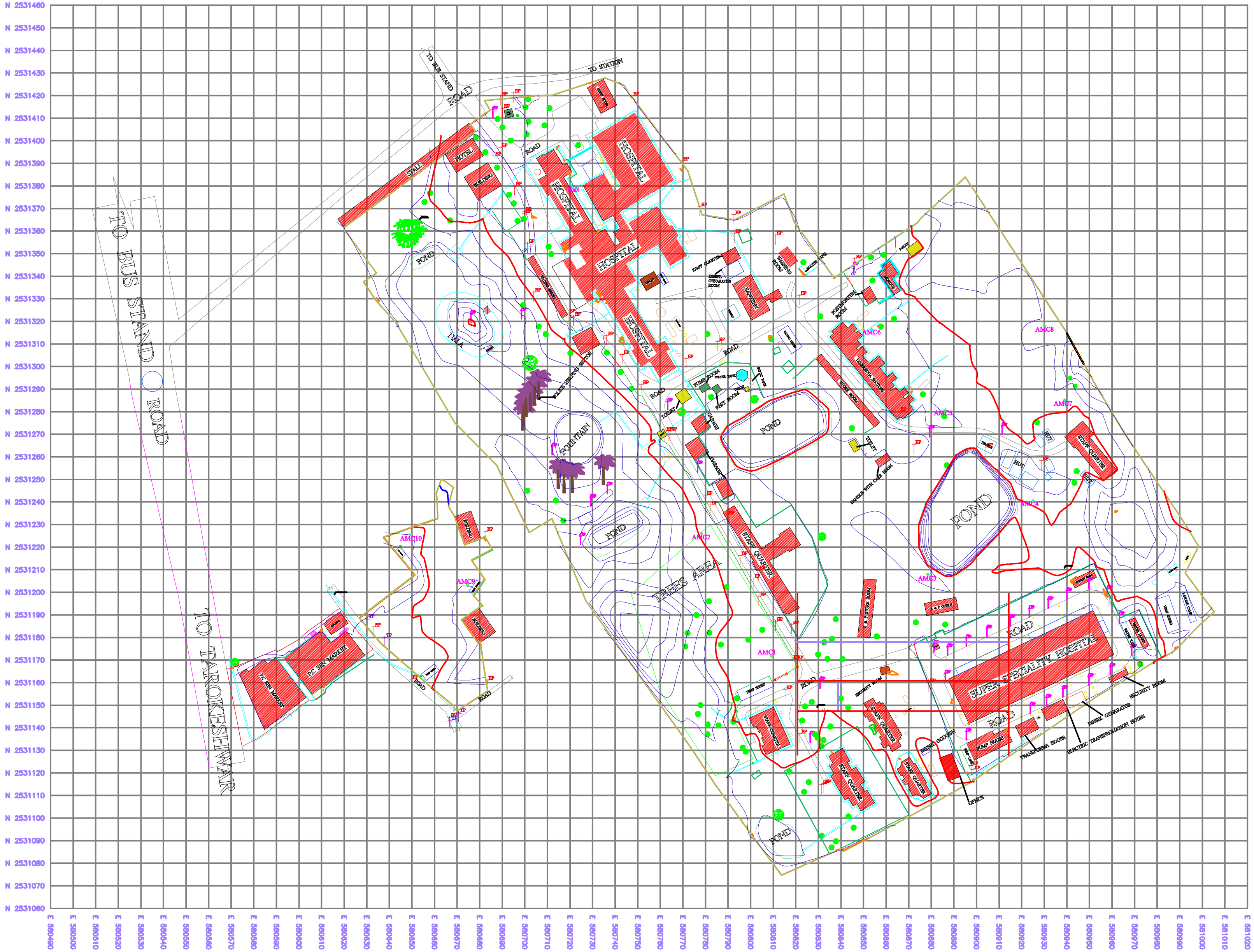
Section 5.1

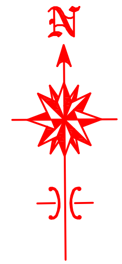
List of Packages

Package	Name of Medical College & Hospital
A	Barasat Medical College & Hospital
	Jhargram Medical College & Hospital
B	Arambagh Medical College & Hospital
	Tamluk Medical College & Hospital

SECTION 5.2(a)

TOPOGRAPHICAL MAPS OF THE SITES





TBM LIST

LEGENDS

Footpath	
TBM pilar	
Temple	
Gate	
Hut	
Fire Box	
Shade	
Septic tank	
Manhol	
Pond	
Contour major	
Contour minor	
Light POST	
E. POST	
Water tank	
Temp Shade	
Boundary line	
Drain	
Road	
Building	

PROPOSED INFRASTRUCTURE:

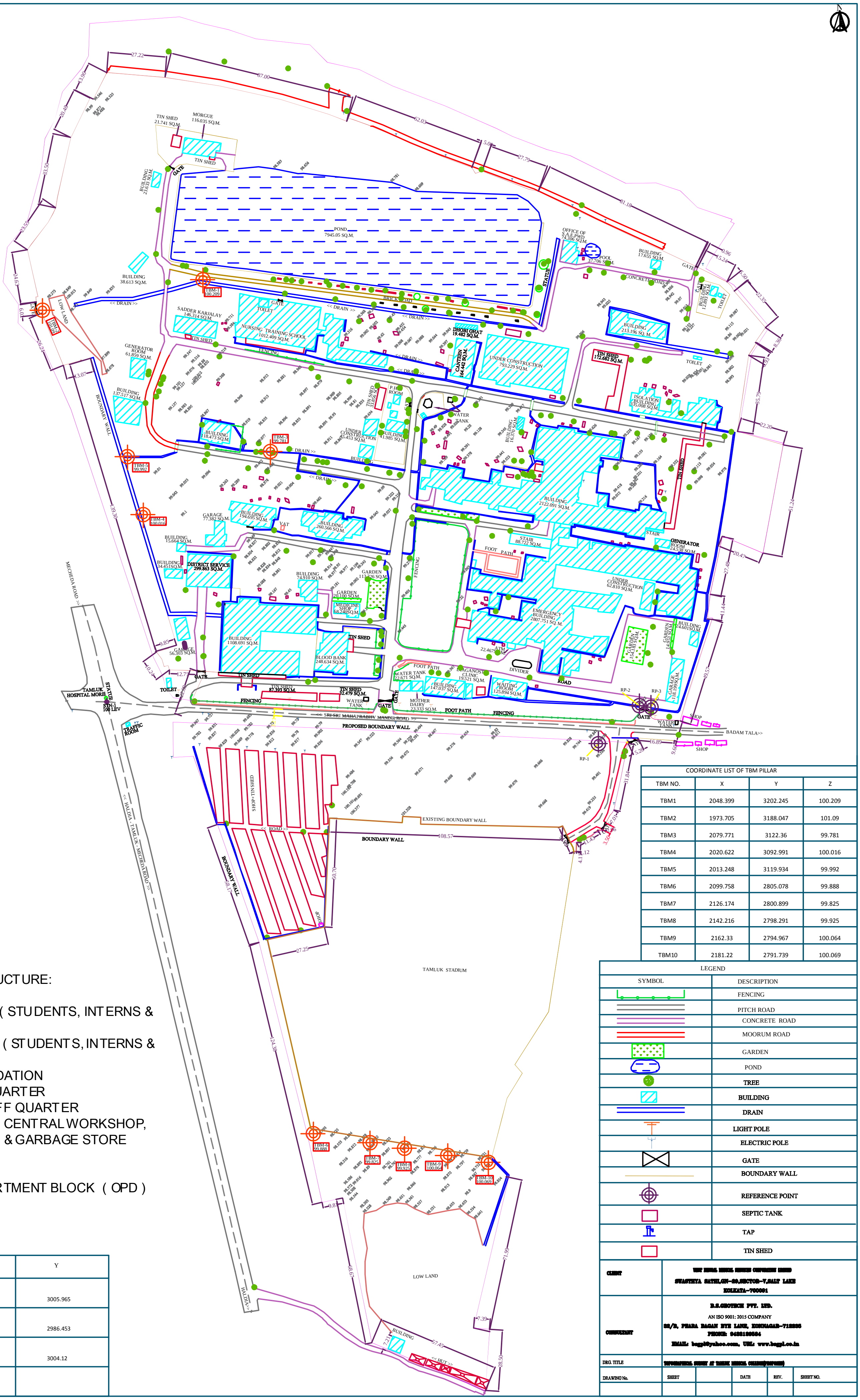
1. ACADEMIC BUILDING
2. HOSTEL FOR BOYS (STUDENTS, INTERNS & RESIDENT DOCTORS)
3. HOSTEL FOR GIRLS (STUDENTS, INTERNS & RESIDENT DOCTORS)
4. NURSES ACCOMMODATION
5. TEACHING STAFF QUARTER
6. NON TEACHING STAFF QUARTER
7. OTHER BUILDINGS (CENTRAL WORKSHOP, MAINTENANCE OFFICE & GARBAGE STORE ETC.)
8. SERVICE BUILDINGS
9. OUT PATIENT DEPARTMENT BLOCK (OPD)
10. PLAY FIELD

PROJECT:
TOPOGRAPHICAL SURVEY OF THE ENTIRE LAND FOR THE PROPOSED ARAMBAGH MEDICAL COLLEGE IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL

CLIENT:
WEST BENGAL MEDICALSERVICES CORPORATION LIMITED

PLAN SHOWING PROPERTY DEMARCATION LINE OF PROPOSED MEDICAL COLLEGE CAMPUS AT ARAMBAGH WEST BENGAL

SCALE : 1:	DWN. BY:SUKANTA HALDER	Rev.
DRG NO. : WBMSCL/ARAMBAGH/01	CHKD.	0
	SURVEYED ON:10th Aug'17	



PROPOSED INFRASTRUCTURE:

1. ACADEMIC BUILDING
2. HOSTEL FOR BOYS (STUDENTS, INTERNS & RESIDENT DOCTORS)
3. HOSTEL FOR GIRLS (STUDENTS, INTERNS & RESIDENT DOCTORS)
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7. OTHER BUILDINGS (CENTRAL WORKSHOP, MAINTENANCE OFFICE & GARBAGE STORE ETC.)
8. SERVICE BUILDINGS
9. OUT PATIENT DEPARTMENT BLOCK (OPD)
10. PLAY FIELD

COORDINATE LIST OF TBM PILLAR

TBM NO.	X	Y	Z
TBM1	2048.399	3202.245	100.209
TBM2	1973.705	3188.047	101.09
TBM3	2079.771	3122.36	99.781
TBM4	2020.622	3092.991	100.016
TBM5	2013.248	3119.934	99.992
TBM6	2099.758	2805.078	99.888
TBM7	2126.174	2800.899	99.825
TBM8	2142.216	2798.291	99.925
TBM9	2162.33	2794.967	100.064
TBM10	2181.22	2791.739	100.069

COORDINATE LIST OF REFERENCE POINT

POINT	X	Y
STN 1	2003.632	3005.965
RP-1	2232.387	2986.453
RP-2	2251.472	3004.12

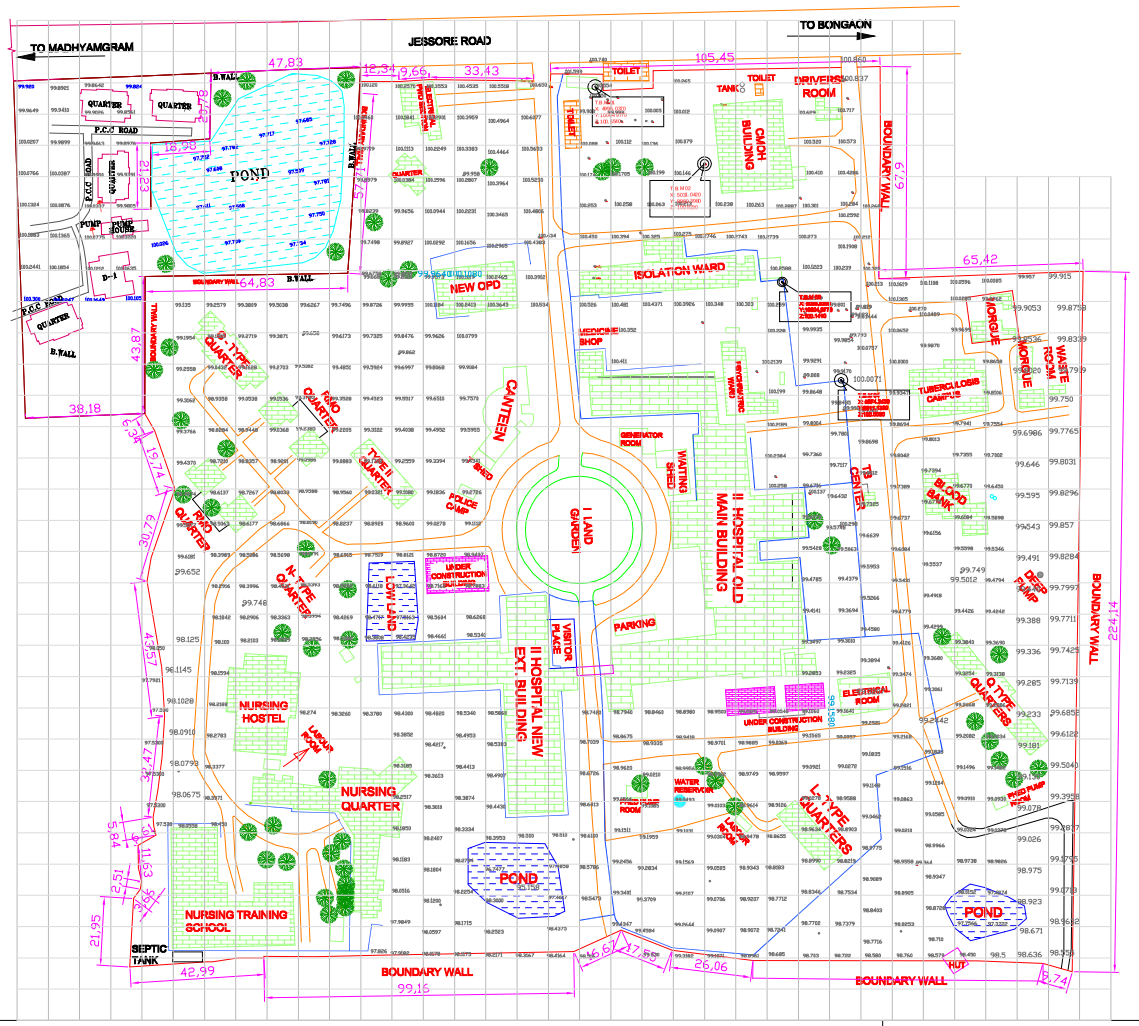
LEGEND

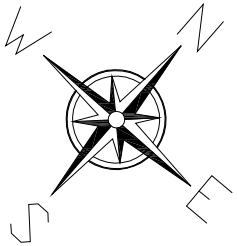
SYMBOL	DESCRIPTION
	FENCING
	PITCH ROAD
	CONCRETE ROAD
	MOORUM ROAD
	GARDEN
	POND
	TREE
	BUILDING
	DRAIN
	LIGHT POLE
	ELECTRIC POLE
	GATE
	BOUNDARY WALL
	REFERENCE POINT
	SEPTIC TANK
	TAP
	TIN SHED

CLIENT	WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED SWASTHYA SATHI,GN-29,SECTOR-V,SALT LAKE KOLKATA-700091
CONSULTANT	B.S.GEOTECH PVT. LTD. AN ISO 9001: 2015 COMPANY 32/B, PEARA BAGAN BYE LANE, KONNAGAR-712235 PHONE: 9433129584 EMAIL: bsgpl@yahoo.com, URL: www.bsgpl.co.in
DRG. TITLE	TOPOGRAPHICAL SURVEY AT TAMLUK MEDICAL COLLEGE(PROPOSED)

DRAWING No.	SHEET		DATE	REV.	SHEET NO.

TOPOGRAPHICAL SURVEY IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L.NO.-80 & KHATIAN NO.-2806) AND UTTARHAT MOUZA (J.L.NO.-78 & KHATIAN NO.-3772) IN THE DISTRICT OF NORTH 24 PARGANAS.





LEGEND

PLAN: EXISTING

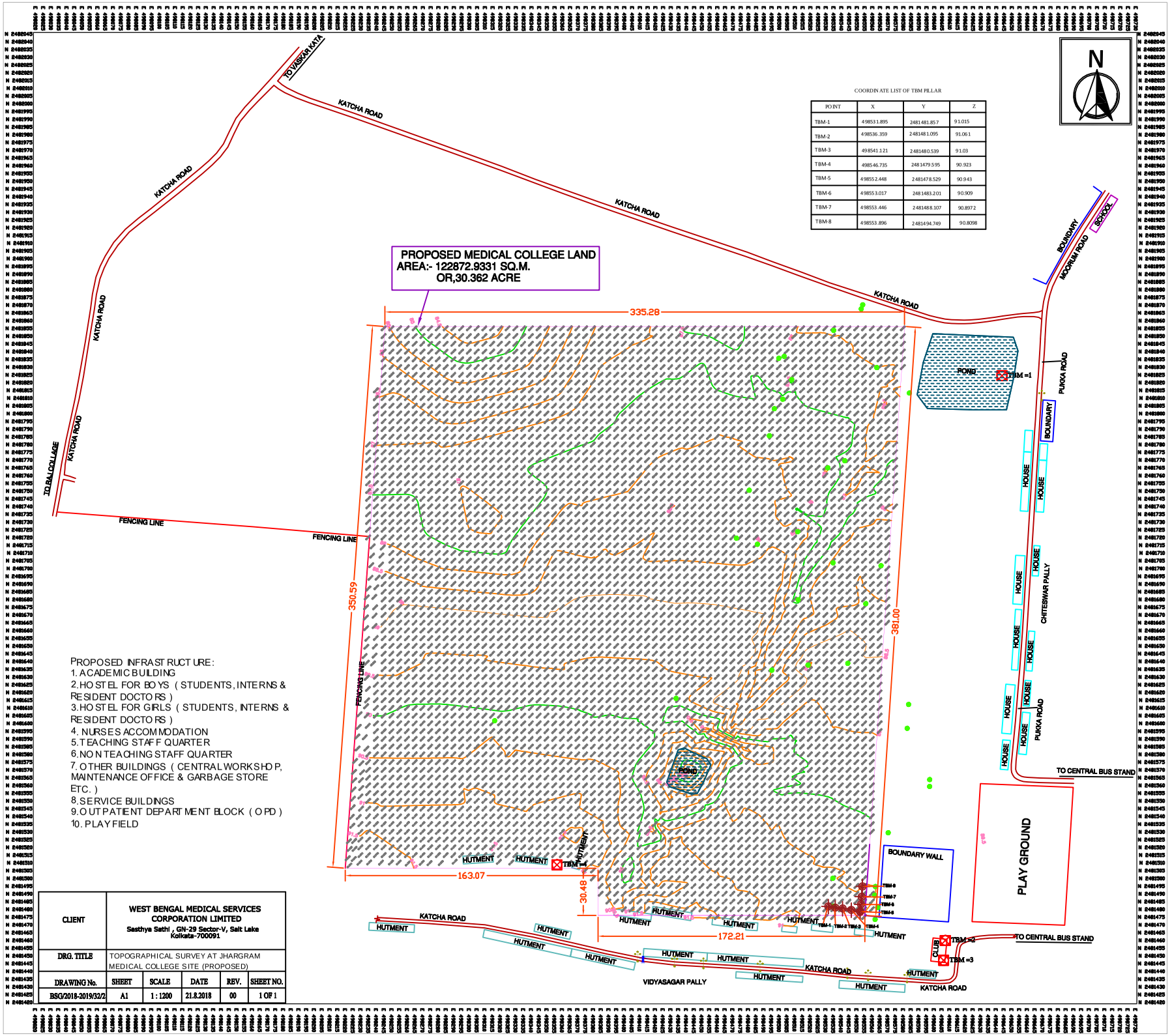
- BOUNDARY WALL
- ROAD
- BUILDING
- UNDER CONSTRUCTION BUILDING
- DEEP PUMP
- TREE
- DRAIN
- ELECTRIC POST
- WATER RESERVOIR
- POND
- TOILET

PROPOSED INFRASTRUCTURE:

1. ACADEMIC BUILDING
2. HOSTEL FOR BOYS (STUDENTS, INTERNS & RESIDENT DOCTORS)
3. HOSTEL FOR GIRLS (STUDENTS, INTERNS & RESIDENT DOCTORS)
4. NURSES ACCOMMODATION
5. TEACHING STAFF QUARTER
6. NON TEACHING STAFF QUARTER
7. OTHER BUILDINGS (CENTRAL WORKSHOP, MAINTENANCE OFFICE & GARBAGE STORE ETC.)
8. SERVICE BUILDINGS
9. OUT PATIENT DEPARTMENT BLOCK (OPD)
10. PLAY FIELD

CLIENT :

WEST BENGAL MEDICAL SERVICES CORPORATION LTD.
SWASTHYA SATHI, GN-29, SECTOR-V, SALT LAKE,
KOLKATA 7000 91.


N
COORDIN ATE LIST OF TBM PILLAR
POINT | X | Y | Z
TBM-1 | 498531.895 | 2481481.857 | 91.015
TBM-2 | 498536.359 | 2481481.095 | 91.061
TBM-3 | 498541.121 | 2481480.539 | 91.03
TBM-4 | 498546.735 | 2481479.595 | 90.923
TBM-5 | 498552.448 | 2481478.529 | 90.943
TBM-6 | 498553.017 | 2481483.201 | 90.909
TBM-7 | 498553.446 | 2481488.107 | 90.8972
TBM-8 | 498553.896 | 2481494.749 | 90.8098
PROPOSED MEDICAL COLLEGE LAND
AREA:- 122872.9331 SQ.M.
OR,30.362 ACRE
TO VASKAR KATA
KATCHA ROAD
TO BAJ COLLAGE
FENCING LINE
335.28
350.59
381.00
163.07
30.48
172.21
POND
TBM =1
TBM =2
TBM =3
BOUNDARY
SCHOOL
MOORUM ROAD
PUKKA ROAD
HOUSE
CHITESWAR PALLY
TO CENTRAL BUS STAND
PLAY GROUND
BOUNDARY WALL
HUTMENT
VIDYASAGAR PALLY
CLUB
PROPOSED INFRASTRUCTURE:
1. ACADEMIC BUILDING
2. HOSTEL FOR BOYS (STUDENTS, INTERNS & RESIDENT DOCTORS)
3. HOSTEL FOR GIRLS (STUDENTS, INTERNS & RESIDENT DOCTORS)
4. NURSES ACCOMMODATION
5. TEACHING STAFF QUARTER
6. NON TEACHING STAFF QUARTER
7. OTHER BUILDINGS (CENTRAL WORKSHOP, MAINTENANCE OFFICE & GARBAGE STORE ETC.)
8. SERVICE BUILDINGS
9. OUT PATIENT DEPARTMENT BLOCK (OPD)
10. PLAY FIELD
CLIENT
WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED
Sasthya Sathi , GN-29 Sector-V, Salt Lake Kolkata-700091
DRG. TITLE
TOPOGRAPHICAL SURVEY AT JHARGRAM MEDICAL COLLEGE SITE (PROPOSED)
DRAWING No. | SHEET | SCALE | DATE | REV. | SHEET NO.
BSG/2018-2019/32/2 | A1 | 1 : 1200 | 21.8.2018 | 00 | 1 OF 1

SECTION 5.2(b)

PROPOSED INFRASTRUCTURE

ARAMBAGH MEDICAL COLLEGE & HOSPITAL

The following buildings are to be constructed for this site-

1. Academic Building
2. Hostel for Boys (Students, Interns and Resident Doctors)
3. Hostel for Girls (Students, Interns and Resident Doctors)
4. Nurses Accommodation
5. Teaching staff Quarter
6. Non- Teaching staff Quarter
7. Other Buildings (Central Workshop, Maintenance Office, Garbage Store etc.)
8. Service Buildings
9. Out Patient Department Block

TAMLUK MEDICAL COLLEGE & HOSPITAL

The following buildings are to be constructed for this site-

1. Academic Building
2. Hostel for Boys (Students, Interns and Resident Doctors)
3. Hostel for Girls (Students, Interns and Resident Doctors)
4. Nurses Accommodation
5. Teaching staff Quarter
6. Non- Teaching staff Quarter
7. Other Buildings (Central Workshop, Maintenance Office, Garbage Store etc.)
8. Service Buildings
9. Out Patient Department Block

BARASAT MEDICAL COLLEGE & HOSPITAL

The following buildings are to be constructed for this site-

1. Academic Building
2. Hostel for Boys (Students, Interns and Resident Doctors)
3. Hostel for Girls (Students, Interns and Resident Doctors)
4. Nurses Accommodation
5. Teaching staff Quarter
6. Non- Teaching staff Quarter
7. Other Buildings (Central Workshop, Maintenance Office, Garbage Store etc.)
8. Service Buildings
9. Out Patient Department Block

JHARGRAM MEDICAL COLLEGE & HOSPITAL

The following buildings are to be constructed for this site-

1. Academic Building
2. Hostel for Boys (Students, Interns and Resident Doctors)
3. Hostel for Girls (Students, Interns and Resident Doctors)
4. Nurses Accommodation
5. Teaching staff Quarter
6. Non- Teaching staff Quarter
7. Other Buildings (Central Workshop, Maintenance Office, Garbage Store etc.)
8. Service Buildings
9. Out Patient Department Block

SECTION 5.2(c)

INDICATIVE GEOTECHNICAL INVESTIGATION REPORTS

BS PROJECTS & ENGINEERS PVT. LTD.

An ISO 9001:2008 Certified Company

*GROUND IMPROVEMENT, *SURVEYING, *SOIL INVESTIGATION, *PILING,
*STRUCTURAL DESIGN, *ESTIMATION,
*CIVIL, MECHANICAL, ELECTRICAL & OFC RELATED JOBS E.T.C.

Regd. *Office : 237, KABI NABIN SEN ROAD, KOLKATA-700 028*
Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

Dial : (033) 6525 1350 (O)
Mob : 98304 83074, 9830737826
Fax : (033) 2547 0784
E-mail ID : rajusubhankar@yahoo.co.in
info@bspe.in

JOB NO.

SOIL REPORT FOR

ARAMBAGH MEDICAL COLLAGE

(BS / SOIL / 2723 / 2017)

AT

ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

CLIENT
WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED

BID REF NO:
WBMSCL/ENGG/1939/17/2208 dated: 29.06.2017

BS PROJECTS & ENGINEERS PVT LTD.

(Formerly known as FOUNDATION-X)
AN ISO 9001:2008 CERTIFIED COMPANY
237, KABI NABIN SEN ROAD, NAGER BAZAR, KOLKATA-700028.
Dial: 6525 1350, 98304 83074, Fax No: 033 2547 0784
Email Id: rajusubhankar@yahoo.co.in.
Website: www.bspe.com

BS PROJECTS & ENGINEERS PVT. LTD.
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info@bspe.in
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Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

JOB NO.

BS PROJECTS & ENGINEERS PVT. LTD. Authorised Signatory 237, Kabi Nabin Sen Road, Kol-28

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Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

JOB NO.

1.0 SUMMARY

RECONNAISSANCE

a) Description of site (level or sloping) : Almost Level

b) General geology of site (in-situ soil, alluvial soil): Soft to medium brownish gray silty clay with deep brown spot.

c) Details of existing or demolished building and trees :

d) Level of site with respect to road level : same level

e) Local inquiry on GW conditions & soil stratification : 1.2 m

f) Comment on fill (Thickness, soil type and age) : 0.4 M

g) Distance of site from coast : NA

h) Is any water body (river /nalah/ etc) exist near site : NA

If yes – Type of water body:

Distance form site:

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Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

JOB NO.

FOUNDATION SIZE & BEARING CAPACITY

Type	Size M*M	Depth of Foundation (M)	Q allowable t/m^2	Permissible Settlement (mm)
Thickness of Compacted Sand Cushion= 0.3m				
SQUARE	1.5 2.0 2.5	1.5	10.1 9.5 8.6	75
STRIP	1.5 2.0	1.5	6.6 5.3	75
Thickness of Compacted Sand Cushion= 0.6m				
SQUARE	1.5 2.0 2.5	1.5	10.4 9.8 8.8	75
STRIP	1.5 2.0	1.5	7.3 6.4	75
Thickness of Compacted Sand Cushion= 1.0m				
SQUARE	1.5 2.0 2.5	1.5	11.0 10.4 9.4	75
STRIP	1.5 2.0	1.5	8.1 7.4	75
Thickness of Compacted Sand Cushion= 1.0m				
RAFT	15 *25	1.5	3.45	125

NB: To achieve the SBC value mentioned in the table we have to compact the sand cushion in such a way as the dry density of the sand become 95% and above of the value of maximum dry density of the sand at its' optimum moisture content. Again sand may be at least fine grained yellowish sand and there should not be any clayey lump. Presence of the clayey lump may be the reason of future development of the higher differential settlement.

BS PROJECTS & ENGINEERS PVT. LTD. Authorised Signatory

BS PROJECTS & ENGINEERS PVT. LTD.
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Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

JOB NO.

2.0 INTRODUCTION

It has been proposed for Geotechnical Investigation of a site at ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY. For this purpose, Field work including laboratory testing was carried out. The object of this investigation was to study the sub-soil characteristics of the underlying deposit of soil and to recommend the safe bearing capacity of the soil for design of appropriate foundation for the said project. BS Projects & Engineers Pvt. Ltd. (237, Kabi Nabin Sen Road, Nagerbazar, Kolkata. - 700 028) have gotten the work order form West Bengal Medical Services Corporation Limited to do so.

The scope of the work comprises sinking of two no of boreholes having 40 m depth each. But practically two no bore having depth 40 m each and one no bore 17m depth more or less have been done. Collecting disturbed and undisturbed soil samples from those boreholes at suitable intervals and testing of the undisturbed samples in laboratory for reporting purpose. In addition chemical test of soil and water also have been done.

The report has been prepared after a careful study of all the data collected during the field operation and the results of different laboratory test. Detailed discussions regarding the type of foundation are also furnished in this report.

BS PROJECTS & ENGINEERS PVT. LTD. Authorised Signatory 237, Kabi Nabin Sen Road, Kol-28

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Regd. Office : 237, KABI NABIN SEN ROAD, KOLKATA-700 028
Corporate Office : 92, KABI NABIN SEN ROAD, KOLKATA-700 028

JOB NO.

3.0 SCOPE OF WORK

The scope of investigation consists of two no of boreholes having 40 m depth each. But practically two no bore having depth 40 m each and one no bore 17m depth more or less have been done. The boreholes were scheduled to determine the depth of full sub-soil stratification and to conduct field i.e. standard penetration test and laboratory test. Disturbed and undisturbed soil samples were also collected from those boreholes.

Normal schedule of field and laboratory test schedule of field and laboratory testing were adopted and all these testing have been done as per relevant IS specification for multi-storied building.

4.0 FIELD EXPLORATIONS

4.1 Boring:

The boreholes were advanced into the soil by wash boring method and auger equipment. Flush-jointed seam less casings with Bentonite were used to stabilize the boreholes. The standing water level of each boreholes were determined at the end of boring.

4.2 Sampling:

Undisturbed and disturbed soil samples were collected at regular intervals of depth or at changes of strata. Disturbed samples including Penetrometer samples were collected and stored in polythene bags after proper labeling. Undisturbed samples were collected in 100 mm diameter

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JOB NO.

sample tubes. The area ratio of each tube was kept within 14 %. The tubes were sealed with paraffin wax at both ends labeled depth wise and dispatched to the laboratory for testing. The depth wise locations of all the undisturbed and disturbed samples are given in the bore log data sheets.

4.3 In situ test:

Standard penetration test:

Standard penetration tests were conducted within each borehole at suitable intervals of depth as levels shown in the bore log data sheets. The tests were done with the standard split-spoon sampler as per I.S.2131.

The N values were obtained by counting the number of blows required to drive the spoon from 15cm to 45cm.

5.0 LABORATORY TESTS METHODS:

The soil samples from the 10cm diameter sampling tubes were extracted in the laboratory by pushing out the soil core with the help of a jack and a frame. The core was jacked out in a direction that corresponded to the soil movement within the tube during sampling.

The following tests were done on representative samples of the cohesive strata.

a) Natural water content.

b) Atterberg limits.

c) Bulk density.

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d) *Specific gravity*

e) *Grain size distribution.*

f) *Unconsolidated Undrained triaxial test / Unconfined compression test.*

g) *Direct shear test*

h) *Consolidation test.*

i) *Chemical test.*

For triaxial tests 38 mm diameter × 76 mm long specimens were obtained by jacking out the soil core into thin-walled brass tubes each having a wall thickness of 0.8 mm. The inside of the tube was coated with a thin layer of silicon oil

To obtain specimens for consolidation test, the odometer ring was placed on the trimmed horizontal face of the soil within 10 cm sampling tube and the soil around the cutting edge was gradually removed with a spatula as the ring was gently pushed into the soil. The ring with the soil was then removed by cutting across the soil core with the help of a piano wire saw.

The laboratory tests as detailed below were run to ascertain the engineering properties of the soil and to obtain the necessary data required for design of the foundations.

A summary of all test results is given with this report in table Annexture 4.1 & 4.2.

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5.1 Natural water content:

These were determined by measuring the weights before and after oven drying of triaxial test samples.

5.2 Atterberg limits and natural water content

Liquid limit, plastic limit, and natural water content of the silty clay/clayey silt samples were determined.

(a) To classify the soil by the M.I.T classification system and

(b) To qualitatively assess their consistency and compressibility of the soil samples.

5.3 Bulk density:

These were determined by measuring the weights and dimensions of triaxial test samples.

5.4 specific gravity:

It is defined as the ratio of the mass of a given volume of solid grains to the mass of an equal volume of water, measured at the same temperature,

$$G = \frac{M_S \text{ (Mass of any volume V of solid grains)}}{M_w \text{ (Mass of water of volume V)}}$$

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5.5 Grain size analysis:

The grain size distributions of some representative samples were determined from sieve analysis / combined sieve analysis and hydrometer analysis.

5.6 Unconsolidated Undrained triaxial test/Unconfined compression test:

Tests were run on the silty clay/clayey silt samples to determine their undrained shear strength. The cell pressures employed in the triaxial tests were 0.5, 1.0, and 1.5 kg/cm^2. The samples were tested under undrained condition at a rate of 1.25 mm/min and were loaded up to a maximum of 20% axial strain in case of unconfined compression test all are same as UU triaxial test but all in absence of cell pressure.

5.7 Direct shear tests:

This test help to determine the shear strength parameters, unit cohesion and angle of shearing resistance, by direct shear of soil in a small shear box. It is suitable for the soil having maximum particle size 4.75 mm.

5.8 Consolidation test:

Consolidation tests were run in floating ring type odometers in an eight unit consolidation frame under standard load increment ratio of one, starting from ¼ kg/cm^2 and going up to 8 kg/cm^2 in general. Four such samples were tested to represent the value of compression index. The e vs. log p curves as given with this report.

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5.9 Chemical test:

Sample have been collected and bring to laboratory for testing of PH value, sulphate and chloride content. The test have been done as per (IS:2720, IS:3025.) obtained values.

Table 5.9.1 Test report of Water.

Sl. No.	Characteristic	Result		Test Method Specification
		S1	S2	
i)	pH Value	7.44	7.33	APHA 21st Edition, 4500-H^+B
ii)	Chloride (as Cl), mg/L	21.7	20.3	APHA 21st Edition, 4500-Cl^-B
iii)	Sulphate (as SO_4), mg/L	6.5	6.7	APHA 21st Edition, 4500-SO_4^{2-}E

Table 5.9.2 Test report of Soil.

Sl. No.	Characteristic	Result		Test Method Specification
		S3	S4	
i)	pH Value	7.91	7.65	BS 1377-3:1990 (Amendment No. – 1)
ii)	Chloride (as Cl), mg/L	101.3	98.6	BS 1377-3:1990 (Amendment No. – 1)
iii)	Sulphate (as SO_4), mg/L	178.5	176.7	BS 1377-3:1990 (Amendment No. – 1)

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6.0 SUB SOIL PROFILE:

The Soil profile as revealed by borings is shown the depth wise variations of N values along the borehole are shown in separate page. The subsoil profile indicates almost similar subsoil stratification throughout the site with some minor variation in the thickness of the individual strata. In general the subsoil resembles successive layers of soft to medium brownish gray silty clay with deep brown spot, followed by medium to firm bluish gray silty clay/clayey silt with deep brownish spot and followed by loose to medium, medium to dense yellowish gray silty fine sand to medium coarse sand with mica traces, which extent to a depth of 41.8 m or more below G.L.

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6.1 Soil properties

6.1. A. Standard penetration resistance:

A summary of the stratum wise variation of N values throughout the site is given in bore log data sheet. The subsoil of stratum 1 is Soft to medium brownish gray silty clay with deep brown spot, the N value increase appreciably from stratum 3 which consist of Loose to medium, medium to dense yellowish gray silty fine sand to medium coarse sand with mica traces.

6.1. B. Laboratory test data

A summary of all laboratory test results is given an appendix D. From study of these test result the engineering properties of different strata can be summarized as follows.

Filled up soil

Thickness of this layer is more or less 0.4 m. Characteristics of this layer are uncertain.

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Stratum I

The topmost stratum is a deposit of Soft to medium brownish gray silty clay with deep brown spot. This layer is found to exist up to a maximum depth of 8.7 m or more below existing G.L. The N value recorded in this stratum varies from 5 to 8. This deposit shows more or less fair engineering properties and may be considered for shallow footings.

Stratum II

This stratum is a deposit of Medium to firm bluish gray silty clay/clayey silt with deep brownish spot. This layer is found to exist up to a maximum depth of 14.6 m below existing G.L. The N value recorded in this stratum varies from 8 to 14.

Stratum III

This stratum is a deposit of Loose to medium, medium to dense yellowish gray silty fine sand to medium coarse sand with mica traces. This layer is found to exist up to a maximum depth of 41.8 m or more below existing G.L. The N value recorded in this stratum varies from 14 to 41.

7.0 HYDROLOGY

The water table in the month of July was located at 1.2 m below Ground Level.

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8.0 FOUNDATION SIZE, BEARING CAPACITY RECOMMENDATION:

Foundation of each structure is to be designed from consideration of superstructure loading as well as subsoil condition at the location. Suitable foundation for this structure should satisfy the basic design criteria:

a) *There must be adequate factor of safety of the foundations against ny possible bearing capacity or uplift failure and*
b) *The settlement of the foundations must be within permissible limits.*
c) *The suitability of the foundation types for each structure has been discussed in this chapter with due consideration to the above requirements.*

Considering depth of foundation = 1.5 m, size of foundation = 2.5 m x 2.5 m

Considering General shear failure, net ultimate bearing capacity,

$q_d = CN_c S_c d_c i_c + q(N_q - 1) S_q d_q i_q + 1/2 B\gamma N_\gamma S_\gamma d_\gamma i_\gamma w'$ *[IS 6403 : 1981]*

C = Undrained shear strength.

B = Breadth of footing.

L = Length of footing.

D = Depth of foundation below G.L.

F = Factor of safety.

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Now if we have a look on the values of C and Ø obtained from Triaxial compression test (UU), Direct shear test and Unconfined compression test we can consider the following values:

$C = 2.5,\ \varphi = 6^{\circ},\ Cc = 0.240$, *Depth of Foundation is 1.5 m*

So,

$Nc = 6.80$ *[Table 1 of IS6403 : 1981]*

$Nq = 1.69$

$N\gamma = 0.59$

$S_c = 1.3$ *[Table 2 of IS6403 : 1981]*

$S_q = 1.2$

$S_\gamma = 0.8$

$d_c = 1 + 0.2\, D_f/B\ \sqrt{N_\phi}$ *where,* $N_\phi = \tan^2(45^0 + \phi/2)$

$= 1.133$

$d_q = d_\gamma = 1$ $\phi < 10^0$ *[from clause 5.1.2.2]*

$I_c = i_q = (1 - \alpha/90)^2$

$= 0.94$

$i_\gamma = (1 - \alpha/\phi)^2$ *[from clause 5.1.2.3]*

$= 0.27$

$q_d = CN_cS_cd_ci_c + q(N_q - 1)\, S_qd_qi_q + 1/2B\gamma N_\gamma S_\gamma d_\gamma i_\gamma w'$

$= 2.5 \times 6.8 \times 1.3 \times 1.133 \times .94 + 1.8 \times 1.5\,(1.69 - 1) \times 1.2 \times 1.0 \times .94$

$+ \frac{1}{2} \times 2.5 \times 1.8 \times 0.59 \times 0.8 \times 1.0 \times 0.27 \times 0.5$

$= 23.54 + 2.1 + 0.14$

$= 25.78\ t/m^2$

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$$Q_s = \frac{25.78}{3} + 1.8 \times 1.5$$

$= 11.31\ t/m^2$

Settlement calculation [as per IS: 8009 (part I)-1976]

$$S_i = \frac{qB}{E}(1-\mu^2)\, I_p$$

μ = *poisson's ratio*
I_p = *influence factor*
E = *modulus of elasticity*

E (medium grayish silty clay) $= 1875\ t/m^2$

$$S_i = \frac{11.31 \times 2.5}{1875}(1 - 0.5^2) \times 1.12$$

$= 12.65\ mm$

$$S_c = \sum \frac{C_1}{1+e_0} H \log_{10} \frac{\rho_0 + \Delta\rho}{\rho_0}$$

$$= \frac{0.240}{1+0.910} \times 5 \log_{10} \frac{4.7 + 2.82}{4.7}$$

$= 128\ mm.$

Applying depth and rigidity correction from Fig12 & clause 9.52 at IS:8009 (part I – 1976).

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$$q_d = CN_c S_c d_c i_c + q(N_q - 1) S_q d_q i_q + 1/2 B\gamma N_\gamma S_\gamma d_\gamma i_\gamma w'$$

$$= 2.5 \times 6.8 \times 1.0 \times 1.133 \times 0.94 + 1.8 \times 1.5(1.69-1) \times 1.0 \times 1.0\ 0.94 + \tfrac{1}{2} \times 2.0 \times 1.8 \times 0.59 \times 1.0 \times 0.27 \times 0.5$$

$$= 18.06 + 1.75 + 0.14$$

$$= 19.95\ t/m^2$$

$$Q_s = \frac{19.95}{3.0} + 1.8 \times 1.5$$

$$= 9.35\ t/m^2$$

Settlement calculation [as per IS: 8009 (part I)-1976]

$$S_i = \frac{qB}{E}(1-\mu^2) I_p$$

μ = *poisson's ratio*
I_p = *influence factor*
E = *modulus of elasticity*
E *(medium grayish silty clay)* $= 1875\ t/m^2$

$$S_i = \frac{9.35 \times 2.0}{1875}(1 - 0.5^2) \times 3.1$$

$$= 23.2\ mm$$

$$S_c = \sum \frac{C_1}{1+e_0} H \log_{10} \frac{\rho_0 + \Delta\rho}{\rho_0}$$

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$$= \frac{0.240}{1 + 0.910} X\ 4 \log_{10} \frac{4.30 + 4.675}{4.3}$$

$= 160$ mm.

Applying depth and rigidity correction from Fig 12 & clause 9.5.2 of IS:8009(part 1) 1976.

$S_{con} = 134$ mm > 75

So , $q_{allowable} = 5.3$ t/m^2

The total settlement should not exceed the limit as per relevant IS code of practice.

SBC CALCULATION FOR A RAFT (15 M x 25 M) :

Considering all strata which will influence SBC of soil for Raft foundation.

We may Consider, $c = 3.2$, $\varphi = 8^o$, Depth of foundation:1.5m

$Nc = 7.6$ [Table 1 of IS6403 : 1981]

$Nq = 3.09$

$N\gamma = 0.91$

$S_c = 1.12$ [Table 2 of IS6403 : 1981]

$S_q = 1.12$

$S_\gamma = 0.76$

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$d_c = 1 + 0.2\, D_f/B\, \sqrt{N_\phi}$ where, $N_\phi = \tan^2(45^0 + \phi/2)$

$= 1.023$

$d_q = d_\gamma = 1$ for $\phi > 10^0$ [from clause 5.1.2.2]

$I_c = i_q = (1 - \alpha/90)^2$

$= 0.94$

$i_\gamma = (1 - \alpha/\phi)^2$ [from clause 5.1.2.3]

$= 0.41$

$q_d = CN_c S_c d_c i_c + q(N_q - 1) S_q d_q i_q + 1/2 B\gamma N_\gamma S_\gamma d_\gamma i_\gamma w'$

$= 3.2 \times 7.6 \times 1.12 \times 1.023 \times 0.94 + 1.8 \times 1.5(3.09-1) \times 1.12 \times 1.0 \times 0.94$
$+ \frac{1}{2} \times 15 \times 1.8 \times 0.91 \times 0.76 \times 0.41 \times 0.5$

$= 26.19 + 5.94 + 1.87$

$= 34.0\ t/m^2$

$$Q_s = \frac{34.0}{3.0} + 1.8 \times 1.5$$

$= 14.03\ t/m^2$

Settlement calculation [as per IS: 8009 (part I)-1976]

$$S_i = \frac{qB}{E}(1 - \mu^2) I_p$$

μ = poisson's ratio
I_p = influence factor
E = modulus of elasticity
E (medium grayish silty clay) = 2275 t/m^2

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JOB NO.

$$S_i = \frac{14.03 \times 15}{2275}(1 - 0.5^2) \times 1.41$$

$$= 97.8mm$$

$$S_c = \sum \frac{\epsilon_0}{1+\epsilon_0} H \log_{10} \frac{\rho_0 + \Delta\rho}{\rho_0}$$

$$= \frac{0.24}{1+0.91} \times 7.2 \log_{10} \frac{5.58 + 9.89}{5.58} + \frac{0.235}{1+0.865} \times 5.9 \log_{10} \frac{10.82+7.71}{10.82}$$

$$= 0.400 + 0.173$$

$$= 0.573\ mm.$$

Applying depth and rigidity correction from Fig12 & clause 9.5.2 of IS:8009 (part – I) - 1976.

$S_{con} = 509 > 125$ *mm Hence not safe.*

So, $S_{safe} = 3.45$

The total settlement should not exceed 125 mm as per provisions of relevant IS code of practice.

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JOB NO.

FOUNDATION SIZE & BEARING CAPACITY

Type	Size M*M	Depth of Foundation (M)	Q allowable t/m^2	Permissible Settlement (mm)
Thickness of Compacted Sand Cushion= 0.3m				
SQUARE	1.5 2.0 2.5	1.5	10.1 9.5 8.6	75
STRIP	1.5 2.0	1.5	6.6 5.3	75
Thickness of Compacted Sand Cushion= 0.6m				
SQUARE	1.5 2.0 2.5	1.5	10.4 9.8 8.8	75
STRIP	1.5 2.0	1.5	7.3 6.4	75
Thickness of Compacted Sand Cushion= 1.0m				
SQUARE	1.5 2.0 2.5	1.5	11.0 10.4 9.4	75
STRIP	1.5 2.0	1.5	8.1 7.4	75
Thickness of Compacted Sand Cushion= 1.0m				
RAFT	15 *25	1.5	3.45	125

NB: To achieve the SBC value mentioned in the table we have to compact the sand cushion in such a way as the dry density of the sand become 95% and above of the value of maximum dry density of the sand at its' optimum moisture content. Again sand may be at least fine grained yellowish sand and there should not be any clayey lump. Presence of the clayey lump may be the reason of future development of the higher differential settlement.

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JOB NO.

DETERMINATION OF SAFE PILE CAPACITY HAVING DIFFERENT DIA

Now the ultimate load of pile in cohesive soil resting on cohesive soil can be determined by following expression:

$Q_{Ul} = Q_f + Q_b$

Where load due to end bearing can be determined with the expression

$Q_b = 2.356\, qN_q B^2$

Q_f= load due to skin friction can be determined with the Expression

$Q_f = \sum \propto * c * \Pi * dl * B + \pi q_a k_s \tan\delta * B * dl$

Here = reduction factor

For Stratum I =0.88

Stratum II =0.79

$Q_{Ul} = 162.30 * B + 356.30 * B^2$

$Qsafe = 64.92 * B + 142.52 * B^2$

Considering, depth of pile below EGL is 20.5 m. & depth of cut off level from EGL is 1.5 m.

Diameter of pile (mm)	Load due to skin friction (ton)	Load due to end bearing (ton)	Total safe load Under compression (ton)
450	29.21	28.86	58.07
500	32.46	35.63	68.09
600	38.95	51.31	90.26

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JOB NO.

LATERAL LOAD CARRYING CAPACITY:

Assuming the lateral deflection of single pile will be restricted within 5.0mm at the bottom of pile cap level, the allowable Lateral Load Carrying Capacity of single pile has been determined.

As per Matlock & Reese, deflection, $d = dt\ [\ PT^3 / EI\ ]$;

where, $T = \sqrt[5]{(EI / nh)}$;

where, E=Modulus of elasticity of pile material $\approx 2.5 \times 10^6\ t/m^2$

nh=co-efficient of soil modulus variation= $49\ t/m^3$

(taken from Poulos, 1980)

I = Moment of Inertia

Now, for 450mm. dia.pile,

I=Moment of Inertia=$\pi\ (0.45)^4 / 64 = 2.01 \times 10^{-3}\ cm^4$

$T = \sqrt[5]{(2.5 \times 10^6 \times 2.01 \times 10^{-3})/49} = 2.525\ m.$

For pile head fixed against rotation, dt=0.93

$0.005 = 0.93[P \times 2.525^3 / 2.5 \times 10^6 \times 2.01 \times 10^{-3}] = 0.00297942\ P$

So, safe lateral load carrying capacity, P= 1.68 t.

Now, for 500mm. dia.pile,

So, safe lateral load carrying capacity, P= 1.99 t

Now, for 600mm. dia.pile,

So, safe lateral load carrying capacity, P= 2.66 t

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JOB NO.

SAFE LOAD CAPACITY OF PILE HAVING DIFFERENT DIA					
Diameter of pile (mm)	Load due to skin friction (ton)	Load due to end bearing (ton)	Total safe load Under compression (ton)	Total safe load Under Tension (ton)	Latteral load carrying capacity of pile (ton)
450	29.21	28.86	58.07	27.02	1.68
500	32.46	35.63	68.09	30.96	1.99
600	38.95	51.31	90.26	39.40	2.66

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JOB NO.

9.0 RECOMMENDATION AND CONCLUTION

Based on the field data, laboratory test result, bearing capacity and foundation size have been considered. And following precautions should be taken.

1) *The sub soils are of soft to medium quality. Water level is at 1.0 m below EGL in the month of june*
2) *The stratum-I is capable of supporting loads from moderately loaded structure.*
3) *The depth of foundation is 1.5 m. & below the footing 300 mm compacted sand cushion should be provided. Any filled up soil should not remain below foundation.*
4) *Safe bearing capacity of soil without or with compacted sand cushion having different thickness have been calculated and given in a tabular format for easy reference.*
5) *Pile capacity having different diameter have been given for easy reference. C/c distance between two adjacent pile should not be less than 2.5-3.d. where d is the diameter of the pile shaft.*
6) *Tie beam should be provided to control differential settlement, as there is variation of strength in different places of the site.*
7) *Gap between two adjacent footings be 67 % (which can be changed by concerned structural engineer) of the average width of the adjacent footing.*
8) *Footing of greater width (<3.0 m.) should be avoided as far as practicable.*
9) *Construction in stage is also recommended.*
10) *It is advisable to provide construction joint if length of the building is more than 20 m. to avoid further stress development due to differential settlement.*

For BS Projects & Engineers Pvt Ltd
Subhankar Roy
02.09.2017
Director

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Director

For BS PROJECTS & ENGINEERS PVT. LTD.
SRI. BHASKAR ROY
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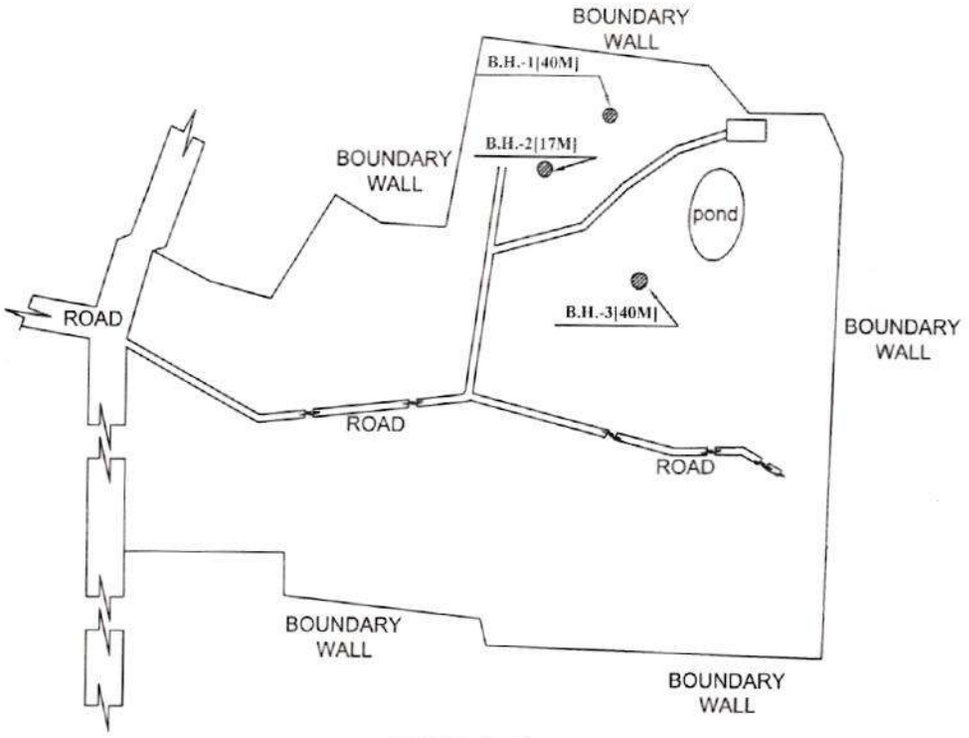
JOB NO.

SITE LAYOUT

ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

N



SITE PLAN

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JOB NO.

BORE LOG DATA SHEET

Site:- ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 1

Commenced on: 24.07.2017

Completed on :

Field test	No	Sample	No	Borehole Diameter : 150 mm
Penetrometer (P)	6	Undisturbed (U)	4	RL of Ground :
Cone Pen (PC)	0	Disturbed (D)	2	Termination Depth: 17.3 m
Vane	0	(V) Water	0	Ground Water : 1.2 m

**Suffix 'P' for sample Penetrometer Depth* *standing water level : NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	From	To	Thk. (m)	N-value	Type no	Depth (m)
Filled up soil.	E.G.L					
		0.4	0.4		D	0.5
					D	1.0
Soft to medium brownish Gray silty clay with Deep brown spot.	0.4				U	1.50-2.10
					U	3.00-3.45
		8.7	8.3			
					U	4.50-5.10
				8	P	6.00-6.60
Medium to firm bluish Gray silty clay/clayey Silt with deep brown spot.	8.7			8	P	7.50-8.10
		14.6	5.9		U	9.00-9.60

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JOB NO.

BORE LOG DATA SHEET

Site: - ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 1

Commenced on: 24.07.2017

Completed on :

Field test	*No*	*Sample*	*No*	*Borehole Diameter: 150 mm*
Penetrometer (P)	*6*	*Undisturbed (U)*	*4*	*RL of Ground :*
Cone Pen (PC)	*0*	*Disturbed (D)*	*2*	*Termination Depth: 17.3 m*
Vane	*0*	*(V) Water*	*0*	*Ground Water : 1.2 m*

**Suffix 'P' for sample Penetrometer Depth* *standing water level: NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	*From*	*To*	*Thk. (m)*	*N-value*	*Type no*	*Depth (m)*
Loose to medium medium	*14.6*			*11*	*P*	*10.50-11.10*
To dense yellowish gray				*14*	*P*	*12.00-12.60*
silty fine sand to medium						
Coarse sand with				*18*	*P*	*15.00-15.60*
Mica traces.		*17.3 Or more*	*2.7 Or more*	*21*	*P*	*18.00-18.60*

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JOB NO.

BORE LOG DATA SHEET

Site:- ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 2

Commenced on: 26.07.2017

Completed on :

Field test	No	Sample	No	Borehole Diameter : 150 mm
Penetrometer (P)	13	Undisturbed (U)	5	RL of Ground :
Cone Pen (PC)	0	Disturbed (D)	2	Termination Depth: 41.8 m
Vane	0	(V) Water	0	Ground Water : 1.2 m

**Suffix 'P' for sample Penetrometer Depth* *standing water level : NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	From	To	Thk. (m)	N-value	Type no	Depth (m)
Filled up soil.	E.G.L					
					D	0.5
					D	1.0
		0.3	0.3		U	1.50-2.10
					U	3.00-3.45
Soft to medium brownish						
Gray silty clay with	0.3			7	P	4.50-5.10
Deep brown spot.						
					U	6.00-6.60
		8.6	8.3		U	7.50-8.10
					U	9.00-9.60

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JOB NO.

BORE LOG DATA SHEET

Site: - ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 2

Commenced on: 26.07.2017

Completed on :

Field test	*No*	*Sample*	*No*	*Borehole Diameter: 150 mm*
Penetrometer (P)	*13*	*Undisturbed (U)*	*5*	*RL of Ground :*
Cone Pen (PC)	*0*	*Disturbed (D)*	*2*	*Termination Depth: 41.8 m*
Vane	*0*	*(V) Water*	*0*	*Ground Water : 1.2 m*

**Suffix 'P' for sample Penetrometer Depth* *standing water level: NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	*From*	*To*	*Thk. (m)*	*N-value*	*Type no*	*Depth (m)*
				10	*P*	*10.50-11.10*
				11	*P*	*12.00-12.60*
Medium to firm bluish	*8.6*					
Gray silty clay/clayey				*16*	*P*	*15.00-15.60*
Silt with deep brown spot.				*17*	*P*	*18.00-18.60*
		14.3	*5.7*			
				18	*P*	*19.50-20.10*
				21	*P*	*22.00-22.60*

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JOB NO.

BORE LOG DATA SHEET

Site: - ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 2

Commenced on: 26.07.2017

Completed on :

Field test	*No*	*Sample*	*No*	*Borehole Diameter: 150 mm*
Penetrometer (P)	*13*	*Undisturbed (U)*	*5*	*RL of Ground :*
Cone Pen (PC)	*0*	*Disturbed (D)*	*2*	*Termination Depth: 41.8 m*
Vane	*0*	*(V) Water*	*0*	*Ground Water : 1.2 m*

**Suffix 'P' for sample Penetrometer Depth* *standing water level: NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	*From*	*To*	*Thk. (m)*	*N-value*	*Type no*	*Depth (m)*
				24	P	25.00-25.60
				31	P	28.00-28.60
Loose to medium medium	*14.3*					
To dense yellowish gray				33	P	31.00-31.60
silty fine sand to medium						
				35	P	34.00-34.60
Coarse sand with		*41.8*	*27.5*			
Mica traces.				38	P	37.00-37.60
				41	P	40.00-40.60

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JOB NO.

BORE LOG DATA SHEET

Site:- ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 3
Commenced on: 26.07.2017
Completed on :

Field test	No	Sample	No	Borehole Diameter : 150 mm
Penetrometer (P)	13	Undisturbed (U)	5	RL of Ground :
Cone Pen (PC)	0	Disturbed (D)	2	Termination Depth: 40.4 m
Vane	0	(V) Water	0	Ground Water : 1.2 m

**Suffix 'P' for sample Penetrometer Depth* *standing water level : NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	From	To	Thk. (m)	N-value	Type no	Depth (m)
Filled up soil.	E.G.L					
					D	0.5
		0.5	0.5		D	1.0
				5	P	1.50-2.10
Soft to medium brownish	0.5				U	3.00-3.45
Gray silty clay with						
Deep brown spot.					U	4.50-5.10
		8.5	8.0		U	6.00-6.60
					U	7.50-8.10
				9	P	9.00-9.60

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E-mail ID : rajusubhankar@yahoo.co.in
info@bspe.in

JOB NO.

BORE LOG DATA SHEET

Site: - ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

Borehole No : 3

Commenced on: 26.07.2017

Completed on :

Field test	No	Sample	No	Borehole Diameter: 150 mm
Penetrometer (P)	13	Undisturbed (U)	5	RL of Ground :
Cone Pen (PC)	0	Disturbed (D)	2	Termination Depth: 40.4 m
Vane	0	(V) Water	0	Ground Water : 1.2 m

**Suffix 'P' for sample Penetrometer Depth* *standing water level: NILL*
'V' for sample at Vane depth
(NOTE: ALL DEPTH MEASURED BELOW GROUND LEVEL)

Description	From	To	Thk. (m)	N-value	Type no	Depth (m)
				12	P	10.50-11.10
					U	12.00-12.60
Medium to firm bluish	8.5					
Gray silty clay/clayey				17	P	15.00-15.60
Silt with deep brown spot.				18	P	18.00-18.60
		14.5	6.0			
				20	P	19.50-20.10
				22	P	22.00-22.60

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JOB NO.

LABORATORY TEST RESULT DATA SHEET

ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

B.H no	Depth below g.l (m)	n. m. c %	Bulk density (t/m2)	Dry density	L. L %	P L %	Triasial test C kg/ cm2	Triasial test ϕ degree	Sp. gr (g)	Consolidation Properties C_c	Consolidation Properties e_o	Grain size distribution Gravel %	Grain size distribution Sand %	Grain size distribution Silt %	Grain size distribution Clay %	Unconfined Compressor Test kg/ cm2
I	1.5	32	1.80	1.36	52	23	0.25	6^0	2.65	0.235	0.945	-	8	59	33	-
	3.0	33	1.80	1.35	54	24	0.25	6^0	2.65	0.240	0.910	-	9	58	33	0.27
	4.5	32	1.80	1.36	53	23	0.27	7^0	2.65	0.235	0.895	-	7	55	38	-
	6.0	32	1.80	1.36	53	24	0.28	7^0	2.65	0.235	0.905	-	9	58	33	-
	7.5	31	1.80	1.37	51	24	0.31	8^0	2.65	0.245	0.985	-	7	54	39	-
	9.0	36	1.81	1.38	50	23	0.35	9^0	2.65	0.235	0.795	-	12	59	29	-
II	1.5	33	1.80	1.35	53	24	0.25	6^0	2.65	0.240	0.930	-	7	58	35	0.26
	3.0	33	1.80	1.35	52	23	0.26	7^0	2.65	0.240	0.930	-	6	60	34	-
	6.0	32	1.80	1.36	53	24	0.28	7^0	2.65	0.235	0.905	-	9	58	33	-
	9.0	30	1.80	1.38	52	23	0.34	9^0	2.65	0.250	0.995	-	11	58	31	0.36

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ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY

B.H no	Depth below g.l (m)	n. m. c %	Bulk density (t/m2)	Dry density	L. L %	P L %	Triasial test C kg/ cm2	Triasial test φ degree	Sp. gr (g)	Consolidation Properties C_c	Consolidation Properties e_o	Grain size distribution Gravel %	Grain size distribution Sand %	Grain size distribution Silt %	Grain size distribution Clay %	Unconfined Compressor Test
II	3.0	33	1.80	1.35	51	23	0.25	7°	2.65	0.235	0.895	-	6	55	39	0.26
	4.5	32	1.80	1.36	50	23	026	7°	2.65	0.250	0.995	-	8	51	41	0.27
	6.0	30	1.80	1.38	53	24	0.28	9°	2.65	0.240	0.930	-	7	55	38	-
	7.5	31	1.80	1.37	49	23	0.31	9°	2.65	0.240	0.930	-	6	60	34	0.34
	12.0	29	1.80	1.40	49	24	0.42	9°	2.65	0.235	0.905	-	9	55	36	-
	18.0	22	1.81	1.48	41	25	--	35°	--	---	---	12	58	30	-	-
	22.0	25	1.82	1.44	43	26	--	37°	--	---	---	11	51	38	-	-

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JOB NO.

LOCATION: *ARAMBAGH MOUZA IN THE CAMPUS OF ARAMBAGH SUB-DIVISIONAL HOSPITAL AT ARAMBAGH IN THE DISTRICT OF HOOGHLY*

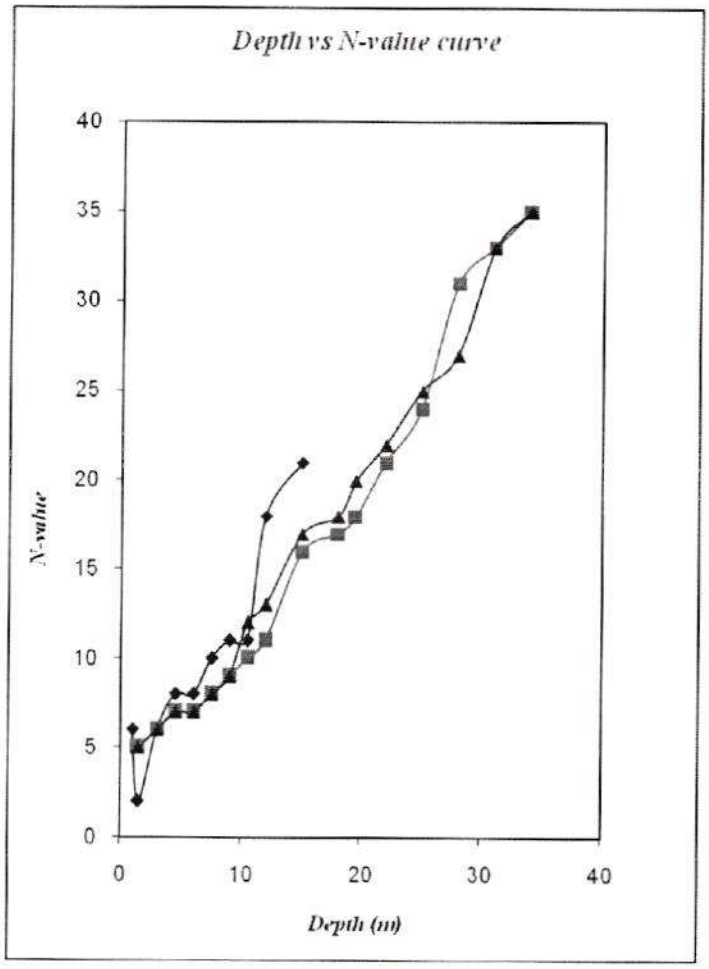

Fig. Annexture 5(a)1. Depth vs N value curve.

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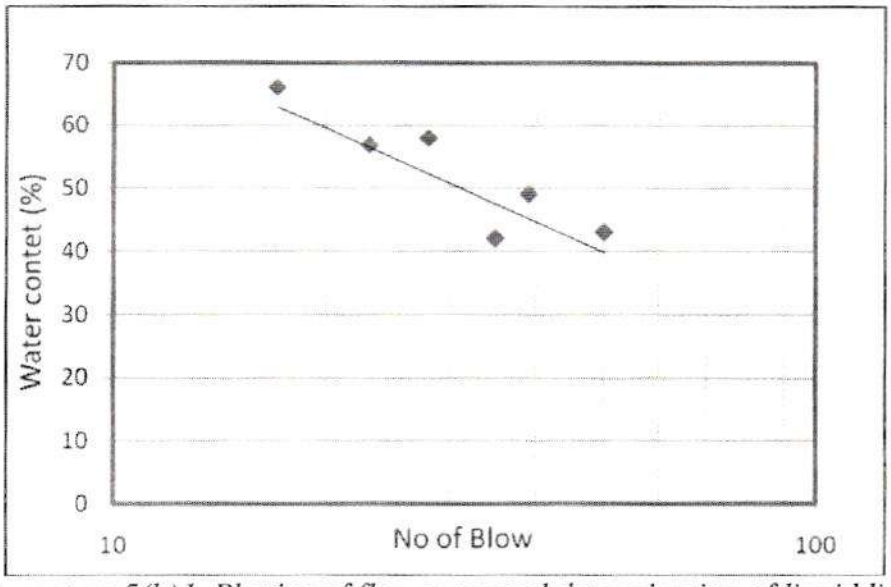

Fig. Annexture *5(b)1. Plotting of flow curve and determination of liquid limit of a soil sample collected from a depth of 3.0m.(BH-I)*

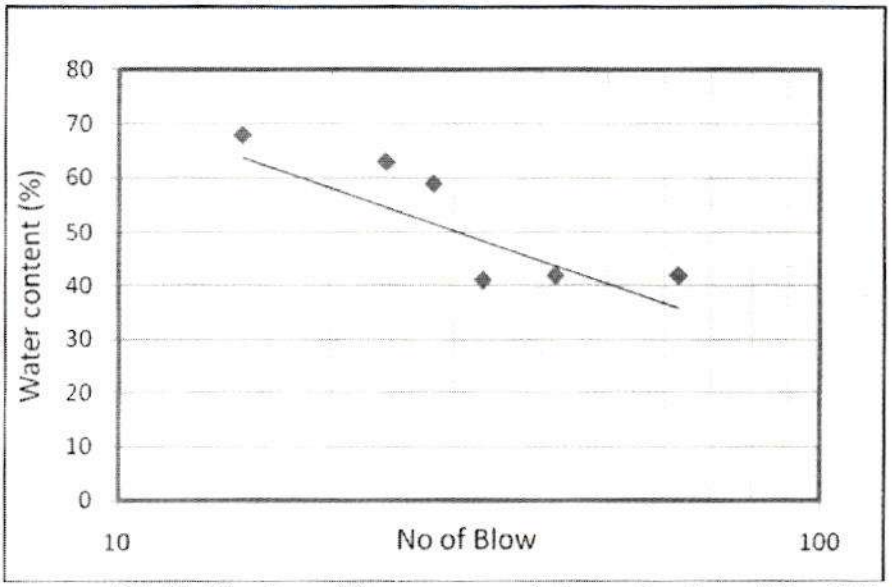

Fig. Annexture *5(b)2. Plotting of flow curve and determination of liquid limit of a soil sample collected from a depth of 6.0m.(BH-II)*

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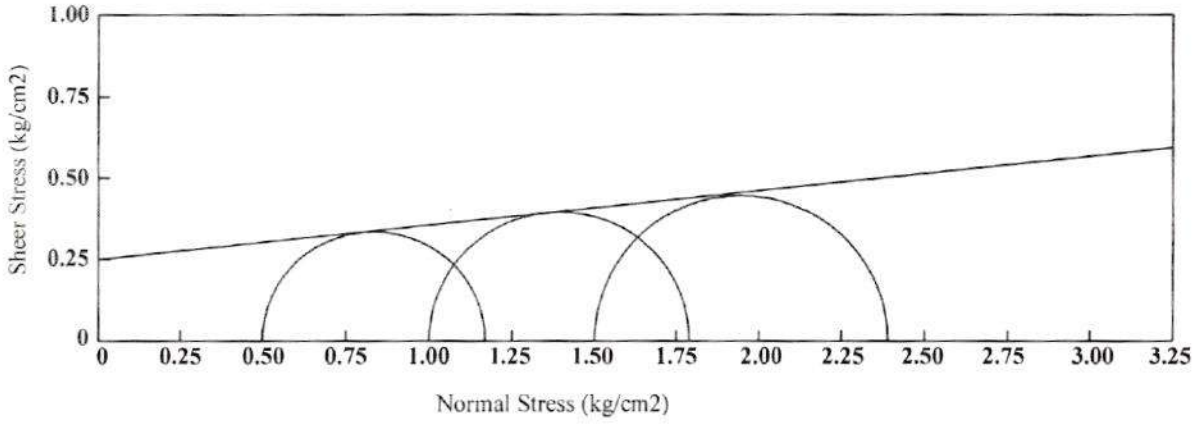

Fig. Annexture 5(c)1. Mohr's circle at failure from UU Triaxial test on a sample collected from a depth of 1.5 m.(BH-I)

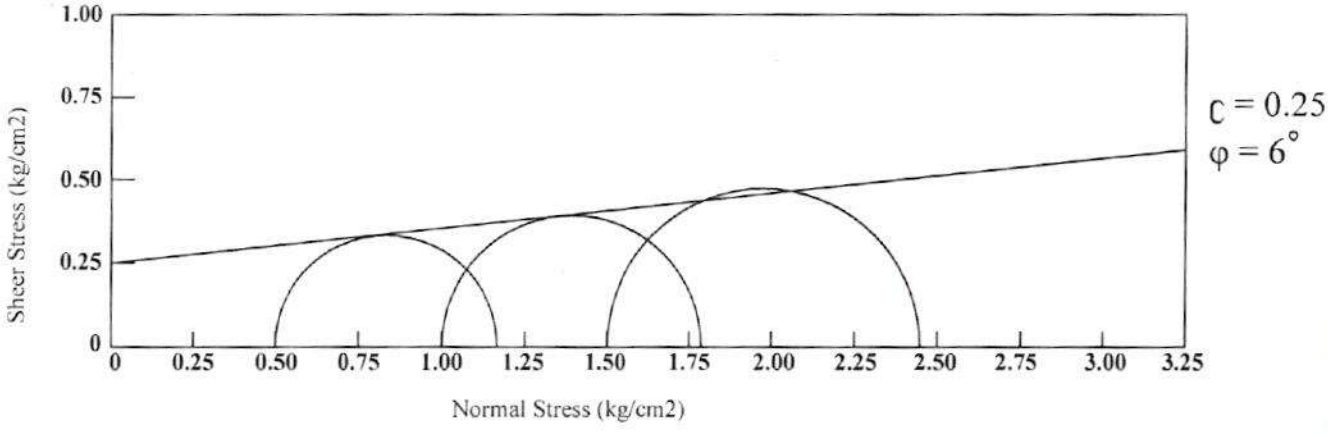

Fig. Annexture 5(c)2. Mohr's circle at failure from UU Triaxial test on a sample collected from a depth of 3.0 m.(BH-I)

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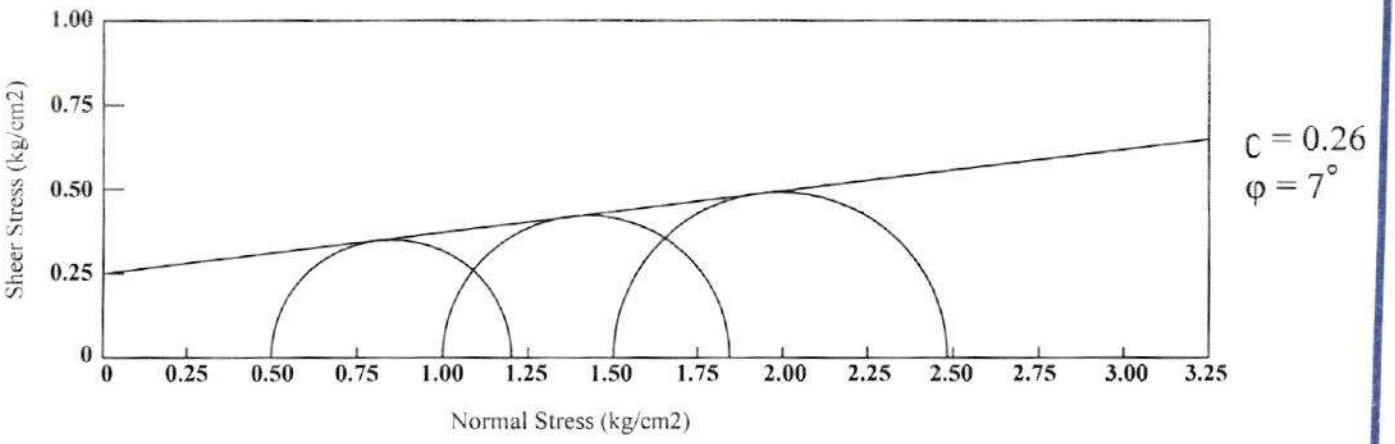

Fig. Annexture 5(c)3. Mohr's circle at failure from UU Triaxial test on a sample collected from a depth of 4.5 m.(BH-III)

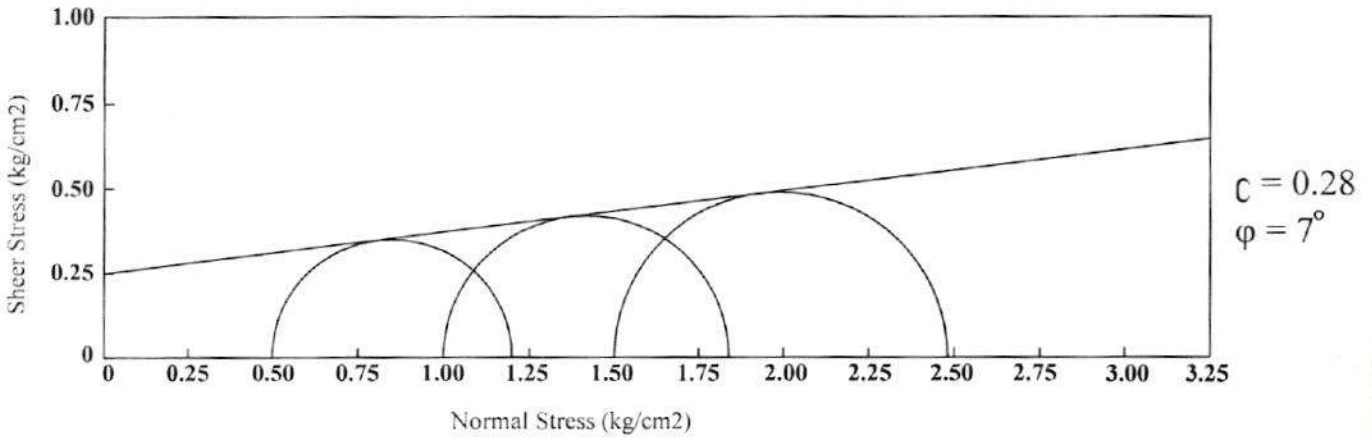

Fig. Annexture 5(c)4. Mohr's circle at failure from UU Triaxial test on a sample collected from a depth of 6.0 m.(BH-II)

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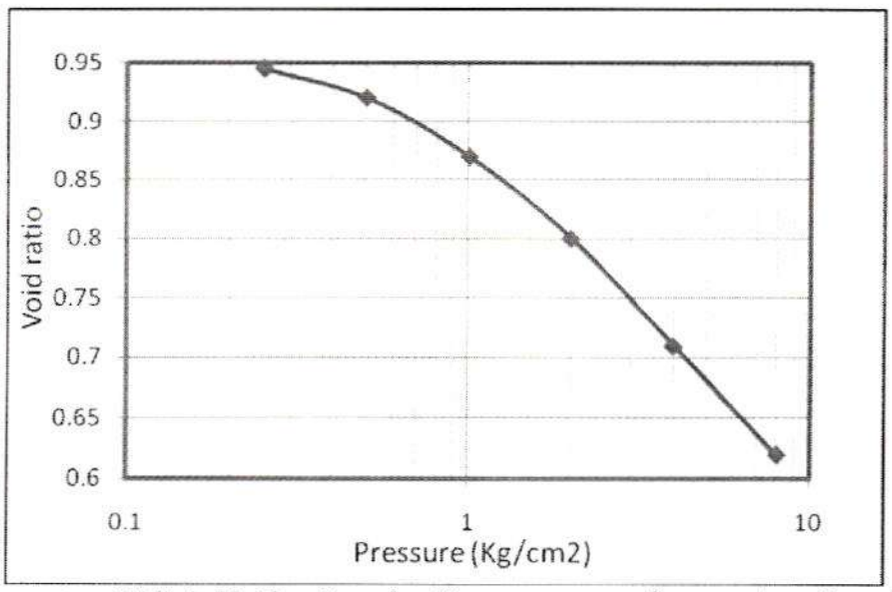

Fig. Annexture *5(d) 1. Void ratio vs log Pressure curve of a sample collected from a depth of 1.5m.(BH-I)*

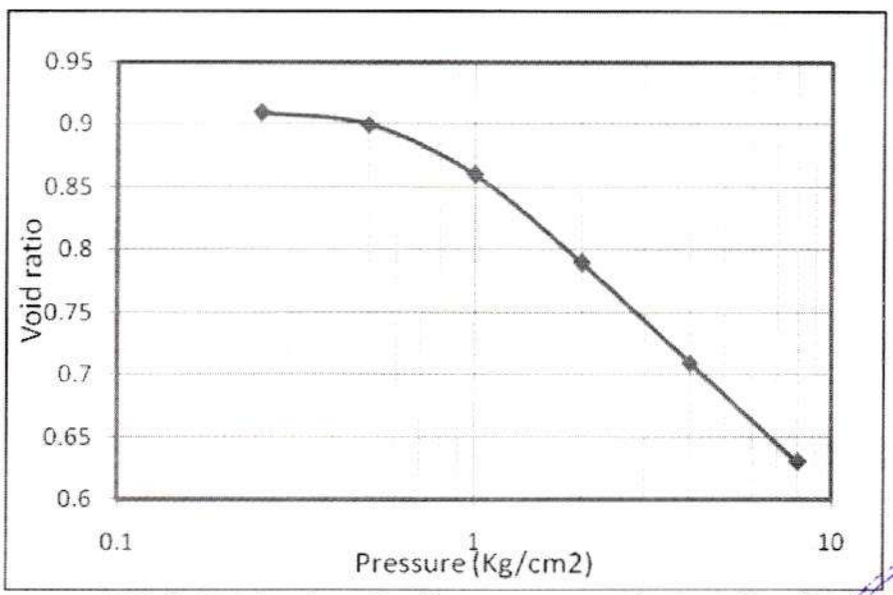

Fig. Annexture *5(d) 2. Void ratio vs log Pressure curve of a sample collected from a depth of 3.0m. (BH-I)*

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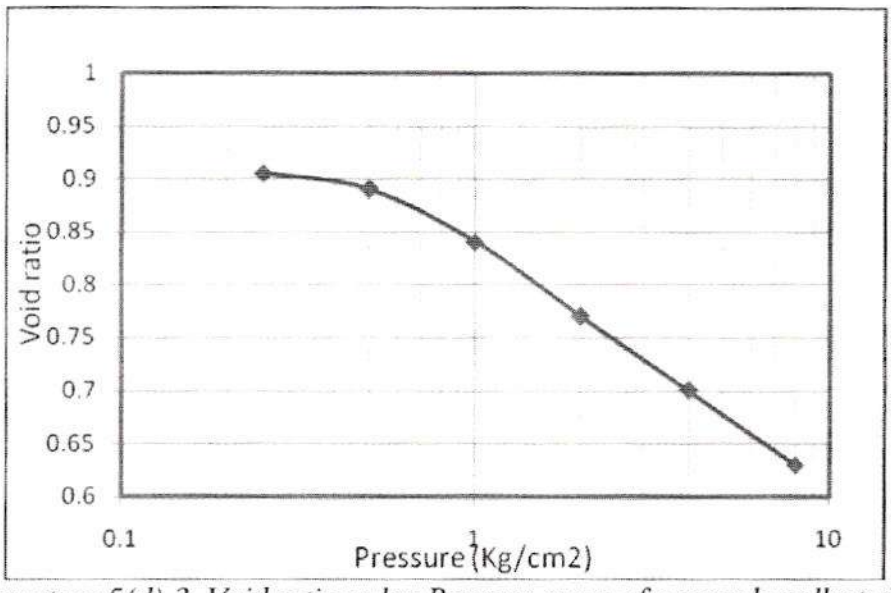

Fig. Annexture *5(d) 3. Void ratio vs log Pressure curve of a sample collected from a depth of 4.5m. (BH-III)*

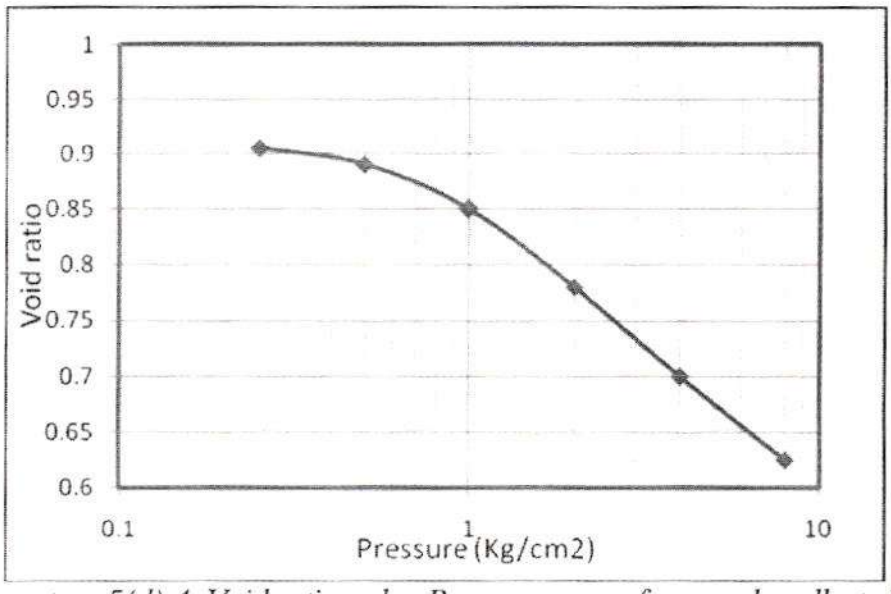

Fig. Annexture *5(d) 4. Void ratio vs log Pressure curve of a sample collected from a depth of 6.0m. (BH-II)*

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REPORT
ON
GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK
FOR

PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR

Work Order.
Memo No.- HFW-41014(14)/1/2018-WBMSCL SEC-DEPT. OF H&FW/2365
Dated:-04.06.2018

PROJECT OF:

MANAGING DIRECTOR
& SECRETARY HEALTH & FAMILY WELFARE DEPARTMENT.

Executed by :

G.MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001 2008 CERTIFIED COMPANY

OFFICE & LABORATORY:.4, PRIYO NATH GHOSH ROAD, KOLKATA – 700075.

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REGD OFFICE:86,HARIDAS DUTTA ROAD,JAYNAGAR 24 PGS (SOUTH)

AUGUST- 2018

G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001:2008 CERTIFIED

Ref No. GMA/WBMSCL/TAMLUK/HOSPITAL/07/18

DATE: 23.08.2018

To
THE MANAGING DIRECTOR
& SECRETARY HEALTH & FAMILY WELFARE DEPARTMENT.

Sub : REPORT ON GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

Dear Sir,

We have pleasure in submitting here with the detailed Soil Investigation Report on the said job.

This Report contains the details of field work carried out, results of the field and laboratory tests along with recommendation for design of foundations for the proposed MEDICAL COLLEGE.

Should have any queries out this report you may feel free to refer the same to us.

Thanking you,

Yours faithfully,

For G.MITRA & ASSOCIATES

Proprietor / Authorized Signatory

Enclo : As stated above.

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CONTENTS

APPENDIX

- SKETCH LAYOUT PLAN SHOWING BORE HOLE LOCATIONS
- SEQUENCE OF SUB-SOIL STRATIFICATIONS
- LABORATORY TEST RESULTS
- MV VALUE
- BORE LOG DATA SHEETS
- SOIL PROFILE AND SPT CURVES
- TIME SETTLEMENT AND e LOG p CURVE
- PRATICLE SIZE DISTRIBUTION CURVE
- MOHR'S CIRCLE

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ABBREVIATION AND NOTATIONS

S P T	:	STANDARD PENETRATION TEST
D C P T	:	DYNAMIC CONE PENETRATION TEST
U D S	:	UNDISTURBED SAMPLE
D S	:	DISTURBED SAMPLE
T C L	:	TEST COMMENCEMENT LEVEL
G L	:	GROUND LEVEL
E G L	:	EXISTING GROUND LEVEL
R L	:	ROAD LEVEL
S_f	:	PERMISSIBLE SETTLEMENT OF FOOTING AT SHALLOW DEPTH
q_d	:	NET ULTIMATE BEARING CAPACITY OF SHALLOW FOUNDATION
c_u	:	UNDRAINED COHESION
N_c N_q N_γ	:	BEARING CAPACITY FACTORS
S_c S_q S_γ	:	SHAPE FACTORS
d_c d_q d_γ	:	DEPTH FACTOR
I_c I_q I_γ	:	SHAPE FACTOR FOR SIZE, DEPTH AND INCLINATION OF FOOTING RESPECTIVELY
q	:	INTENSITY OF SURCHARGE AT FOUNDING LEVEL
w'	:	CORRECTION FACTOR TO ACCOUNT FOR THE EFFECT OF WATER TABLE
b_f	:	WIDTH OF FOUNDATION
s_i	:	ELASTIC SETTLEMENT OR IMMEDIATE SETTLEMENT
p	:	INTENSITY OF LOADING FROM FOUNDATION, i.e. NET FOUNDATION LOADING
μ	:	POISSON'S RATIO

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G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

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E	:	YOUNG'S MODULUS A ELASTIC CONSTANT FOR SOIL UNDER CONSIDERATION
i_p	:	INFLUENCE FACTOR
s_c	:	CONSOLIDATION SETTLEMENT
c_c	:	COMPRESSION INDEX
h_o	:	DRAINAGE PATH
e_o	:	INITIAL VOID RATIO
P_O	:	EFFECTIVE INITIAL OVERBURDEN PRESSURE
ΔP	:	CHANGE IN EFFECTIVE PRESSURE DUE TO FOUNDATION LOADING
s_t	:	TOTAL SETTLEMENT
Δ'	:	EFFECTIVE NORMAL STRESS
ϕ	:	ANGLE OF INTERNAL FRICTION
q	:	COMPRESSIVE STRENGTH IN FAILURE
q_a	:	FRACTURE INITIATION STRENGTH
q_t	:	TENSILE STRENGTH AT FAILURE
q_y	:	UNIAXIAL COMPRESSIVE STRENGTH
D W	:	DECOMPOSED WOOD
D V	:	DECOMPOSED VEGETATION
N M C	:	NATURAL MOISTURE CONTENT
N P	:	NON – PLASTIC
H_{yd}	:	HYDROMETER ANALYSIS
U_u	:	TRIAXIAL UNDRAINED
D_d	:	TRIAXIAL DRAINED
U_c	:	UNCONFINED UNDISTURBED
U_{cr}	:	UNCONFINED REMOULDED
C_u / C_d	:	CONSOLIDATION UNDRAINED/DRAINED
D_s	:	DIRECT SHEAR

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1.0 INTRODUCTION

REPORT ON GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR. The job has been awarded by THE MANAGING DIRECTOR & SECRETARY HEALTH & FAMILY WELFARE DEPARTMENT. to execute the soil investigation work for recommendation of foundation design.

2.0 FIELD SOIL EXPLORATION

For the purpose of exploration of subsurface soil deposits, **Four Number of bore holes** of depth 40.60 m, 40.10 m, 40.10 m & 40.10 m were sunk at predetermined locations suggested by THE MANAGING DIRECTOR & SECRETARY HEALTH & FAMILY WELFARE DEPARTMENT. At the site of works, the approximate locations of Bore Holes B.H-1, B.H-2, B.H-3, & B.H.- 4 have been shown in the site plan

During the progress of boring using Shell & auger method, disturbed and undisturbed soil samples were collected at suitable intervals and also wherever soil layers changed. The collection of these soil samples were made with help of 100mm diameter, 450mm long, thin-walled open drive sampler as per IS:2132.

The undisturbed soil samples inside the sample tubes were waxed at both ends, properly labeled and stored for conducting necessary tests. Disturbed soil samples were also collected in polythene bags for general identification purposes. Table presents the scheme of the field investigation. The field soil exploration was commenced on 31.07.2018 and completed on 08.08.2018 Table presents the scheme of the field investigation.

Table – I Scheme of the field investigation

Bore Hole No	Bored Depth(m)	Standing Water Level(m)	Samples collected		
			UDS	SPT	DS
1	40.60 m	0.0 m	13	22	6
2	40.10 m	0.50 m	13	22	6
3	40.10 m	0.0 m	9	27	5
4	40.10 m	1.20 m	12	22	7
		Total =	**47**	**93**	**24**

2.1 Standard Penetration Tests

The Standard Penetration Tests as per IS: 2131 were conducted at regular intervals in the bore holes. At the desired depths of cleaned bore holes, the SPT tests were conducted with standard split spoon sampler. The sampler is an open ended cylinder which splits longitudinally into two halves. These two halves are held together by a cutting shoe at the lower end and a coupling which connects the sampler to the drill rod. The split spoon was driven through 60cm into the ground at the required level in the bore holes, with the help of a standard drop hammer of 65kg falling freely from a height of 75cm. The number of hammer blows of the standard hammer, for each 15cm penetration were recorded. The total number of blows required to drive the second and third 15 cm of penetration were recorded as the SPT or N-value.

At the end of tests, disturbed soil samples from the split spoon sampler were collected in polythene bags with proper labels, and stored for general identification and classification tests.

2.2 Ground Water

Ground water observations were made during boring and the depth at which ground water was encountered and the standing water levels were recorded. Whenever ground water was struck, it was allowed to stabilize. The depth of the water table was then measured.

3.0 LABORATORY INVESTIGATIONS

For the purpose of proper identification and classification of soil samples collected during field exploration, and also for determining various properties of these soils, the following laboratory tests on representative and undisturbed soil samples were conducted as follows:

(a) Bulk density and natural moisture content.
(b) Particle size distribution.
(c) Liquid Limit (L.L.) and Plastic Limits (P.L.).
(d) Unconfined Compression Tests (UC).
(e) Triaxial Shear Tests (UU, UD, CU & CD).
(f) Specific gravity of soils.
(g) Consolidation Tests.

All the laboratory tests were conducted as per relevant Indian Standard Codes of Practice, and the results have been presented in Table-1-IV.

3.1 Particle Size Distribution

The particle size distribution tests of soil samples were conducted as per IS:2720(Part-4). The soil fractions passing 75 micron sieve, Hydrometer tests were conducted. The particle size distribution curves have been shown in FIG.3-20.

3.2 Liquid Limit & Plastic Limit

The tests for Plasticity index, i.e., Liquid Limit, and Plastic Limit were determined as per IS: 2720(Part-5 & 6). The liquid limits were determined using standard liquid limit device and a grooving tool.

3.3 Specific Gravity of Soil

The specific gravity of different minerals present in soils may vary on the average from **2.65 to 2.70**. Specific gravity as such does not indicate the behavior of soil mass under external loads, but it is an important factor, which is used in computing other properties of soil, particularly consolidation characteristics. The specific gravity of soil samples were determined in the laboratory as per IS: 2720(Part-3), particularly for those samples for which consolidations tests were conducted.

3.4 Unconfined Compression Tests

This test is a very quick method of determining the shear strength of soil, which is predominantly fine-grained cohesive soil, with very low or negligible value of angle of internal friction soil. This is basically similar to conventional triaxial shear test on soil with all-round confining pressure as zero. Approximately, half of the unconfined compression strength of the sample is taken as the value of cohesion or shear strength of the soil.

3.5 Direct Shear Tests

Direct shear test (DS) on samples were conducted in the laboratory, as per relevant IS code of Practice. This test is particularly done for soil samples which are predominantly coarse grained soils.

3.6 Triaxial Shear Tests

For the purpose of determining the shear strength parameters of clayey soils, unconsolidated undrained (UU), Triaxial compression tests were conducted with undisturbed soil samples in the laboratory in an electrically operated Universal Triaxial Compression Testing Machine, as per IS:2720. Mohr-Coulomb failure envelopes for the samples tested in triaxial machine. Under the field conditions for the proposed structure, the dissipation of induced excess pore pressure may not be instantaneous. As such, to simulate the field conditions in a reasonable manner, unconsolidated undrained (UU) triaxial shear tests were conducted on undisturbed soil samples.

3.7 Consolidation Tests

The consolidation properties of fine grained soils required for settlement analysis of foundations, were determined from consolidation tests conducted in the laboratory as per IS:2720(Part-15).

For sandy soils, consolidation tests were not conducted as settlement in such deposits are generally rapid and occur immediately during constructions.

4.0 AVERAGE SOIL PROFILE

Four bore holes **B.H-1, B.H-2 B.H-3, & B.H-4** up to depths of 40.60 m, 40.10 m, 40.10 m & 40.10 m were made over the site at the locations where MEDICAL COLLEGE. the construction has been proposed to be constructed. Bore hole locations have been shown in the site plan. Locations of bore holes were so chosen in consultation with the concerned Engineers.

On the basis of field bore logs and subsequent laboratory tests results on soil samples collected during field soil exploration, average soil profile has been established. Within the depths of exploration, **Four major soil stratums** have been identified.

The top soil consists of **Heterogeneous fill with clay ,roots ,etc.** This layer starts from T.C.L. and continue from 1.20 m to 1.50 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft/meduim brownish grey /grey silty clay / clayey silt** This layer starts from 1.20 m to 1.50 m depth below E.G.L. and continue up to 3.80 m to 5.60 m depth below E.G.L. . The 'N' value of this layer varies is 2 to 7.

Stratum – II : This stratum consists of **Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.** This layer starts from 3.80 m to 5.60 m depth below E.G.L. and continue from 11.00 m to 12.00 m depth below E.G.L. The 'N' value of this layer varies from 1 to 3.

Stratum – III: This stratum consists of **Medium / stiff grey silty clay / clayey silt .** This layer starts from 11.00 m to 12.00 m depth below E.G.L. and continue from upto 35.00 m to 36.00 m depth below E.G.L. The 'N' value of this layer varies from 4 to 12.

Stratum – IV: This stratum consists of **Very stiff grey silty clay / clayey silt.**This layer starts from 35.00 m to 36.00 m depth below E.G.L. and continue from upto 40.10 m to 40.60 m depth below E.G.L. The 'N' value of this layer varies from 16 to 20.

4.1 Soil Properties

Based on the results of field, laboratory investigation the average SPT values and engineering properties of different subsoil strata are summarized as follows:

Stratum – I: This stratum consists of **Soft/meduim brownish grey /grey silty clay / clayey silt** This layer starts from 1.20 m to 1.50 m depth below E.G.L. and continue up to 3.80 m to 5.60 m depth below E.G.L. . The 'N' value of this layer varies is 2 to 7.The average engineering properties and sub soil properties of this layer has been given below :-

Field 'N' value	=	2 to 7	
Bulk Density	=	1.85	t/cum
Natural Moisture Content	=	29	%
Specific gravity	=	2.70	
Initial void ratio 'e_0'	=	0.783	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	04	%
Silt	=	64	%
Clay	=	32	%
Gravel	=	-	%
I.S. Classification	=	CL-ML	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
	0.050	0.783	0.10	1.45	0.040	0.0040
0.25 - 0.50	0.250	0.760	0.08	1.39	0.033	0.0033
	0.500	0.738	0.06	1.38	0.024	0.0024
1.00 - 2.00	1.000	0.710	0.03	0.87	0.020	0.0020
	2.000	0.650	0.05	1.86	0.016	0.0016
4.00 - 8.00	4.000	0.580	0.04	2.00	0.013	0.0013
	8.000	0.500	0.04	4.00	0.007	0.0007

Stratum – II : This stratum consists of **Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.** This layer starts from 3.80 m to 5.60 m depth below E.G.L. and continue from 11.00 m to 12.00 m depth below E.G.L. The 'N' value of this layer varies from 1 to 3.The average engineering properties and sub soil properties of this layer has been given below :-

Field 'N' value	=	1 to 3	
Bulk Density	=	1.71	t/cum
Natural Moisture Content	=	49	%
Specific gravity	=	2.53	
Initial void ratio 'e_0'	=	1.240	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	02	%
Silt	=	49	%
Clay	=	49	%
Gravel	=	-	%
I.S. Classification	=	CL-OH	

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Stratum – III: This stratum consists of **Medium / stiff grey silty clay / clayey silt .** This layer starts from 11.00 m to 12.00 m depth below E.G.L. and continue from upto 35.00 m to 36.00 m depth below E.G.L. The 'N' value of this layer varies from 4 to 12.The average engineering properties and sub soil properties of this layer has been given below :-

Field 'N' value	=	4 to 12	
Bulk Density	=	1.85	t/cum
Natural Moisture Content	=	29	%
Specific gravity	=	2.69	
Initial void ratio 'e_0'	=	0.780	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	06	%
Silt	=	66	%
Clay	=	28	%
Gravel	=	-	%
I.S. Classification	=	CL-ML	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_o	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
	0.050	0.783	0.10	1.45	0.040	0.0040
0.25 - 0.50	0.250	0.760	0.08	1.39	0.033	0.0033
	0.500	0.738	0.06	1.38	0.024	0.0024
1.00 - 2.00	1.000	0.710	0.03	0.87	0.020	0.0020
	2.000	0.650	0.05	1.86	0.016	0.0016
4.00 - 8.00	4.000	0.580	0.04	2.00	0.013	0.0013
	8.000	0.500	0.04	4.00	0.007	0.0007

Stratum – IV: This stratum consists of **Very stiff grey silty clay / clayey silt.**This layer starts from 35.00 m to 36.00 m depth below E.G.L. and continue from upto 40.10 m to 40.60 m depth below E.G.L. The 'N' value of this layer varies from 16 to 20.The average engineering properties and sub soil properties of this layer has been given below :-

Field 'N' value	=	16 to 20	
Bulk Density	=	1.90	t/cum
Natural Moisture Content	=	25	%
Specific gravity	=	2.70	
Initial void ratio 'e_0'	=	0.675	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	03	%
Silt	=	51	%
Clay	=	46	%
Gravel	=	-	%
I.S. Classification	=	CL-ML	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
	0.050	0.675	0.035	1.45	0.014	0.0014
0.25-0.50	0.250	0.660	0.020	1.39	0.009	0.0009
	0.500	0.650	0.010	1.38	0.004	0.0004
1.0-2.0	1.000	0.640	0.020	1.35	0.009	0.0009
	2.000	0.620	0.010	1.00	0.006	0.0006
4.0-8.0	4.000	0.610	0.030	2.00	0.009	0.0009
	8.000	0.480	0.010	4.00	0.002	0.0002

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The average soil Profile

STRATUM	DESCRIPTION	DEPTH IN METRE		THICKNESS		RANGE OF N-VALUES	
		FROM	TO	IN METRE	B.H. No.	FROM	TO
TOP SOIL	Heterogeneous fill with clay ,roots ,etc.	T.C.L.	1.20	1.20	B.H. 1	-	-
		T.C.L.	1.50	1.50	B.H. 2	-	-
		T.C.L.	1.40	1.40	B.H. 3	-	-
		T.C.L.	1.50	1.50	B.H. 4	-	-
I	Soft/meduim brownish grey /grey silty clay / clayey silt .	1.20	3.80	2.60	B.H. 1	3	-
		1.50	4.30	2.80	B.H. 2	2	5
		1.40	4.80	3.40	B.H. 3	3	7
		1.50	5.60	4.10	B.H. 4	2	5
II	Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	3.80	11.8	8.00	B.H. 1	1	3
		4.30	11.5	7.20	B.H. 2	1	3
		4.80	11.00	6.20	B.H. 3	1	3
		5.60	12.00	6.40	B.H. 4	1	3
III	Medium / stiff grey silty clay / clayey silt .	11.80	35.00	23.20	B.H. 1	4	11
		11.50	36.00	24.50	B.H. 2	5	10
		11.00	35.60	24.60	B.H. 3	4	12
		12.00	36.00	24.00	B.H. 4	4	10
IV	Very stiff grey silty clay / clayey silt.	35.00	40.60	5.60	B.H. 1	17	19
		36.00	40.10	4.10	B.H. 2	16	19
		35.60	40.10	4.50	B.H. 3	16	18
		36.00	40.10	4.10	B.H. 4	17	20

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CHAPTER – V

DISCUSSION & CALCULATION

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DISCUSSION & CALCULATION

5 1 0 **GENERAL**

From the information it is planned to construct FOR GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR. At present excepting the nature of the sub soil all other details are unknown. However, in general, foundation design should satisfy two basic requirements viz.

a) There must be adequate factor of safety of the foundation against any possible bearing capacity failure and

b) The settlement of the foundation must be within permissible limits as defined in I.S. Code. The suitability of different types of foundation may be investigated in the light of the above requirements.

5 1 0 A study of the sub-soil characteristics at the site reveal that top soil consists of **Heterogeneous fill with clay ,roots ,etc.** This layer starts from T.C.L. and continue from 1.20 m to 1.50 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft/meduim brownish grey /grey silty clay / clayey silt** This layer starts from 1.20 m to 1.50 m depth below E.G.L. and continue up to 3.80 m to 5.60 m depth below E.G.L. . The 'N' value of this layer varies is 2 to 7.

Stratum – II : This stratum consists of **Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.** This layer starts from 3.80 m to 5.60 m depth below E.G.L. and continue from 11.00 m to 12.00 m depth below E.G.L. The 'N' value of this layer varies from 1 to 3.

Stratum – III: This stratum consists of **Medium / stiff grey silty clay / clayey silt .** This layer starts from 11.00 m to 12.00 m depth below E.G.L. and continue from upto 35.00 m to 36.00 m depth below E.G.L. The 'N' value of this layer varies from 4 to 12.

Stratum – IV: This stratum consists of **Very stiff grey silty clay / clayey silt.**This layer starts from 35.00 m to 36.00 m depth below E.G.L. and continue from upto 40.10 m to 40.60 m depth below E.G.L. The 'N' value of this layer varies from 16 to 20.

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R. C. PILE

LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

Founding Level = 40.0m

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLE 1 to 4					
Founding Level =	40.00	M Below E.B.L.			
Cut off Level = (–)	2.00	M below E.B.L.			
Filling (m)	Considering back filled sand of 1m from existing ground level.	Here top soil (m)	Cut of Level (m)	Therefore the **Negative Skin friction** thickness (m)	
1.50	0.00	1.50	2.00	-0.50	

NEGATIVE SKIN FRICTION					
Here Top Soil (m)	Cut of Level (m)	Therefore the Negative Skin friction thickness (m)	Lab. Test result C = (t/sq.m)		
1.50	2.00	-0.5	0.00		
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	P = $\Pi \times D \times L \times C \times \alpha$ (in T)	Where Π = 3.141	
0.00	0	FALSE	0.00	D	

Stratum-1 : Soft/meduim brownish grey /grey silty clay / clayey silt .					
The Bottom of this layer (m)	Top Soil (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
3.8	2.0	1.8	7	2.70	0
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	P = $\Pi \times D \times L \times C \times \alpha$ (in T)	Where Π = 3.141	
2.70	0	1.00	15.27	D	

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Stratum-2 : Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.

The Bottom of this layer (m)	Top of Sta. I (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
11.8	3.8	8	3	1.90	0
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	$P = \Pi \times D \times L \times C \times \alpha$ (in T) Where Π = 3.141		
1.90	0	1.00	47.74	D	

Stratum-3 : Medium / stiff grey silty clay / clayey silt .

The Bottom of this layer (m)	Top of Sta. II (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
35.0	11.8	23.2	12	3.50	0
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	$P = \Pi \times D \times L \times C \times \alpha$ (in T) Where Π = 3.141		
3.50	0	1.00	255.05	D	

Stratum-4 : Very stiff grey silty clay / clayey silt.

The Bottom of this layer (m)	Top of Sta. III (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
40.6	35.0	5.6	20	8.50	0
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	$P = \Pi \times D \times L \times C \times \alpha$ (in T)	Where $\Pi = 3.141$	
8.50	0	0.59	88.21	D	

End Bearing (Clay)					
Use C (t/sq.m)	Phi (deg)	N_c	Maxi. Pressure (q)	N_q	So the ultimate end bearing (t/sqm) $C \times N_c + q \times N_q$
8.00	0	9	9	0	72
Constant	Q_{tip}				
0.785	56.52 D^2t				
Total Skin Friction (in Ton) Sta. I+II+III+IV – Negative Skin Friction		So ultimate pile capacity (Q_{tip}+Tot. skin fric)	F.O.S.	Allowable pile capacity $=(Skin_{fric}/FOS)\,D + (Q_{tip}/2.5)\,D^2$	
406.27 D		462.79	2.5	162.51	D +
				22.61	D^2

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LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

TABLE

Diameter of Pile in mm	Dia. Of Pile (in m)	PILE CAPACITY IN TON FOR		38.00	M SHAFT LENGTH
		162.51	D	22.61	D^2
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	4.58	73.13	**77.71**	
500	0.50	5.65	81.25	**86.91**	
550	0.55	6.84	89.38	**96.22**	
600	0.60	8.14	97.50	**105.64**	
650	0.65	9.55	105.63	**115.18**	
700	0.70	11.08	113.76	**124.83**	
750	0.75	12.72	121.88	**134.60**	
800	0.80	14.47	130.01	**144.48**	
850	0.85	16.33	138.13	**154.47**	
900	0.90	18.31	146.26	**164.57**	
950	0.95	20.40	154.38	**174.79**	
1000	1.00	22.61	162.51	**185.12**	
1100	1.10	27.36	178.76	**206.11**	
1200	1.20	32.56	195.01	**227.56**	

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LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

The allowable capacity of a single bored pile of 40.6 m length below EGL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH =		**38.00**	metre	
DIA OF PILE IN MM	**PILE CAPACITY IN TON**	UPLIFT CAPACITY IN TON	Depth of fixity **L_f (in m)**	Lateral Capacity of pile **[Q] (in T)**
450	77.71	26.08	4.11	4.76
500	86.91	29.76	4.57	5.28
550	96.22	33.49	5.03	5.81
600	105.64	37.26	5.48	6.34
650	115.18	41.07	5.94	6.87
700	124.83	44.93	6.40	7.40
750	134.60	48.84	6.85	7.93
800	144.48	52.79	7.31	8.45
850	154.47	56.79	7.77	8.98
900	164.57	60.83	8.22	9.51
950	174.79	64.91	8.68	10.04
1000	185.12	69.05	9.14	10.57
1100	206.11	77.45	10.05	11.62
1200	227.56	86.03	10.96	12.68

For R.C. bored pile minimum c/c distance of piles in group, should be as per provisions of relevant I.S. Code (I.S. 2911). Besides, as per discretion of structural engineer, group action, efficiency of piles are to be considered for pile design.

Moreover for R.C. bored pile it is strongly recommended that the design load carrying capacity of pile should be taken as per load test on test / working pile, done as per recommendation of IS 2911 (part – IV), since the pile capacities are calculated on basis of average sub-soil profile only.

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RECOMMENDATION AND CONCLUSION

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RECOMMENDATION AND CONCLUSION

Based on the field and laboratory test results and from the discussions, the following are summarized below:

The sub-soil characteristics FOR GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR. reveal that top soil consists of **Heterogeneous fill with clay ,roots ,etc.** This layer starts from T.C.L. and continue from 1.20 m to 1.50 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft/meduim brownish grey /grey silty clay / clayey silt** This layer starts from 1.20 m to 1.50 m depth below E.G.L. and continue up to 3.80 m to 5.60 m depth below E.G.L. . The 'N' value of this layer varies is 2 to 7.

Stratum – II : This stratum consists of **Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.** This layer starts from 3.80 m to 5.60 m depth below E.G.L. and continue from 11.00 m to 12.00 m depth below E.G.L. The 'N' value of this layer varies from 1 to 3.

Stratum – III: This stratum consists of **Medium / stiff grey silty clay / clayey silt .** This layer starts from 11.00 m to 12.00 m depth below E.G.L. and continue from upto 35.00 m to 36.00 m depth below E.G.L. The 'N' value of this layer varies from 4 to 12.

Stratum – IV: This stratum consists of **Very stiff grey silty clay / clayey silt.**This layer starts from 35.00 m to 36.00 m depth below E.G.L. and continue from upto 40.10 m to 40.60 m depth below E.G.L. The 'N' value of this layer varies from 16 to 20.

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R. C. PILE

LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

Founding Level = 40.0m

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLE 1 to 4					
Founding Level =	40.00	M Below E.B.L.			
Cut off Level = (–)	2.00	M below E.B.L.			

TABLE					
Diameter of Pile in mm	Dia. Of Pile (in m)	PILE CAPACITY IN TON FOR		38.00	M SHAFT LENGTH
		162.51	D	22.61	D^2
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	4.58	73.13	**77.71**	
500	0.50	5.65	81.25	**86.91**	
550	0.55	6.84	89.38	**96.22**	
600	0.60	8.14	97.50	**105.64**	
650	0.65	9.55	105.63	**115.18**	
700	0.70	11.08	113.76	**124.83**	
750	0.75	12.72	121.88	**134.60**	
800	0.80	14.47	130.01	**144.48**	
850	0.85	16.33	138.13	**154.47**	
900	0.90	18.31	146.26	**164.57**	
950	0.95	20.40	154.38	**174.79**	
1000	1.00	22.61	162.51	**185.12**	
1100	1.10	27.36	178.76	**206.11**	
1200	1.20	32.56	195.01	**227.56**	

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LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

The allowable capacity of a single bored pile of 40.6 m length below EGL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH =	**38.00**	metre	
DIA OF PILE IN MM	**PILE CAPACITY IN TON**	UPLIFT CAPACITY IN TON	Depth of fixity **L_f (in m)**	Lateral Capacity of pile **[Q] (in T)**
450	77.71	26.08	4.11	4.76
500	86.91	29.76	4.57	5.28
550	96.22	33.49	5.03	5.81
600	105.64	37.26	5.48	6.34
650	115.18	41.07	5.94	6.87
700	124.83	44.93	6.40	7.40
750	134.60	48.84	6.85	7.93
800	144.48	52.79	7.31	8.45
850	154.47	56.79	7.77	8.98
900	164.57	60.83	8.22	9.51
950	174.79	64.91	8.68	10.04
1000	185.12	69.05	9.14	10.57
1100	206.11	77.45	10.05	11.62
1200	227.56	86.03	10.96	12.68

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LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

Founding Level = 35.0m

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLE 1			
Founding Level =	35.00	M Below E.B.L.	
Cut off Level = (–)	2.00	M below E.B.L.	

TABLE

Diameter of Pile in mm	Dia. Of Pile (in m)	PILE CAPACITY IN TON FOR 33.00 M SHAFT LENGTH			
		127.22 D		22.61 D^2	
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	4.58	57.25	**61.83**	
500	0.50	5.65	63.61	**69.26**	
550	0.55	6.84	69.97	**76.81**	
600	0.60	8.14	76.33	**84.47**	
650	0.65	9.55	82.69	**92.25**	
700	0.70	11.08	89.06	**100.13**	
750	0.75	12.72	95.42	**108.13**	
800	0.80	14.47	101.78	**116.25**	
850	0.85	16.33	108.14	**124.47**	
900	0.90	18.31	114.50	**132.81**	
950	0.95	20.40	120.86	**141.27**	
1000	1.00	22.61	127.22	**149.83**	
1100	1.10	27.36	139.95	**167.30**	
1200	1.20	32.56	152.67	**185.22**	

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LOCATION : GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED TAMLUK MEDICAL COLLEGE IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

The allowable capacity of a single bored pile of 35.0 m length below EGL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH =		33.00	metre	
DIA OF PILE IN MM	PILE CAPACITY IN TON	UPLIFT CAPACITY IN TON	Depth of fixity L_f (in m)	Lateral Capacity of pile [Q] (in T)
450	61.83	19.73	4.11	4.76
500	69.26	22.71	4.57	5.28
550	76.81	25.72	5.03	5.81
600	84.47	28.79	5.48	6.34
650	92.25	31.90	5.94	6.87
700	100.13	35.05	6.40	7.40
750	108.13	38.25	6.85	7.93
800	116.25	41.50	7.31	8.45
850	124.47	44.79	7.77	8.98
900	132.81	48.13	8.22	9.51
950	141.27	51.51	8.68	10.04
1000	149.83	54.93	9.14	10.57
1100	167.30	61.92	10.05	11.62
1200	185.22	69.09	10.96	12.68

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R. C. PILE

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Founding Level = 30.0m

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLE 1			
Founding Level =	30.00	M Below E.B.L.	
Cut off Level = (–)	2.00	M below E.B.L.	

TABLE					
Diameter of Pile in mm	Dia. Of Pile (in m)	PILE CAPACITY IN TON FOR		28.00	M SHAFT LENGTH
		105.24	D	22.61	D^2
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	4.58	47.36	**51.93**	
500	0.50	5.65	52.62	**58.27**	
550	0.55	6.84	57.88	**64.72**	
600	0.60	8.14	63.14	**71.28**	
650	0.65	9.55	68.40	**77.96**	
700	0.70	11.08	73.67	**84.74**	
750	0.75	12.72	78.93	**91.64**	
800	0.80	14.47	84.19	**98.66**	
850	0.85	16.33	89.45	**105.78**	
900	0.90	18.31	94.71	**113.02**	
950	0.95	20.40	99.97	**120.38**	
1000	1.00	22.61	105.24	**127.84**	
1100	1.10	27.36	115.76	**143.12**	
1200	1.20	32.56	126.28	**158.84**	

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The allowable capacity of a single bored pile of 30.0 m length below EGL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH =		28.00	metre	
DIA OF PILE IN MM	PILE CAPACITY IN TON	UPLIFT CAPACITY IN TON	Depth of fixity L_f (in m)	Lateral Capacity of pile [Q] (in T)
450	51.93	15.77	4.11	4.76
500	58.27	18.31	4.57	5.28
550	64.72	20.89	5.03	5.81
600	71.28	23.51	5.48	6.34
650	77.96	26.18	5.94	6.87
700	84.74	28.90	6.40	7.40
750	91.64	31.66	6.85	7.93
800	98.66	34.46	7.31	8.45
850	105.78	37.31	7.77	8.98
900	113.02	40.21	8.22	9.51
950	120.38	43.15	8.68	10.04
1000	127.84	46.14	9.14	10.57
1100	143.12	52.25	10.05	11.62
1200	158.84	58.54	10.96	12.68

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For R.C. bored pile minimum c/c distance of piles in group, should be as per provisions of relevant I.S. Code (I.S. 2911). Besides, as per discretion of structural engineer, group action, efficiency of piles are to be considered for pile design.

Moreover for R.C. bored pile it is strongly recommended that the design load carrying capacity of pile should be taken as per load test on test / working pile, done as per recommendation of IS 2911 (part – IV), since the pile capacities are calculated on basis of average sub-soil profile only.

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APPENDIX

BUSINESS ACTIVITY : GEOTECHNICAL & CIVIL CONSULTANTS
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SEQUENCE OF SOIL STRATIFICATION

STRATUM	DESCRIPTION	DEPTH IN METRE		THICKNESS		RANGE OF N-VALUES	
		FROM	TO	IN METRE	B.H. No.	FROM	TO
TOP SOIL	Heterogeneous fill with clay ,roots ,etc.	T.C.L.	1.20	1.20	B.H. 1	-	-
		T.C.L.	1.50	1.50	B.H. 2	-	-
		T.C.L.	1.40	1.40	B.H. 3	-	-
		T.C.L.	1.50	1.50	B.H. 4	-	-
I	Soft/meduim brownish grey /grey silty clay / clayey silt .	1.20	3.80	2.60	B.H. 1	3	-
		1.50	4.30	2.80	B.H. 2	2	5
		1.40	4.80	3.40	B.H. 3	3	7
		1.50	5.60	4.10	B.H. 4	2	5
II	Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	3.80	11.8	8.00	B.H. 1	1	3
		4.30	11.5	7.20	B.H. 2	1	3
		4.80	11.00	6.20	B.H. 3	1	3
		5.60	12.00	6.40	B.H. 4	1	3
III	Medium / stiff grey silty clay / clayey silt .	11.80	35.00	23.20	B.H. 1	4	11
		11.50	36.00	24.50	B.H. 2	5	10
		11.00	35.60	24.60	B.H. 3	4	12
		12.00	36.00	24.00	B.H. 4	4	10
IV	Very stiff grey silty clay / clayey silt.	35.00	40.60	5.60	B.H. 1	17	19
		36.00	40.10	4.10	B.H. 2	16	19
		35.60	40.10	4.50	B.H. 3	16	18
		36.00	40.10	4.10	B.H. 4	17	20

JOB NO.GMA/WBMSCL/TAMLUK/HOSPITAL/07/18

LOCATION: GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

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LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content as per IS-2720 (P-II)	Bulk Density t/cum	Liquid Limit % as per IS 2720(P-V)	Plastic Limit % as per 2720(P-V)	Determination of U.C.S 'C' t/sqm as per IS 2720 (P-X) Remoulded	TRIAXIAL SHEAR at Determination of Shear Parameters of a specimen tested in Unconsolidation Undrained triaxial compression without measurement of pore waer pressure as per IS 2720 (Part-XI)				Specific Gravity	Initial Void Ratio Determination of Consoldation Properties as per IS 2720(P-XIV)	GRAIN SIZE				Free Sweel	Direct Shear Deg
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand %	Slit %	Clay %	Gravel %	%	
Stratum-I																			
2	U	1.50	30	1.84	73	24	2.7	2.8	3.4	3.1	2.0	2.70	0.810	2	35	63	-	35	
2	P	2.00	-	-	70	24	-	-	-	-	-	-	-	4	34	62	-	30	
2	U	3.00	32	1.86	40	24	2.4	2.6	3.2	2.9	2.0	2.70	0.864	3	60	37	-	-	
2	P	3.50	-	-	75	25	-	-	-	-	-	-	-	2	34	64		40	
Stratum-II																			
2	U	5.00	48	1.7	78	30	1.5	1.8	2.4	2.1	1.2	2.54	1.219	2	50	48	-	-	
2	U	8.00	52	1.71	82	30	1.4	1.6	2.2	1.9	1.0	2.52	1.310	2	45	53	-	-	
Stratum-III																			
2	U	13.00	29	1.85	39	19	2.5	3.1	3.7	3.4	4.0	2.69	0.780	5	67	28			
2	U	15.00	28	1.86	42	24	3.0	3.1	3.7	3.4	2.0	2.70	0.756	2	60	38			
2	U	18.00	27	1.88	44	22	4.0	4.50	5.1	4.8	2.0	2.70	0.729	3	59	38			
2	U	21.00	30	1.84	44	24	2.5	2.9	3.5	3.2	2.0	2.70	0.810	2	64	34			
2	U	29.00	26	1.83	40	20	4.4	5.5	6.1	5.8	5.0	2.69	0.699	4	68	28			
Stratum-IV																			
2	U	37.00	25	1.90	60	24	8.4	9.2	9.8	9.5	2.0	2.70	0.675	3	53	44			
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

JOB NO.GMA/WBMSCL/TAMLUK/HOSPITAL/07/18
LOCATION:GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

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LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content as per IS-2720 (P-II)	Bulk Density t/cum	Liquid Limit % as per IS 2720(P-V)	Plastic Limit % as per 2720(P-V)	Determination of U.C.S 'C' t/sqm as per IS 2720 (P-X) Remoulded	TRIAXIAL SHEAR at Determination of Shear Parameters of a specimen tested in Unconsolidation Undrained triaxial compression without measurement of pore waer pressure as per IS 2720 (Part-XI)				Specific Gravity	Initial Void Ratio Determination of Consoldation Properties as per IS 2720(P-XIV)	GRAIN SIZE				Free Sweel	Direct Shear Deg
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand %	Slit %	Clay %	Gravel %	%	
Stratum-I																			
1	U	1.20	29	1.85	40	20	2.7	2.9	3.5	3.2	2.0	2.70	0.783	4	64	32	-	-	
1	P	2.00	-	-	70	24	-	-	-	-	-	-	-	4	34	62	-	30	
1	U	3.00	33	1.85	60	24	2.5	2.7	3.3	3.0	2.0	2.70	0.891	5	35	60	-	25	
Stratum-II																			
1	U	5.00	49	1.71	79	30	1.6	1.9	2.5	2.2	1.2	2.53	1.240	2	49	49	-	-	
1	U	10.20	53	1.69	83	30	1.3	1.5	2.1	1.8	1.0	2.51	1.330	2	46	52	-	-	
Stratum-III																			
1	U	13.00	29	1.85	39	19	2.5	3.1	3.7	3.4	4.0	2.69	0.780	6	66	28			
1	U	18.50	28	1.86	44	24	3.0	3.3	3.9	3.6	2.0	2.70	0.756	2	62	36			
1	U	22.70	27	1.87	42	22	4.0	4.50	5.1	4.8	2.0	2.70	0.729	3	59	38			
1	U	25.00	30	1.84	44	24	2.5	2.9	3.5	3.2	2.0	2.70	0.810	2	64	34			
1	U	33.00	27	1.84	40	20	4.5	5.6	6.2	5.9	5.0	2.69	0.726	5	66	29			
Stratum-IV																			
1	U	36.00	25	1.90	64	24	8.5	9.1	9.7	9.4	2.0	2.70	0.675	3	51	46			
1	U	39.00	25	1.91	58	24	8.8	9.3	9.9	9.6	2.0	2.70	0.675	2	56	42			
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

JOB NO.GMA/WBMSCL/TAMLUK/HOSPITAL/07/18
LOCATION:GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

G. MITRA & ASSOCIATES
GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 2008 CERTIFIED COMPANY

LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content as per IS-2720 (P-II)	Bulk Density t/cum	Liquid Limit % as per IS 2720(P-V)	Plastic Limit % as per 2720(P-V)	Determination of U.C.S 'C' t/sqm as per IS 2720 (P-X) Remoulded	TRIAXIAL SHEAR at Determination of Shear Parameters of a specimen tested in Unconsolidation Undrained triaxial compression without measurement of pore waer pressure as per IS 2720 (Part-XI)				Specific Gravity	Initial Void Ratio Determination of Consoldation Properties as per IS 2720(P-XIV)	GRAIN SIZE				Free Sweel	Direct Shear Deg
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand %	Slit %	Clay %	Gravel %	%	
Stratum-I																			
4	U	1.50	28	1.84	39	22	2.6	2.7	3.3	3.0	2.0	2.70	0.756	3	55	42	-	10	
4	U	3.00	32	1.86	44	22	2.5	2.7	3.3	3.0	2.0	2.70	0.864	4	50	46	-		
Stratum-II																			
4	U	7.00	48	1.72	78	30	1.7	1.8	2.4	2.1	1.3	2.51	1.205	2	50	48	-	-	
4	U	9.00	54	1.68	80	30	1.4	1.6	2.2	1.9	1.0	2.53	1.366	2	47	51	-	-	
Stratum-III																			
4	U	13.00	29	1.85	39	19	2.5	3.1	3.7	3.4	4.0	2.69	0.780	6	65	29			
4	U	19.00	29	1.86	44	24	3.0	3.3	3.9	3.6	2.0	2.70	0.783	2	62	36			
4	U	23.00	28	1.84	44	22	4.0	4.50	5.1	4.8	2.0	2.70	0.756	5	56	39			
4	U	27.00	30	1.84	42	24	2.5	2.8	3.4	3.1	2.0	2.70	0.810	2	64	34			
4	U	33.00	29	1.84	40	20	4.5	5.5	6.1	5.8	4.0	2.70	0.783	4	68	28			
Stratum-IV																			
4	U	37.00	25	1.90	64	24	8.5	9.1	9.7	9.4	2.0	2.70	0.675	3	50	47			
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

JOB NO.GMA/WBMSCL/TAMLUK/HOSPITAL/07/18
LOCATION:GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

G. MITRA & ASSOCIATES
GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 2008 CERTIFIED COMPANY

LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content as per IS-2720 (P-II)	Bulk Density t/cum	Liquid Limit % as per IS 2720(P-V)	Plastic Limit % as per 2720(P-V)	Determination of U.C.S 'C' t/sqm as per IS 2720 (P-X) Remoulded	TRIAXIAL SHEAR at Determination of Shear Parameters of a specimen tested in Unconsolidation Undrained triaxial compression without measurement of pore waer pressure as per IS 2720 (Part-XI)				Specific Gravity	Initial Void Ratio Determination of Consoldation Properties as per IS 2720(P-XIV)	GRAIN SIZE				Free Sweel	Direct Shear Deg
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand %	Slit %	Clay %	Gravel %	%	
Stratum-I																			
3	U	2.00	29	1.84	70	24	2.6	2.7	3.3	3.0	2.0	2.70	0.783	4	34	62	-	30	
3	P	2.50	-	-	70	24	-	-	-	-	-	-	-	4	34	62	-	30	
Stratum-II																			
3	U	5.00	48	1.72	78	30	1.7	2.0	2.6	2.3	1.2	2.56	1.229	2	51	47	-	-	
3	U	7.00	52	1.67	80	30	1.4	1.6	2.2	1.9	1.0	2.52	1.310	2	45	53	-	-	
Stratum-III																			
3	U	13.00	28	1.84	38	18	2.6	3.2	3.8	3.5	3.0	2.69	0.753	5	68	27			
3	U	19.00	29	1.85	39	19	4.0	3.4	4.0	3.7	2.0	2.70	0.783	2	61	37			
3	U	21.60	28	1.87	44	24	3.0	4.40	5.0	4.7	2.0	2.70	0.756	2	59	39			
3	U	27.00	29	1.85	44	24	2.6	3.0	3.6	3.3	4.0	2.70	0.783	2	61	37			
3	U	31.00	30	1.86	40	20	4.2	5.4	6.0	5.7	4.0	2.69	0.807	4	66	30			
Stratum-IV																			
3	U	37.00	26	1.90	60	24	8.4	9.2	9.8	9.5	2.0	2.70	0.702	3	49	48			
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

JOB NO.GMA/WBMSCL/TAMLUK/HOSPITAL/07/18
LOCATION:GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.

G. MITRA & ASSOCIATES

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BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Job No.:**	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		**Depth**		**Location:**	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	31.07.2018	**Completed on**	02.08.2018				
Water Struck		**Ground Water**	0.0 M	**Cordination Sext Angles**			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			**Bore Hole No.**		1	

DESCRIPTIN OF STRATA	DEPTH (M)		THICKNESS	N-VALUE	SAMPLES	DEPTH IN M
	FROM	TO			TYPE	
Heterogeneous fill with clay ,roots ,etc.	T.C.L	1.20	1.20	-	D	0.50
				-	D	1.00
Soft/meduim brownish grey /grey silty clay / clayey silt	1.20	3.80	2.60	-	U	1.20
				-	D	2.00
				3	P	2.00
				-	U	3.00
				-	D	3.80
Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	3.80	11.80	8.00	1	P	4.00
				-	D	5.00
				-	U	5.00
				2	P	6.00
				1	P	7.00
				3	P	8.00
				-	D	9.00
				-	U	9.00
				3	P	9.50
				-	U	10.20
Medium / stiff grey silty clay / clayey silt .	11.80	35.00	23.20	4	P	12.00
				-	U	13.00
				8	P	13.50
				7	P	14.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	6	**No. of U.D.S. :**	13	**No. of Vane Test:**
No. of Large Diameter Sample :		**No. of S.P.T. :**	22	**No. of Water Sample :**

G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	Shell & Augar	Bentinite	Drilling	Job No.:	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		Depth		Location:	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	31.07.2018	Completed on	02.08.2018				
Water Struck		Ground Water	0.0 M	Cordination Sext Angles			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			Bore Hole No.	1		

DESCRIPTIN OF STRATA	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Medium / stiff grey silty clay / clayey silt .				6	P	16.00
				9	P	17.90
				-	U	18.50
				10	P	19.00
				8	P	21.00
				-	U	22.70
				7	P	24.00
				-	U	25.00
				8	P	26.00
				-	U	27.00
				7	P	28.00
				8	P	30.00
				11	P	31.60
				-	U	33.00
				10	P	34.40
Very stiff grey silty clay / clayey silt.	35.00	40.60	5.60	18	P	35.00
				-	U	36.00
				17	P	37.00
				-	U	39.00
				19	P	40.00

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	6	No. of U.D.S. :	13	No. of Vane Test:
No. of Large Diameter Sample :		No. of S.P.T. :	22	No. of Water Sample :

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GEOTECHNICAL & CIVIL CONSULTANTS

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BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Job No.:**	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		**Depth**		**Location:**	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	02.08.2018	**Completed on**	04.08.2018				
Water Struck		**Ground Water**	0.50 M	**Cordination Sext Angles**			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			**Bore Hole No.**		2	

DESCRIPTIN OF STRATA	DEPTH (M)		THICKNESS	N-VALUE	SAMPLES	DEPTH IN M
	FROM	TO			TYPE	
Medium / stiff grey silty clay / clayey silt .	11.50	36.00	24.50	5	P	12.00
				-	U	13.00
				8	P	14.00
				-	D	15.00
				-	U	15.00
				7	P	16.00
				-	U	18.00
				8	P	18.50
				7	P	20.00
				-	D	21.00
				-	U	21.00
				9	P	23.00
				-	U	25.00
				7	P	26.00
				6	P	27.50
				-	U	29.00
				8	P	30.80
				10	P	32.00
				-	U	33.00
				9	P	34.00
				10	P	35.40
Very stiff grey silty clay / clayey silt.	36.00	40.10	4.10	16	P	36.00
				-	U	37.00
				19	P	38.00
				18	P	39.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	6	**No. of U.D.S. :**	13	**No. of Vane Test:**
No. of Large Diameter Sample :		**No. of S.P.T. :**	22	**No. of Water Sample :**

G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	Shell & Augar	Bentinite	Drilling	Job No.:	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		Depth		Location:	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	02.08.2018	Completed on	04.08.2018				
Water Struck		Ground Water	0.50 M	Cordination Sext Angles			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			Bore Hole No.		2	

DESCRIPTIN OF STRATA	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Heterogeneous fill with clay ,roots ,etc.	T.C.L	1.50	1.50	-	D	0.50
				-	D	1.00
				-	D	1.50
Soft/meduim brownish grey /grey silty clay / clayey silt .	1.50	4.30	2.80	-	U	1.50
				2	P	2.00
				-	U	3.00
				5	P	3.50
Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	4.30	11.50	7.20	1	P	4.40
				-	D	5.00
				-	U	5.00
				2	P	6.00
				1	P	7.00
				-	U	8.00
				3	P	8.50
				2	P	9.40
				-	U	11.00

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	6	No. of U.D.S. :	13	No. of Vane Test:
No. of Large Diameter Sample :		No. of S.P.T. :	22	No. of Water Sample :

G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	Shell & Augar	Bentinite	Drilling	Job No.:	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		Depth		Location:	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	04.08.2018	Completed on	06.08.2018				
Water Struck		Ground Water	0.0 M	Cordination Sext Angles			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			Bore Hole No.		3	

DESCRIPTIN OF STRATA	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Medium / stiff grey silty clay / clayey silt .				5	P	18.00
				-	D	19.00
				-	U	19.00
				8	P	20.00
				-	U	21.60
				9	P	23.00
				7	P	24.00
				8	P	26.00
				-	D	27.00
				-	U	27.00
				10	P	28.00
				11	P	30.00
				-	U	31.00
				12	P	32.00
				11	P	34.00
				12	P	35.00
Very stiff grey silty clay / clayey silt.	35.60	40.10	4.50	16	P	36.00
				-	U	37.00
				18	P	38.00
				18	P	39.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	5	No. of U.D.S. :	9	No. of Vane Test:
No. of Large Diameter Sample :		No. of S.P.T. :	27	No. of Water Sample :

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GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	Shell & Augar	Bentinite	Drilling	Job No.:	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		Depth		Location:	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	04.08.2018	Completed on	06.08.2018				
Water Struck		Ground Water	0.0 M	Cordination Sext Angles			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			Bore Hole No.		3	

DESCRIPTIN OF STRATA	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Heterogeneous fill with clay ,roots ,etc.	T.C.L	1.40	1.40	-	D	0.50
				-	D	1.00
Soft/meduim brownish grey /grey silty clay / clayey silt .	1.40	4.80	3.40	3	P	1.40
				-	U	2.00
				4	P	2.50
				7	P	3.40
				6	P	4.20
Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	4.80	11.00	6.20	-	U	5.00
				1	P	5.50
				1	P	6.00
				-	D	7.00
				-	U	7.00
				2	P	8.00
				3	P	9.00
				2	P	10.00
Medium / stiff grey silty clay / clayey silt .	11.00	35.60	24.60	4	P	11.00
				8	P	12.00
				-	U	13.00
				6	P	15.00
				8	P	16.00
				6	P	17.00

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	5	No. of U.D.S. :	9	No. of Vane Test:
No. of Large Diameter Sample :		No. of S.P.T. :	27	No. of Water Sample :

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GEOTECHNICAL & CIVIL CONSULTANTS

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BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Job No.:**	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		**Depth**		**Location:**	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	06.08.2018	**Completed on**	08.08.2018				
Water Struck		**Ground Water**	1.20 M	**Cordination Sext Angles**			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			**Bore Hole No.**		4	

DESCRIPTIN OF STRATA	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Medium / stiff grey silty clay / clayey silt .	12.00	36.00	24.00	4	P	12.00
				-	D	13.00
				-	U	13.00
				5	P	13.50
				6	P	14.60
				5	P	16.00
				7	P	18.00
				-	U	19.00
				8	P	20.00
				7	P	21.70
				-	U	23.00
				8	P	24.00
				8	P	25.00
				-	U	27.00
				9	P	28.00
				-	U	29.50
				10	P	30.00
				9	P	32.00
				-	U	33.00
				10	P	34.00
				10	P	35.00
Very stiff grey silty clay / clayey silt.	36.00	40.10	4.10	17	P	36.00
				-	U	37.00
				20	P	39.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	7	**No. of U.D.S. :**	12	**No. of Vane Test:**
No. of Large Diameter Sample :		**No. of S.P.T. :**	22	**No. of Water Sample :**

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BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Job No.:**	GMA/WBMSCL/TAMLUK/HOSPITAL/07/18		
Dia of Hole		**Depth**		**Location:**	GEO-TECHNICAL INVESTIGATION OF SUB-SOIL (ANY TYPE SOIL /ROCK) IN CONNECTION WITH WORK FOR PROPOSED **TAMLUK MEDICAL COLLEGE** IN STATE OF WEST BENGAL IN THE CAMPUS OF TAMLUK DISTRICT HOSPITAL IN THE DISTRICT OF PURBA MEDINIPUR.		
Commenced on	06.08.2018	**Completed on**	08.08.2018				
Water Struck		**Ground Water**	1.20 M	**Cordination Sext Angles**			
Ground/Bed/RL	T.C.L IS SAME AS ROAD LEVEL			**Bore Hole No.**		4	

DESCRIPTIN OF STRATA	DEPTH (M)		THICKNESS	N-VALUE	SAMPLES	DEPTH IN M
	FROM	TO			TYPE	
Heterogeneous fill with clay ,roots ,etc.	T.C.L	1.50	1.50	-	D	0.50
				-	D	1.00
				-	D	1.50
Soft/meduim brownish grey /grey silty clay / clayey silt .	1.50	5.60	4.10	-	U	1.50
				2	P	2.00
				-	D	3.00
					U	3.00
				4	P	4.00
				5	P	5.00
Very soft / soft dark grey silty clay with black D.W. / D.V.& peat approx 20 % to 90 %.	5.60	12.00	6.40	1	P	6.00
				-	D	7.00
				-	U	7.00
				2	P	8.00
				-	D	9.00
				-	U	9.00
				3	P	10.00
				-	U	11.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	7	**No. of U.D.S. :**	12	**No. of Vane Test:**
No. of Large Diameter Sample :		**No. of S.P.T. :**	22	**No. of Water Sample :**

REPORT ON GEO-TECHNICAL INVESTIGATION

OF

SUB-SJOIL (ANY TYPE SOIL/ROCK) IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL

AT

BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906)

AND

UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772)

IN THE DISTRICT OF NORTH 24 PARGANAS.

Memo No.- HFW-41014(14)/17/2018-WBMSCL SEC-Dept. of H&FW/3670, Dated 05-09-2018

PROJECT OF:

The Managing director & Secretary,
Health & Family Welfare Department,
West Bengal Medical Services Corporation Ltd
(Wholly Owned by the Government of West Bengal)
CIN: U85110WB2008SG126373
Regd. Off. : Swasthya Sathi, GN-29, Sector-V, Salt Lake, Kolkata - 700 091

Executed by :

G.MITRA & ASSOCIATES
GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 2008 CERTIFIED COMPANY

OFFICE & LABORATORY: 4, PRIYO NATH GHOSH ROAD, KOLKATA – 700 075
MOBILE. : 9831135947, 9051496121, 9836477484, *e-mail: gmitra58@yahoo.in*
REGD OFFICE: 86, HARIDAS DUTTA ROAD, JAYNAGAR, 24 PGS (SOUTH)

November 2018

G. MITRA & ASSOCIATES

GEOTECHNICAL & CIVIL CONSULTANTS

ISO 9001:2008 CERTIFIED

Ref No. GMA/WBMSCL/BARASAT/MEDI.COLLEGE/10/18

DATE : 04/11/2018.

To
The Managing director & Secretary,
Health & Family Welfare Department,
West Bengal Medical Services Corporation Ltd
(Wholly Owned by the Government of West Bengal)
CIN: U85110WB2008SG126373
Regd. Off. : Swasthya Sathi, GN-29, Sector-V, Salt Lake, Kolkata - 700 091

Sub : GEO-TECHNICAL INVESTIGATION OF SUB-SJOIL (ANY TYPE SOIL/ROCK) IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

Dear Sir,

We have pleasure in submitting here with the detailed Soil Investigation Report on the said job.

This Report contains the details of field work carried out, results of the field and laboratory tests along with recommendation for design of foundations for the proposed MEDICAL COLLEGE.

Should have any queries out this report you may feel free to refer the same to us.

Thanking you,

Yours faithfully,

For G.MITRA & ASSOCIATES

Proprietor / Authorized Signatory

Enclo : As stated above.

BUSINESS ACTIVITY : GEOTECHNICAL & CIVIL CONSULTANTS
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CONTENTS

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APPENDIX

- SKETCH LAYOUT PLAN SHOWING BORE HOLE LOCATIONS
- SEQUENCE OF SUB-SOIL STRATIFICATIONS
- LABORATORY TEST RESULTS
- MV VALUE
- BORE LOG DATA SHEETS
- SOIL PROFILE AND SPT CURVES
- TIME SETTLEMENT AND e LOG p CURVE
- PRATICLE SIZE DISTRIBUTION CURVE
- MOHR'S CIRCLE
- DIRECT SHEAR

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ABBREVIATION AND NOTATIONS

S P T	:	STANDARD PENETRATION TEST
D C P T :		DYNAMIC CONE PENETRATION TEST
U D S	:	UNDISTURBED SAMPLE
D S	:	DISTURBED SAMPLE
T C L	:	TEST COMMENCEMENT LEVEL
G L	:	GROUND LEVEL
E G L	:	EXISTING GROUND LEVEL
R L	:	ROAD LEVEL
S_f	:	PERMISSIBLE SETTLEMENT OF FOOTING AT SHALLOW DEPTH
q_d	:	NET ULTIMATE BEARING CAPACITY OF SHALLOW FOUNDATION
c_u	:	UNDRAINED COHESION
N_c N_q N_γ :		BEARING CAPACITY FACTORS
S_c S_q S_γ :		SHAPE FACTORS
d_c d_q d_γ :	:	DEPTH FACTOR
I_c I_q I_γ	:	SHAPE FACTOR FOR SIZE, DEPTH AND INCLINATION OF FOOTING RESPECTIVELY
q	:	INTENSITY OF SURCHARGE AT FOUNDING LEVEL
w'	:	CORRECTION FACTOR TO ACCOUNT FOR THE EFFECT OF WATER TABLE
b_f	:	WIDTH OF FOUNDATION
s_i	:	ELASTIC SETTLEMENT OR IMMEDIATE SETTLEMENT
p	:	INTENSITY OF LOADING FROM FOUNDATION, i.e. NET FOUNDATION LOADING
μ	:	POISSON'S RATIO

E	:	YOUNG'S MODULUS A ELASTIC CONSTANT FOR SOIL UNDER CONSIDERATION
i_p	:	INFLUENCE FACTOR
s_c	:	CONSOLIDATION SETTLEMENT
c_c	:	COMPRESSION INDEX
h_o	:	DRAINAGE PATH
e_o	:	INITIAL VOID RATIO
P_O	:	EFFECTIVE INITIAL OVERBURDEN PRESSURE
ΔP	:	CHANGE IN EFFECTIVE PRESSURE DUE TO FOUNDATION LOADING
s_t	:	TOTAL SETTLEMENT
Δ'	:	EFFECTIVE NORMAL STRESS
ϕ	:	ANGLE OF INTERNAL FRICTION
q	:	COMPRESSIVE STRENGTH IN FAILURE
q_a	:	FRACTURE INITIATION STRENGTH
q_t	:	TENSILE STRENGTH AT FAILURE
q_y	:	UNIAXIAL COMPRESSIVE STRENGTH
D W	:	DECOMPOSED WOOD
D V	:	DECOMPOSED VEGETATION
N M C	:	NATURAL MOISTURE CONTENT
N P	:	NON – PLASTIC
H_{yd}	:	HYDROMETER ANALYSIS
U_u	:	TRIAXIAL UNDRAINED
D_d	:	TRIAXIAL DRAINED
U_c	:	UNCONFINED UNDISTURBED
U_{cr}	:	UNCONFINED REMOULDED
C_u / C_d :	:	CONSOLIDATION UNDRAINED/DRAINED
D_s	:	DIRECT SHEAR

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1.0 INTRODUCTION

GEO-TECHNICAL INVESTIGATION OF SUB-SJOIL (ANY TYPE SOIL/ROCK) IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

2.0 FIELD SOIL EXPLORATION

For the purpose of exploration of subsurface soil deposits, **Five Number of bore holes** of depth 40.6 m, 40.1 m, 40.6 m, 40.6 m & 40.1 m, were sunk at predetermined locations suggested by **The Managing director & Secretary,** Health & Family Welfare Department, West Bengal Medical Services Corporation Ltd. At the site of works, the approximate locations of Bore Holes B.H-1 to B.H-5, have been shown in the site plan.

During the progress of boring using Shell & auger method, disturbed and undisturbed soil samples were collected at suitable intervals and also wherever soil layers changed. The collection of these soil samples were made with help of 100mm diameter, 450mm long, thin-walled open drive sampler as per IS:2132.

The undisturbed soil samples inside the sample tubes were waxed at both ends, properly labeled and stored for conducting necessary tests. Disturbed soil samples were also collected in polythene bags for general identification purposes. Table presents the scheme of the field investigation. The field soil exploration was commenced on 06.10.2018 and completed on 11.10.2018 Table presents the scheme of the field investigation.

Table – I Scheme of the field investigation

Bore Hole No	Bored Depth(m)	Ground Water Level(m)	Samples collected		
			UDS	SPT	DS
1	40.60 m		4	22	4
2	40.10 m		3	22	2
3	40.60 m		3	24	3
4	40.60 m		3	22	3
5	40.10 m		3	21	3
		Total =	**16**	**111**	**15**

2.1 Standard Penetration Tests

The Standard Penetration Tests as per IS: 2131 were conducted at regular intervals in the bore holes. At the desired depths of cleaned bore holes, the SPT tests were conducted with standard split spoon sampler. The sampler is an open ended cylinder which splits longitudinally into two halves. These two halves are held together by a cutting shoe at the lower end and a coupling which connects the sampler to the drill rod. The split spoon was driven through 60cm into the ground at the required level in the bore holes, with the help of a standard drop hammer of 65kg falling freely from a height of 75cm. The number of hammer blows of the standard hammer, for each 15cm penetration were recorded. The total number of blows required to drive the second and third 15 cm of penetration were recorded as the SPT or N-value.

At the end of tests, disturbed soil samples from the split spoon sampler were collected in polythene bags with proper labels, and stored for general identification and classification tests.

2.2 Ground Water

Ground water observations were made during boring and the depth at which ground water was encountered and the standing water levels were recorded. Whenever ground water was struck, it was allowed to stabilize. The depth of the water table was then measured.

3.0 LABORATORY INVESTIGATIONS

For the purpose of proper identification and classification of soil samples collected during field exploration, and also for determining various properties of these soils, the following laboratory tests on representative and undisturbed soil samples were conducted as follows:

(a) Bulk density and natural moisture content.
(b) Particle size distribution.
(c) Liquid Limit (L.L.) and Plastic Limits (P.L.).
(d) Unconfined Compression Tests (UC).
(e) Triaxial Shear Tests (UU, UD, CU & CD).
(f) Specific gravity of soils.
(g) Consolidation Tests.

All the laboratory tests were conducted as per relevant Indian Standard Codes of Practice, and the results have been presented in Table-1-IV.

3.1 Particle Size Distribution

The particle size distribution tests of soil samples were conducted as per IS:2720(Part-4). The soil fractions passing 75 micron sieve, Hydrometer tests were conducted. The particle size distribution curves have been shown in FIG.3-20.

3.2 Liquid Limit & Plastic Limit

The tests for Plasticity index, i.e., Liquid Limit, and Plastic Limit were determined as per IS: 2720(Part-5 & 6). The liquid limits were determined using standard liquid limit device and a grooving tool.

3.3 Specific Gravity of Soil

The specific gravity of different minerals present in soils may vary on the average from **2.65 to 2.70**. Specific gravity as such does not indicate the behavior of soil mass under external loads, but it is an important factor, which is used in computing other properties of soil, particularly consolidation characteristics. The specific gravity of soil samples were determined in the laboratory as per IS: 2720(Part-3), particularly for those samples for which consolidations tests were conducted.

3.4 Unconfined Compression Tests

This test is a very quick method of determining the shear strength of soil, which is predominantly fine-grained cohesive soil, with very low or negligible value of angle of internal friction soil. This is basically similar to conventional triaxial shear test on soil with all-round confining pressure as zero. Approximately, half of the unconfined compression strength of the sample is taken as the value of cohesion or shear strength of the soil.

3.5 Direct Shear Tests

Direct shear test (DS) on samples were conducted in the laboratory, as per relevant IS code of Practice. This test is particularly done for soil samples which are predominantly coarse grained soils.

3.6 Triaxial Shear Tests

For the purpose of determining the shear strength parameters of clayey soils, unconsolidated undrained (UU), Triaxial compression tests were conducted with undisturbed soil samples in the laboratory in an electrically operated Universal Triaxial Compression Testing Machine, as per IS:2720. Mohr-Coulomb failure envelopes for the samples tested in triaxial machine. Under the field conditions for the proposed structure, the dissipation of induced excess pore pressure may not be instantaneous. As such, to simulate the field conditions in a reasonable manner, unconsolidated undrained (UU) triaxial shear tests were conducted on undisturbed soil samples.

3.7 Consolidation Tests

The consolidation properties of fine grained soils required for settlement analysis of foundations, were determined from consolidation tests conducted in the laboratory as per IS:2720(Part-15).

For sandy soils, consolidation tests were not conducted as settlement in such deposits are generally rapid and occur immediately during constructions.

4.0 AVERAGE SOIL PROFILE

Five bore holes **B.H-1 to B.H-5** up to depths of 40.6 m, 40.1 m, 40.6 m, 40.6 m & 40.1 m were made over the site at the locations where the construction has been proposed to be constructed. Bore hole locations have been shown in the site plan. Locations of bore holes were so chosen in consultation with the concerned Engineers.

On the basis of field bore logs and subsequent laboratory tests results on soil samples collected during field soil exploration, average soil profile has been established. Within the depths of exploration, **five major soil stratums** have been identified.

The top soil consists of **Heterogenous fill with clay, brickbats, roots etc.** This layer starts from T.C.L. and continue from 1.0 m to 1.5 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.** This layer starts from 1.0 m to 1.5 m depth below E.G.L. and continue up to 3.5 m to 4.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 2: This stratum consists of **Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.** This layer starts from 3.5 m to 4.5 m depth below E.G.L. and continue up to 8.0 m to 10.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 3: This stratum consists of **Medium stiff grey clayey silt / clayey sandy silt.** This layer starts from 8.0 m to 10.5 m depth below E.G.L. and continue up to 11.0 m to 13.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 7 to 13.

Stratum – 4: This stratum consists of **Medium grey silty sand.** This layer starts from 11.0 m to 13.0 m depth below E.G.L. and continue up to 20.0m to 22.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 10 to 23.

Stratum – 5: This stratum consists of **Dense / very dense grey silty sand.** This layer starts from 20.0m to 22.0 m depth below E.G.L. and continue up to 40.6 m depth below E.G.L. The 'N' value of this layer varies are varies from 35 to >50.

4.1 Soil Properties

Based on the results of field, laboratory investigation the average SPT values and engineering properties of different subsoil strata are summarized as follows:

Stratum – I: This stratum consists of **Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.** This layer starts from 1.0 m to 1.5 m depth below E.G.L. and continue up to 3.5 m to 4.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

The average engineering properties and sub soil properties of this layer has been given below :-

Bulk Density	=	1.82	t/cum
Natural Moisture Content	=	33	%
Liquid limit	=	44	%
Specific gravity	=	2.70	
Initial void ratio 'e_0'	=	0.891	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	3	%
Silt	=	61	%
Clay	=	32	%
Gravel	=	-	%
I.S. Classification	=	CI-MI	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
	0.050	0.891	0.047	0.46	0.054	0.0054
0.25-0.50	0.250	0.872	0.028	0.37	0.040	0.0040
	0.500	0.840	0.020	0.36	0.030	0.0030
1.0-2.0	1.000	0.820	0.040	0.84	0.026	0.0026
	2.000	0.780	0.020	1.00	0.011	0.0011
4.0-8.0	4.000	0.640	0.040	2.00	0.012	0.0012
	8.000	0.560	0.050	4.00	0.008	0.0008

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Based on the results of field, laboratory investigation the average SPT values and engineering properties of different subsoil strata are summarized as follows:

Stratum – I: This stratum consists of **Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.** This layer starts from 1.0 m to 1.5 m depth below E.G.L. and continue up to 3.5 m to 4.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

The average engineering properties and sub soil properties of this layer has been given below :-

Bulk Density	=	1.82	t/cum
Natural Moisture Content	=	33	%
Liquid limit	=	44	%
Specific gravity	=	2.70	
Initial void ratio 'e_0'	=	0.891	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	3	%
Silt	=	61	%
Clay	=	32	%
Gravel	=	-	%
I.S. Classification	=	CI-MI	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
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	0.500	0.840	0.020	0.36	0.030	0.0030
1.0-2.0	1.000	0.820	0.040	0.84	0.026	0.0026
	2.000	0.780	0.020	1.00	0.011	0.0011
4.0-8.0	4.000	0.640	0.040	2.00	0.012	0.0012
	8.000	0.560	0.050	4.00	0.008	0.0008

Stratum – 2: This stratum consists of **Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.** This layer starts from 3.5 m to 4.5 m depth below E.G.L. and continue up to 8.0 m to 10.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

The average engineering properties and sub soil properties of this layer has been given below :-

Bulk Density	=	1.72	t/cum
Natural Moisture Content	=	49	%
Liquid limit	=	79	%
Specific gravity	=	2.53	
Initial void ratio 'e_0'	=	1.240	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	2	%
Silt	=	50	%
Clay	=	48	%
Gravel	=	-	%
I.S. Classification	=	CH-MH	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure (σ) Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm²/kg)	m_v (m²/kN)
	0.050	1.240	0.03	0.27	0.050	0.0050
0.25-0.50	0.250	1.210	0.02	0.18	0.043	0.0043
	0.500	1.193	0.02	0.27	0.030	0.0030
1.0-2.0	1.000	1.175	0.03	0.58	0.021	0.0021
	2.000	1.148	0.04	1.00	0.018	0.0018
4.0-8.0	4.000	1.110	0.03	2.00	0.007	0.0007
	8.000	1.080	0.03	4.00	0.004	0.0004

Stratum – 3: This stratum consists of **Medium stiff grey clayey silt / clayey sandy silt.** This layer starts from 8.0 m to 10.5 m depth below E.G.L. and continue up to 11.0 m to 13.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 7 to 13.

The average engineering properties and sub soil properties of this layer has been given below :-

Bulk Density	=	1.88	t/cum
Natural Moisture Content	=	27	%
Liquid limit	=	39	%
Specific gravity	=	2.69	
Initial void ratio 'e_0'	=	0.726	
Grain Size Analysis (Sieve Analysis) :			
Sand	=	9	%
Silt	=	69	%
Clay	=	22	%
Gravel	=	-	%
I.S. Classification	=	CI-MI	

The following are the average coefficient of volume compressibility (m_v) values of this stratum (From e-log p curve)

$$m_v = \frac{\Delta e}{(1+e_0)} \times \frac{1}{\Delta \sigma'_v} = \frac{\Delta e}{(1+e_0) \times \Delta \sigma'_v}$$

Pressure Range	Pressure (σ)	e_0	Δe	$\Delta \sigma'_v$	m_v (cm^2/kg)	m_v (m^2/kN)
	0.050	0.726	0.05	0.95	0.028	0.0028
0.25-0.50	0.250	0.717	0.04	0.89	0.024	0.0024
	0.500	0.700	0.02	0.87	0.014	0.0014
1.0-2.0	1.000	0.680	0.02	0.96	0.012	0.0012
	2.000	0.660	0.02	1.00	0.011	0.0011
4.0-8.0	4.000	0.585	0.03	2.00	0.010	0.0010
	8.000	0.550	0.03	4.00	0.005	0.0005

Stratum – 4: This stratum consists of **Medium grey silty sand.** This layer starts from 11.0 m to 13.0 m depth below E.G.L. and continue up to 20.0m to 22.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 10 to 23.
I.S. Classification = SM

Stratum – 5: This stratum consists of **Dense / very dense grey silty sand.** This layer starts from 20.0m to 22.0 m depth below E.G.L. and continue up to 40.6 m depth below E.G.L. The 'N' value of this layer varies are varies from 35 to >50.
I.S. Classification = SM

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The average soil Profile

STRATUM	DESCRIPTION	DEPTH IN METRE		THICKNESS		RANGE OF N-VALUES	
		FROM	TO	IN METRE	B.H. No.	FROM	TO
TOP	Heterogenous fill with clay, brickbats, roots etc.	T.C.L.	1.00	1.00	B.H. 1	–	–
		T.C.L.	1.00	1.00	B.H. 2	–	–
		T.C.L.	1.50	1.50	B.H. 3	–	–
		T.C.L.	1.50	1.50	B.H. 4	–	–
		T.C.L.	1.40	1.40	B.H. 5	–	–
I	Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	1.00	4.50	3.50	B.H. 1	2	3
		1.00	4.00	3.00	B.H. 2		2
		1.50	4.50	3.00	B.H. 3		2
		1.50	4.00	2.50	B.H. 4		5
		1.40	3.50	2.10	B.H. 5		5
II	Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	4.50	10.50	6.00	B.H. 1	2	3
		4.00	9.00	5.00	B.H. 2	2	3
		4.50	9.00	4.50	B.H. 3	2	3
		4.00	8.00	4.00	B.H. 4	2	3
		3.50	9.00	5.50	B.H. 5	2	3
III	Medium stiff grey clayey silt / clayey sandy silt.	10.50	13.00	2.50	B.H. 1	10	13
		9.00	10.50	1.50	B.H. 2	8	
		9.00	13.00	4.00	B.H. 3	7	9
		8.00	11.00	3.00	B.H. 4	9	10
		9.00	10.00	1.00	B.H. 5		10
IV	Medium grey silty sand.	13.00	21.00	8.00	B.H. 1	16	22
		10.50	20.00	9.50	B.H. 2	12	18
		13.00	21.00	8.00	B.H. 3	14	20
		11.00	22.00	11.00	B.H. 4	14	23
		10.00	20.00	10.00	B.H. 5	10	28
V	Dense / very dense grey silty sand.	21.00	40.60	19.60	B.H. 1	40	>50
		20.00	40.10	20.10	B.H. 2	45	>50
		21.00	40.60	19.60	B.H. 3	42	>50
		22.00	40.60	18.60	B.H. 4	30	>50
		20.00	40.10	20.10	B.H. 5	35	>50

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CHAPTER – V

DISCUSSION & CALCULATION

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DISCUSSION & CALCULATION

5 1 0 **GENERAL**

a) There must be adequate factor of safety of the foundation against any possible bearing capacity failure and

b) The settlement of the foundation must be within permissible limits as defined in I.S. Code. The suitability of different types of foundation may be investigated in the light of the above requirements.

5 1 0 A study of the sub-soil characteristics at the site reveal that top soil consists of **Heterogenous fill with clay, brickbats, roots etc.** This layer starts from T.C.L. and continue from 1.0 m to 1.5 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.** This layer starts from 1.0 m to 1.5 m depth below E.G.L. and continue up to 3.5 m to 4.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 2: This stratum consists of **Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.** This layer starts from 3.5 m to 4.5 m depth below E.G.L. and continue up to 8.0 m to 10.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 3: This stratum consists of **Medium stiff grey clayey silt / clayey sandy silt.** This layer starts from 8.0 m to 10.5 m depth below E.G.L. and continue up to 11.0 m to 13.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 7 to 13.

Stratum – 4: This stratum consists of **Medium grey silty sand.** This layer starts from 11.0 m to 13.0 m depth below E.G.L. and continue up to 20.0m to 22.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 10 to 23.

Stratum – 5: This stratum consists of **Dense / very dense grey silty sand.** This layer starts from 20.0m to 22.0 m depth below E.G.L. and continue up to 40.6 m depth below E.G.L. The 'N' value of this layer varies are varies from 35 to >50.

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R. C. PILE

Founding level = 35.0m below T.C.L. (Test commencement level)

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLES 1, 2, 3, 4 & 5		
Founding Level =	35.00	M Below T.C.L. (Test Commencement Level)
Cut off Level = (–)	2.00	M Below T.C.L. (Test Commencement Level)
Shaft length =	32.00	M

Stratum-1

The Bottom of this layer (m)	Top Soil (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
3.5	2.0	1.5	3	2.00	1.5
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	$P = \Pi \times D \times L \times C \times \alpha$ (in T)	Where Π = 3.141	
2.00	0	1.00	9.42	D	

Stratum - 2

The Bottom of this layer (m)	Top of this Sta. (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
10.5	3.5	7	2	1.2	1
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	$P = \Pi \times D \times L \times C \times \alpha$ (in T)	Where Π = 3.141	
1.2	0	1.00	26.38	D	

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Stratum - 3					
The Bottom of this layer (m)	Top of this Sta. (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
13.0	10.5	2.5	8	3.80	4
Let us use C = (t/sq.m)	Phi (deg)	Use adhesion factor (α)	P = $\Pi \times D \times L \times C \times \alpha$ (in T)	Where Π = 3.141	
3.80	0	1.00	29.84	D	

Stratum - 4					
The Bottom of this layer (m)	Top of this Sta. (m)	The effective length to give rise to pile shaft friction (m)	Average Corrected N =	Lab. Test result C = (t/sq.m)	Estimated cohesion from N value (t/sq.m)
22.0	13.0	9	0	0.00	0

Considering the above cases, let us treat the soil, as pure sand.				
	Phi (deg)	Use adhesion factor (α)	k_0 = 1 –sinϕ	Let us restrict the maxi. Pressure to (t/sqm) σ_z
	23	0.0	0.471	9
			sin 32º = 0.529	
tan 23		f_s (t/sqm) = $k_0 \times \sigma_2 \times \tan\phi$	P = $\Pi \times D \times L \times f_S$ (in T)	Where, Π = 3.141 D = Dia L= shaft length of pile f_s = = $k_0 \times s_2 \times \tan\phi$
= 0.424		1.797336	50.81	Dia

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Total Skin Friction (in Ton) Sta. I to V – Negative Skin Friction		So ultimate pile capacity (Q_{tip}+Tot. skin fric)	F.O.S.	Allowable pile capacity =($Skin_{fric}$/FOS) D + (Q_{tip}/2.5) D^2	
224.46	D	288.05	2.5	**89.79**	**D +**
				25.43	**D^2**

TABLE					
Diameter of Pile in mm	Dia. Of Pile (in m)	**PILE CAPACITY IN TON FOR**		**33.00**	**M SHAFT LENGTH**
		89.79 D		**25.43**	**D^2**
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	5.15	40.40	**45.55**	
500	0.50	6.36	44.89	**51.25**	
550	0.55	7.69	49.38	**57.08**	
600	0.60	9.16	53.87	**63.03**	
650	0.65	10.75	58.36	**69.11**	
700	0.70	12.46	62.85	**75.31**	
750	0.75	14.31	67.34	**81.65**	
800	0.80	16.28	71.83	**88.11**	
850	0.85	18.38	76.32	**94.69**	
900	0.90	20.60	80.81	**101.41**	
950	0.95	22.95	85.30	**108.25**	
1000	1.00	25.43	89.79	**115.22**	
1100	1.10	30.78	98.76	**129.54**	
1200	1.20	36.62	107.74	**144.37**	

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The allowable capacity of a single bored pile of 33.0 m shaft length below TCL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH = 33.00 metre				
DIA OF PILE IN MM	PILE CAPACITY IN TON	UPLIFT CAPACITY IN TON	Depth of fixity L_f (in m)	Lateral Capacity of pile [Q] (in T)
450	**45.55**	13.22	4.11	4.76
500	**51.25**	15.50	4.57	5.28
550	**57.08**	17.83	5.03	5.81
600	**63.03**	20.21	5.48	6.34
650	**69.11**	22.64	5.94	6.87
700	**75.31**	25.13	6.40	7.40
750	**81.65**	27.66	6.85	7.93
800	**88.11**	30.24	7.31	8.45
850	**94.69**	32.88	7.77	8.98
900	**101.41**	35.56	8.22	9.51
950	**108.25**	38.30	8.68	10.04
1000	**115.22**	41.09	9.14	10.57
1100	**129.54**	46.82	10.05	11.62
1200	**144.37**	52.75	10.96	12.68

For R.C. bored pile minimum c/c distance of piles in group, should be as per provisions of relevant I.S. Code (I.S. 2911). Besides, as per discretion of structural engineer, group action, efficiency of piles are to be considered for pile design.

Moreover for R.C. bored pile it is strongly recommended that the design load carrying capacity of pile should be taken as per load test on test / working pile, done as per recommendation of IS 2911 (part – IV), since the pile capacities are calculated on basis of average sub-soil profile only.

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RECOMMENDATION AND CONCLUSION

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RECOMMENDATION AND CONCLUSION

Based on the field and laboratory test results and from the discussions, the following are summarized below:

The sub-soil characteristics of GEO-TECHNICAL INVESTIGATION OF SUB-SJOIL (ANY TYPE SOIL/ROCK) IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS, reveal that the top soil consists of **Heterogenous fill with clay, brickbats, roots etc.** This layer starts from T.C.L. and continue from 1.0 m to 1.5 m depth below E.G.L.

Stratum – I: This stratum consists of **Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.** This layer starts from 1.0 m to 1.5 m depth below E.G.L. and continue up to 3.5 m to 4.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 2: This stratum consists of **Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.** This layer starts from 3.5 m to 4.5 m depth below E.G.L. and continue up to 8.0 m to 10.5 m depth below E.G.L. The 'N' value of this layer are varies from 2 to 3.

Stratum – 3: This stratum consists of **Medium stiff grey clayey silt / clayey sandy silt.** This layer starts from 8.0 m to 10.5 m depth below E.G.L. and continue up to 11.0 m to 13.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 7 to 13.

Stratum – 4: This stratum consists of **Medium grey silty sand.** This layer starts from 11.0 m to 13.0 m depth below E.G.L. and continue up to 20.0m to 22.0 m depth below E.G.L. The 'N' value of this layer varies are varies from 10 to 23.

Stratum – 5: This stratum consists of **Dense / very dense grey silty sand.** This layer starts from 20.0m to 22.0 m depth below E.G.L. and continue up to 40.6 m depth below E.G.L. The 'N' value of this layer varies are varies from 35 to >50.

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R. C. PILE

Founding level = 35.0m below T.C.L. (Test commencement level)

AVERAGE PILE CAPACITY CALCULATIONS AROUND BORE HOLES 1, 2, 3, 4 & 5		
Founding Level =	35.00	M Below T.C.L. (Test Commencement Level)
Cut off Level = (–)	2.00	M Below T.C.L. (Test Commencement Level)
Shaft length =	32.00	M

TABLE

Diameter of Pile in mm	Dia. Of Pile (in m)	PILE CAPACITY IN TON FOR 33.00 M SHAFT LENGTH			
		89.79 D		25.43	D^2
		Load Due to End Bearing	Load Due to Skin Friction	Total Load capacity in Ton	
450	0.45	5.15	40.40	**45.55**	
500	0.50	6.36	44.89	**51.25**	
550	0.55	7.69	49.38	**57.08**	
600	0.60	9.16	53.87	**63.03**	
650	0.65	10.75	58.36	**69.11**	
700	0.70	12.46	62.85	**75.31**	
750	0.75	14.31	67.34	**81.65**	
800	0.80	16.28	71.83	**88.11**	
850	0.85	18.38	76.32	**94.69**	
900	0.90	20.60	80.81	**101.41**	
950	0.95	22.95	85.30	**108.25**	
1000	1.00	25.43	89.79	**115.22**	
1100	1.10	30.78	98.76	**129.54**	
1200	1.20	36.62	107.74	**144.37**	

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The allowable capacity of a single bored pile of 33.0 m shaft length below TCL. with 2.0 M filling have been worked out given below :

SHAFT LENGTH = 33.00 metre				
DIA OF PILE IN MM	**PILE CAPACITY IN TON**	**UPLIFT CAPACITY IN TON**	Depth of fixity **L_f (in m)**	Lateral Capacity of pile **[Q] (in T)**
450	**45.55**	13.22	4.11	4.76
500	**51.25**	15.50	4.57	5.28
550	**57.08**	17.83	5.03	5.81
600	**63.03**	20.21	5.48	6.34
650	**69.11**	22.64	5.94	6.87
700	**75.31**	25.13	6.40	7.40
750	**81.65**	27.66	6.85	7.93
800	**88.11**	30.24	7.31	8.45
850	**94.69**	32.88	7.77	8.98
900	**101.41**	35.56	8.22	9.51
950	**108.25**	38.30	8.68	10.04
1000	**115.22**	41.09	9.14	10.57
1100	**129.54**	46.82	10.05	11.62
1200	**144.37**	52.75	10.96	12.68

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LOCATION: GEO-TECHNICAL INVESTIGATION OF SUB-SJOIL (ANY TYPE SOIL/ROCK) IN CONNECTION WITH WORK FOR PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

For R.C. bored pile minimum c/c distance of piles in group, should be as per provisions of relevant I.S. Code (I.S. 2911). Besides, as per discretion of structural engineer, group action, efficiency of piles are to be considered for pile design.

Moreover for R.C. bored pile it is strongly recommended that the design load carrying capacity of pile should be taken as per load test on test / working pile, done as per recommendation of IS 2911 (part – IV), since the pile capacities are calculated on basis of average sub-soil profile only.

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APPENDIX

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SEQUENCE OF SOIL STRATIFICATION

STRATUM	DESCRIPTION	DEPTH IN METRE		THICKNESS		RANGE OF N-VALUES	
		FROM	TO	IN METRE	B.H. No.	FROM	TO
TOP	Heterogenous fill with clay, brickbats, roots etc.	T.C.L.	1.00	1.00	B.H. 1	–	–
		T.C.L.	1.00	1.00	B.H. 2	–	–
		T.C.L.	1.50	1.50	B.H. 3	–	–
		T.C.L.	1.50	1.50	B.H. 4	–	–
		T.C.L.	1.40	1.40	B.H. 5	–	–
I	Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	1.00	4.50	3.50	B.H. 1	2	3
		1.00	4.00	3.00	B.H. 2		2
		1.50	4.50	3.00	B.H. 3		2
		1.50	4.00	2.50	B.H. 4		5
		1.40	3.50	2.10	B.H. 5		5
II	Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	4.50	10.50	6.00	B.H. 1	2	3
		4.00	9.00	5.00	B.H. 2	2	3
		4.50	9.00	4.50	B.H. 3	2	3
		4.00	8.00	4.00	B.H. 4	2	3
		3.50	9.00	5.50	B.H. 5	2	3
III	Medium stiff grey clayey silt / clayey sandy silt.	10.50	13.00	2.50	B.H. 1	10	13
		9.00	10.50	1.50	B.H. 2	8	
		9.00	13.00	4.00	B.H. 3	7	9
		8.00	11.00	3.00	B.H. 4	9	10
		9.00	10.00	1.00	B.H. 5		10
IV	Medium grey silty sand.	13.00	21.00	8.00	B.H. 1	16	22
		10.50	20.00	9.50	B.H. 2	12	18
		13.00	21.00	8.00	B.H. 3	14	20
		11.00	22.00	11.00	B.H. 4	14	23
		10.00	20.00	10.00	B.H. 5	10	28
V	Dense / very dense grey silty sand.	21.00	40.60	19.60	B.H. 1	40	>50
		20.00	40.10	20.10	B.H. 2	45	>50
		21.00	40.60	19.60	B.H. 3	42	>50
		22.00	40.60	18.60	B.H. 4	30	>50
		20.00	40.10	20.10	B.H. 5	35	>50

JOB NO. GMA/WBMSCL/BARASAT/MEDI.COLLEGE/10/18

LOCATION : PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

G. MITRA & ASSOCIATES
GEOTECHNICAL & CIVIL CONSULTANTS
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LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content	Bulk Density t/cum	Liquid Limit %	Plastic Limit %	U.C.S 'C' t/sqm	TRIAXIAL SHEAR				Specific Gravity	Initial Void Ratio (consolidation Test)	GRAIN SIZE				Determination of Sand Content as per IS 2720 (Part-IV)	Free Sweel	Direct Shear
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand	Slit	Clay	Gravel			
														%	%	%	%	%	%	Deg
Stratum-I																				
1	U	2.00	33	1.82	44	24	2.3	2.5	3.1	2.8	3.0	2.70	0.891	3	61	36				
Stratum-II																				
1	U	4.50	49	1.72	79	28	1.5	1.9	2.5	2.2	1.2	2.53	1.240	2	50	48				
1	U	8.00	52	1.69	82	31	1.2	1.5	2.1	1.8	1.0	2.50	1.300	2	48	50				
Stratum-III																				
1	U	10.50	27	1.88	39	19	4.0	5.5	6.1	5.8	6.0	2.69	0.726	9	69	22				
1	P	14.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
1	P	18.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24
1	P	20.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	26
1	P	25.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	33
1	P	30.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	36

LOCATION: PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

G. MITRA & ASSOCIATES
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LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content	Bulk Density t/cum	Liquid Limit %	Plastic Limit %	U.C.S 'C' t/sqm	TRIAXIAL SHEAR				Specific Gravity	Initial Void Ratio (consolidation Test)	GRAIN SIZE				Determination of Sand Content as per IS 2720 (Part-IV)	Free Sweel	Direct Shear
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand	Slit	Clay	Gravel			
														%	%	%	%	%	%	Deg
Stratum-I																				
2	U	3.00	34	1.81	42	22	2.2	2.4	3.0	2.7	3.0	2.70	0.918	2	63	35				
Stratum-II																				
2	U	6.50	47	1.7	76	26	1.4	1.8	2.4	2.1	1.2	2.53	1.189	3	50	47				
Stratum-III																				
2	U	9.00	26	1.87	38	18	3.8	5.2	5.8	5.5	5.0	2.69	0.699	9	70	21				
2	P	15.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
2	P	19.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24
2	P	20.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	26
2	P	24.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	33
2	P	30.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	36

LOCATION: PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

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GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 : 2008 CERTIFIED COMPANY

LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content	Bulk Density t/cum	Liquid Limit %	Plastic Limit %	U.C.S 'C' t/sqm	TRIAXIAL SHEAR				Specific Gravity	Initial Void Ratio (consolidation Test)	GRAIN SIZE				Determination of Sand Content as per IS 2720 (Part-IV)	Free Sweel	Direct Shear
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand	Slit	Clay	Gravel			
														%	%	%	%	%	%	Deg
Stratum-I																				
3	U	3.50	32	1.81	44	22	2.2	2.4	3.0	2.7	2.8	2.71	0.867	3	62	35				
Stratum-II																				
3	U	7.50	50	1.68	80	30	1.2	1.4	2.0	1.7	1.1	2.48	1.240	3	49	48				
Stratum-III																				
3	U	12.00	26	1.86	38	18	3.8	5.4	6.0	5.7	5.8	2.66	0.692	8	72	20				
3	P	15.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
3	P	20.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23
3	P	23.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24
3	P	27.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30
3	P	31.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34

LOCATION: PROPOSED REPLACEMENT OF R.C.C. BRIDGE OVER CANAL DY-13 FOR 01 (ONE) LOCATION AT CH. 20.00 OF R.B.M.C. OF R.B.I. (I) SUB-DIVISION UNDER RIGHT BANK IRRIGATION DIVISION.

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LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content	Bulk Density t/cum	Liquid Limit %	Plastic Limit %	U.C.S 'C' t/sqm	TRIAXIAL SHEAR				Specific Gravity	Initial Void Ratio (consolidation Test)	GRAIN SIZE				Determination of Sand Content as per IS 2720 (Part-IV)	Free Sweel	Direct Shear
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand	Slit	Clay	Gravel			
														%	%	%	%	%	%	Deg
Stratum-I																				
4	U	3.50	32	1.80	42	22	2.1	2.4	3.0	2.7	3.1	2.69	0.861	2	63	35				
Stratum-II																				
4	U	6.00	48	1.71	77	26	1.4	1.8	2.4	2.1	1.0	2.51	1.205	2	51	47				
Stratum-III																				
4	U	9.00	26	1.87	38	18	3.9	5.4	6.0	5.7	5.8	2.67	0.694	8	71	21				
4	P	15.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
4	P	19.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
4	P	23.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24
4	P	27.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30
4	P	31.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34

LOCATION: PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

G. MITRA & ASSOCIATES
GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 : 2008 CERTIFIED COMPANY

LABORATORY TEST RESULTS

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21
B.H No.	Sample No.	Depth in Metre	Natural Moisture Content	Bulk Density t/cum	Liquid Limit %	Plastic Limit %	U.C.S 'C' t/sqm	TRIAXIAL SHEAR				Specific Gravity	Initial Void Ratio (consolidation Test)	GRAIN SIZE				Determination of Sand Content as per IS 2720 (Part-IV)	Free Sweel	Direct Shear
								'C' uu t/sqm	'C' cu t/sqm	'C' cd t/sqm	ϕ Deg.			Sand	Slit	Clay	Gravel			
														%	%	%	%	%	%	Deg
Stratum-I																				
5	U	2.50	32	1.81	42	22	2.2	2.2	2.8	2.5	3.1	2.70	0.864	3	61	36				
Stratum-II																				
5	U	4.00	47	1.68	77	27	1.2	1.8	2.4	2.1	1.1	2.53	1.189	3	51	46				
5	U	6.50	49	1.68	78	28	1.1	1.4	2.0	1.7	1.0	2.50	1.225	3	49	48				
5	P	16.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24
5	P	18.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	26
5	P	22.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28
5	P	26.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34
5	P	32.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	38

LOCATION: PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906) AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.

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GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Location:**	PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906)AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.
Dia of Hole		**Depth**	40.6 m		
Commenced on	10-06-18	**Completed on**	10-07-18		
Water Struck		**Ground Water**		**Cordination Sext Angles**	
Ground/Bed/RL				**Bore Hole No.**	1

DESCRIPTION OF STRATA	STRATUM	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Heterogenous fill with clay, brickbats, roots etc.	TOP	TCL	1.00	1.00		D	0.50
						D	1.00
Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	I	1.00	4.50	3.50	2	P	1.00
						U	2.00
					3	P	3.00
						D	4.00
Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	II	4.50	10.50	6.00		U	4.50
					2	P	5.00
					2	P	6.50
						U	8.00
					3	P	9.00
Medium stiff grey clayey silt / clayey sandy silt.	III	10.50	13.00	2.50		U	10.50
					10	P	11.00
					13	P	12.00
Medium grey silty sand.	IV	13.00	21.00	8.00	16	P	13.00
					18	P	15.00
					19	P	17.00
					20	P	19.00
					22	P	20.00
Dense / very dense grey silty sand.	V	21.00	40.60	19.60		D	21.00
					40	P	22.00
					43	P	24.00
					46	P	26.00
					48	P	28.00
					>50	P	30.00
					>50	P	32.00
					>50	P	34.00
					>50	P	36.00
					>50	P	38.00
					>50	P	40.00

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	4		No. of U.D.S. :	4	No. of Vane Test:	
No. of Large Diameter Sample :			No. of S.P.T. :	22	No. of Water Sample :	

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ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Location:**	PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906)AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.		
Dia of Hole		**Depth**	40.6 m				
Commenced on	10-08-18	**Completed on**	10-09-18				
Water Struck		**Ground Water**		**Cordination Sext Angles**			
Ground/Bed/RL				**Bore Hole No.**	**2**		

DESCRIPTION OF STRATA	STRATUM	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Heterogenous fill with clay, brickbats, roots etc.	TOP	TCL	1.00	1.00		D	0.50
						D	1.00
Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	I	1.00	4.00	3.00	2	P	1.00
					3	P	2.00
						U	3.00
Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	II	4.00	9.00	5.00	2	P	4.00
					2	P	5.00
						U	6.50
					3	P	8.00
Medium stiff grey clayey silt / clayey sandy silt.	III	9.00	10.50	1.50		U	9.00
					8	P	10.00
Medium grey silty sand.	IV	10.50	20.00	9.50	12	P	11.00
					14	P	13.00
					15	P	15.00
					16	P	17.00
					18	P	19.00
Dense / very dense grey silty sand.	V	20.00	40.10	20.10	45	P	20.00
					45	P	22.00
					47	P	24.00
					48	P	26.00
					>50	P	28.00
					>50	P	30.00
					>50	P	32.00
					>50	P	34.00
					>50	P	36.00
					>50	P	38.00
					>50	P	39.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	2		No. of U.D.S. :	3	No. of Vane Test:	
No. of Large Diameter Sample :			No. of S.P.T. :	22	No. of Water Sample :	

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GEOTECHNICAL & CIVIL CONSULTANTS
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BORE LOG DATA SHEET

Type or Boring	Shell & Augar	Bentinite	Drilling	Location:	PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906)AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.
Dia of Hole		Depth	40.6 m		
Commenced on	10-08-18	Completed on	10-09-18		
Water Struck		Ground Water		Cordination Sext Angles	
Ground/Bed/RL				Bore Hole No.	2

DESCRIPTION OF STRATA	STRATUM	DEPTH (M) FROM	DEPTH (M) TO	THICKNESS	N-VALUE	SAMPLES TYPE	DEPTH IN M
Heterogenous fill with clay, brickbats, roots etc.	TOP	TCL	1.00	1.00		D	0.50
						D	1.00
Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	I	1.00	4.00	3.00	2	P	1.00
					3	P	2.00
						U	3.00
Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	II	4.00	9.00	5.00	2	P	4.00
					2	P	5.00
						U	6.50
					3	P	8.00
Medium stiff grey clayey silt / clayey sandy silt.	III	9.00	10.50	1.50		U	9.00
					8	P	10.00
Medium grey silty sand.	IV	10.50	20.00	9.50	12	P	11.00
					14	P	13.00
					15	P	15.00
					16	P	17.00
					18	P	19.00
Dense / very dense grey silty sand.	V	20.00	40.10	20.10	45	P	20.00
					45	P	22.00
					47	P	24.00
					48	P	26.00
					>50	P	28.00
					>50	P	30.00
					>50	P	32.00
					>50	P	34.00
					>50	P	36.00
					>50	P	38.00
					>50	P	39.50

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	2		No. of U.D.S. :	3	No. of Vane Test:	
No. of Large Diameter Sample :			No. of S.P.T. :	22	No. of Water Sample :	

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GEOTECHNICAL & CIVIL CONSULTANTS
ISO 9001 : 2008 CERTIFIED COMPANY

BORE LOG DATA SHEET

Type or Boring	**Shell & Augar**	**Bentinite**	**Drilling**	**Location:**	PROPOSED BARASAT GOVERNMENT MEDICAL COLLEGE IN THE STATE OF WEST BENGAL AT BONOMALIPUR MOUZA (J.L. NO. 80 & KHATIAN NO.- 2906)AND UTTARHAT MOUZA (J.L. NO. 78 & KHATIAN NO.- 3772) IN THE DISTRICT OF NORTH 24 PARGANAS.
Dia of Hole		**Depth**	40.6 m		
Commenced on	10-12-18	**Completed on**	13/10/2018		
Water Struck		**Ground Water**		**Cordination Sext Angles**	
Ground/Bed/RL				**Bore Hole No.**	**4**

DESCRIPTION OF STRATA	STRATUM	DEPTH (M)		THICKNESS	N-VALUE	SAMPLES	DEPTH IN M
		FROM	TO			TYPE	
Heterogenous fill with clay, brickbats, roots etc.	TOP	TCL	1.50	1.50		D	0.50
						D	1.00
						D	1.50
Soft / very soft brownish grey silty clay / grey clayey sandy silt / clayey silty sand / silty sand / silty clay / clayey silt.	I	1.50	4.00	2.50	5	P	1.50
					5	P	2.50
						U	3.50
Very soft / soft dark grey silty clay with black D.W./D.V. & peat app. 20% to 40%.	II	4.00	8.00	4.00	2	P	4.00
						U	6.00
					3	P	7.00
Medium stiff grey clayey silt / clayey sandy silt.	III	8.00	11.00	3.00	9	P	8.00
						U	9.00
					10	P	10.00
Medium grey silty sand.	IV	11.00	22.00	11.00	14	P	11.00
					16	P	13.00
					19	P	15.00
					20	P	17.00
					22	P	19.00
					23	P	21.00
Dense / very dense grey silty sand.	V	22.00	40.60	18.60	30	P	23.00
					34	P	25.00
					36	P	27.00
					44	P	29.00
					46	P	31.00
					>50	P	33.00
					>50	P	35.00
					>50	P	37.00
					>50	P	39.00
					>50	P	40.00

Code : U – Undisturbed Sample, D – Disturbed Sample, L – Large Diameter, C – Core, T.C.L. – Test Commencement Level.

W – Water Sample, P – Penetrometer Test, D.W. – Decomposed Wood, D.V. – Decomposed Vegetation

No. of Disturbed Sample :	3		No. of U.D.S. :	3	No. of Vane Test:		
No. of Large Diameter Sample :			No. of S.P.T. :	22	No. of Water Sample :		

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REPORT ON GEOTECHNICAL INVESTIGATION

FOR

PROPOSED JHARGRAM MEDICAL COLLEGE

AT

JUNGLE KHAS MOUZA (JL NO: 395)
JHARGRAM, WEST BENGAL

CLIENT:

WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED
SWASTHYA SATHI, GN – 29, SECTOR – V, SALTLAKE
KOLKATA – 700 091

EXECUTED BY:

NIRMAN
4/B, SURYA SEN NAGAR, SARSUNA
KOLKATA – 700 061

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P R E F A C E

Geotechnical investigation of sub soil was carried out for the **proposed Jhargram Medical College** at **Jungle Khas Mouza (JL No. 395) Jhargram, West Bengal.** Objective of the investigation was to determine sub-soil parameters for assessing load carrying capacity of foundation for design and construction of the proposed structure.

On instructions from **West Bengal Medical Services Corporation Limited** via Work Order having **Memo No. HFW-4104(14)/2/2018-WBMSL SEC- Dept of H&FW/2364** dated **4th June 2018** fieldwork for the soil investigation was commenced on **19th July 2018** and completed on **26th July 2018.** This report deals with the findings of field and laboratory tests and makes recommendations for the foundations of the proposed structure.

The report is based upon the field test data and laboratory test results obtained. It deals with the description of the field work, laboratory test results and recommendations for foundation. **Section-I** of this report covers the fieldwork while **Section-II** contains a brief description of the subsoil conditions. **Section-III** deals with recommendations for foundation.

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SECTION – I

1.0 INTRODUCTION

On instruction from **West Bengal Medical Services Corporation Limited,** geotechnical investigation was carried out for the **proposed Jhargram District Hospital** at **Jungle Khas Mouza (JL No. 395) Jhargram, West Bengal**. Objective of the investigation was to determine sub-soil conditions at site and to determine a suitable foundation system as required for the proposed structure.

2.0 INVESTIGATION SCHEME AND LOCATION OF TESTS

The scheme of Soil Investigation framed by the client comprised of four (04) nos of borehole up to a depth 40.00m below the E.G.L. The scope of work also included collection of undisturbed soil samples from cohesive deposits, disturbed samples, conducting Standard Penetration Tests in boreholes, carrying out routine laboratory tests on soil samples. Results of field tests, laboratory test results and recommendations for foundations are furnished in this report.

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3.0 FIELD EXPLORATION

3.1 BORING/DRILLING VIA ROTARY WASH BORING

In this method, boring is effected by the cutting action of a rotating bit which is kept in firm contact with the bottom of the hole. The bit is attached to the lower end of a hollow drill rod which is rotated manually. Drilling mud (usually bentonite solution) is continuously forced down to hollow drill rods. The mud returning upwards though the annular space between the drill rods

and the side of the hole brings the cuttings to the surface. The soil thus cut gets mixed with water and floats up through the annular space between the casing pipe and the drill rod. The slurry flowing out provides an indication of the soil type. The change in soil strata can be summarized from the rate of progress and the slurry flowing out.

In this method, heavier particles of different soil layers remain under suspension in the casing pipe and get mixed up. Because of the samples recovered from the wash water are of no value. Samples of the soil were obtained through suitable sampler after the borehole has been cleaned wash boring can be conveniently used even below water table in practically all types of soil.

Rotary drilling was resorted in the boreholes after encountering refusal N values i.e. N value greater than 100. NX diameter drilling is done using diamond bit.

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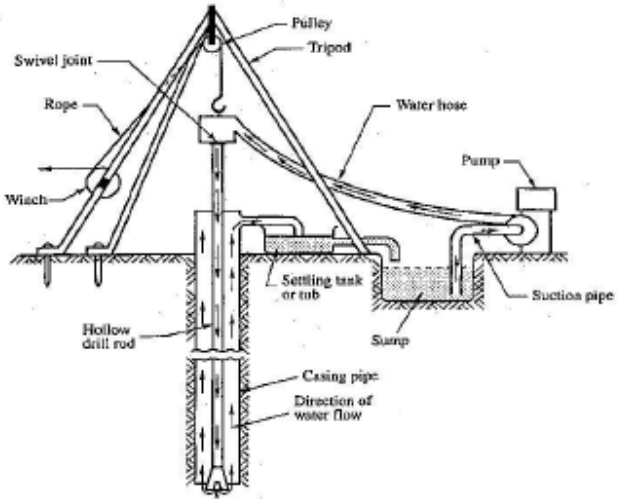

Rotating Bit

3.2 SAMPLING

Disturbed samples were taken at suitable intervals of depth and at changes of strata in order to physical examination of the nature of all the representative strata. These were collected from the auger and the barrel of the split spoon sampler after the standard penetration tests. The depth wise locations of the entire disturbed and standard penetration test samples have been given in the bore log data sheets, enclosed with this report.

3.3 STANDARD PENETRATION TEST

The standard penetration test is a well established and unsophisticated method, which was developed in the United States around 1925. It has since undergone refinements with respect to equipment and testing procedure. The testing procedure varies in different parts of the world. Therefore standardisation of SPT was essential in order to facilitate the comparison of results from different investigations. The equipment is simple, relatively inexpensive and rugged. Another advantage is that representative but disturbed soil samples are obtained. The reliability of the method and the accuracy of the result depend on the experience and care of the engineer / engineering supervisor on site.

A split barrel sampler is driven from the bottom of a pre-bored hole into the soil by means of a 63.5 kg hammer, dropped freely from a height of 0.76 m. The diameter of the prebored hole varies normally between 60 and 200 mm. If the hole does not stay open by itself, casing or drilling mud should be used. The sampler is first driven to a depth of 15 cm below the bottom of the pre-bored hole, then the number of blows required to drive the sampler another 30 cm into the soil, the so called N30 count, is recorded. The rods used for driving the sampler should have sufficient stiffness. The quality of test results depends on several factors, such as actual energy delivered to the head of the drill rod, the dynamic properties (impedance) of the drill rod, the method of drilling and bore hole stabilisation. The SPT is generally conducted in all types of deposit . But the SPT can be difficult to perform in loose sands and silts below the ground water level, as the bore hole can collapse and disturb the soil to be tested. The following factors can affect the test results : nature of the drilling fluid in the bore hole, diameter of the bore hole, the configuration of the sampling spoon and the frequency of delivery of the hammer blows. Therefore, it should be noted that drilling and stabilisation of the bore hole must be carried out with care. The measured **N-value** (**blows / 0.30 m**) is so-called standard penetration resistance of the soil.

The penetration resistance is influenced by the stress conditions at the depth of test. Peck et al. (1974) proposed, based on settlement observations of footings, the following relationship for correction of confinement pressure.. The measured N value is to be multiplied by a correction factor C_N to obtain a reference value, N_1, cor 5 ding to an effective overburden stress of **1 t/ft^2** (approximately **107 kpa**).

Thus $\mathbf{N_1 = N. C_N}$

Where, $\mathbf{C_N}$ is a stress correction factor.

Again $\mathbf{C_N = 0.77. \log_{10} (20/p')}$

Where p' is the effective overburden pressure.

The second correction over the corrected value of N_1 is due to fine or silty sand below water table.

The reason for this correction is that for a measured N greater than 15 cm, the sand is medium dense or denser. The means that when the hammer is dropped to drive the tube cause the sand to dilate. Where water is present, this dilation causes negative pore pressures to be developed.

For relatively clean sand, these pore water pressures are fully dissipated by the time the next blow is applied. For sand, which has its pore space partly blocked by silts or clays or is a very fine sand, the rate at which these negative pore water pressures dissipates may very much lower. Therefore they may not be fully dissipated by the time, the next blow is applied a second or so latter. This may mean that there is a built up negative pore water pressures as the blows are applied.

Since, there has been no change in total stress a reduction of pore water pressure (even though it is temporary) must lead to a temporary increase in effective stress. Since the greater the effective stress, the greater is the strength of the material being tested. Therefore as the strength increase has only been caused temporarily because of dilation effects. It must be accounted for by the measured 'N' value. Thus for this correction, the following facts have been kept in mind.

- **Sand layer must be always below the water table.**
- **'N' value must be greater than 15.**
- **Have reduced permeability.**

The resistance (N30) has been correlated with the consistency of clayey soil and also the relative density of non cohesive soils can be classified as shown below in table – 1, Brooms (1986).

FOR SAND AND GRAVEL

Relative density	Very loose	Loose	Medium	Dense	Very Dense.
N_{30} blows / 0.30 m	< 4	< 4 – 10	10 – 30	30 – 50	> 50

FOR CLAY AND SILT

Consistency	Very Soft	Soft	Medium	Stiff	Very Stiff.
N_{30} blows / 0.30 m	<2	2 – 4	4 – 8	8 – 16	16 – 32

The test is mainly used to estimate the relative stiffness and strength (bearing capacity) of soils. Deformation characteristics of granular soils can be estimated from empirical correlations, Peck et. Al. (1974). It is also possible to get some indications from SPT of the shear strength in cohesive soils. The SPT used frequently for the evaluation of the liquefaction potential of water saturated, loose sands and silts in seismic areas, Seed and De Alba (1986).
For this work, the method used for SPT is as per IS: 2131 – 1981.

SECTION – II

4.0 LABORATORY TESTS

The soil samples from the 10cm diameter sampling tubes were extracted in the laboratory by pushing out the soil core with the help of a jack and a frame. The core was jacked out in a direction that corresponded to the soil movement within the tube during sampling. Laboratory tests have been conducted as per IS specifications on soil samples (Disturbed and Un-disturbed) to determine the following properties.

i) Natural Moisture Content

The natural moisture content of soil is determined from samples taken in the field and placed in a container which is then sealed to prevent loss of moisture by evaporation. Natural moisture content determinations are valuable in interpreting information obtained from test borings.

Generally, 100 gm of soil is enough to determine the moisture content of fine grained soils. Larger samples are required for soils that contain gravel. Normally, moisture content samples are placed in metal dishes (canisters) that have tight fitting covers. When the moisture content test is to be performed within 1 day after the sample is obtained, sealing of the container is not required. If a longer time interval will elapse between sampling and testing, the containers may be sealed. Natural moisture content have been determined in the laboratory as per IS: 2720 (Part 2) – 1973.

ii) Bulk Density and Dry Density

Soil Bulk density is defined as the ratio of the mass of dry solids to the bulk volume of the soil occupied by those dry solids. The bulk volume includes the volume of the solids and the pore space. **Bulk density is needed for converting water percentage by weight to content by volume, for calculating porosity and void ratio when the particle density is known, and for estimating the weight of a volume of soil too large to weight conveniently**.

The dry density = Bulk density / (1 + moisture content %)

iii) Particle Size Distribution

By the term particle size distribution, we mean sieve and hydrometer analysis. Particle size distribution test is performed to determine the percentage of different grain sizes contained within a soil. The mechanical or sieve analysis is performed to determine the distribution of the coarser, larger sized particles and the hydrometer method is used to determine the distribution of the finer particles.

The distribution of different grain sizes affects the engineering properties of soil. Grain size analysis provides the grain size distribution, and it is required in classifying the soil.

The test has been performed in the laboratory as per IS: 2720 (Part 4) - 1985.

iv) Atterberg Limits

In 1911, the Swedish soil scientist Albert Atterberg (1846-1916) developed a series of tests to evaluate the relationship between moisture content and soil consistency (Atterberg,1911; Blackall, 1952). Then, in the 1930,s, Karl Terzaghi and Arthur Casagrande adapted these tests for civil engineering purpose, and they soon became a routine part of Geotechnical engineering. This series includes three separate tests : the liquid limit test, the plastic limit test, and the shrinkage limit test. Together they are known as the Atterberg limits test (ASTM D427 and D4318).

The liquid limit and plastic limit tests are routinely performed in many soil mechanics laboratories. However, the shrinkage limit test is less useful, and is rarely performed by civil engineers. Shrinkage limit test is very much required in finding the expansiveness of soil. In our laboratory, liquid limit and plastic limit tests have been done as per IS: 2720 (Part 5) – 1985. As per soil strata encountered in the field, we observed that the basic material is sand and silt and thus no shrinkage property will be observed. Thus considering of no use we have discarded shrinkage limit test.

v) Specific Gravity of Soil

The ratio of the unit weight of a material to the unit weight of distilled water at 4^0C is a common definition of specific gravity. Soil specific gravities, however, are normally referred to the weight of water at 20^0C. In itself, the specific gravity is not an index property of a soil. It is, however, required for determination of the unit weight of soil and in many computations. **While it is possible to have a range of values from 2.2 to 3.5, most soils have specific gravity from 2.60 to 2.80. Any values outside of this latter range should be viewed sceptically and a retest should be made to verify the value.**

In our laboratory test, specific gravity has been determined as per IS: 2720 (Part 3 / Sec 2) – 1980.

vi) Shear strength parameters by Unconfined Compression test

The primary purpose of this test is to determine the unconfined compressive strength , which is then used to calculate the unconfined cohesion of clayey soil. The unconfined compressive strength **(q_u)** is defined as the compressive stress at which an unconfined cylindrical specimen of soil will fail in a simple compression test. In addition, in this test method, the unconfined compressive strength is taken as the maximum load attained per unit area, or the load per unit area at **15 % axial strain**, whichever occurs first during the performance of a test.

For soils, the undrained shear strength **(s_u)** is necessary for the determination of the bearing capacity of foundations, dams etc. The undrained shear strength **(s_u)** of clays is commonly determined from an unconfined compression test. The undrained shear strength **(s_u)** of a cohesive soil is equal to one-half the unconfined compressive strength **(q_u)** when the soil is under the $\phi = 0^0$ condition **(ϕ = the angle of internal friction).** The most critical condition for the soil usually occurs immediately after construction, which represents undrained conditions, when the undrained shear strength is basically equal to the cohesion **(c).** This is expressed as $S_u = c = q_u / 2$. Then, as time passes, the pore water in the soil slowly dissipates, and the intergranular stress increases, so that the drained shear strength **(s)**, given by $s = c + \sigma' \tan \phi$, must be used. Where **$\sigma'$ = intergranular pressure** acting perpendicular to the shear plane; and **$\sigma' = (\sigma - u)$, σ = total pressure, and u = pore water pressure; c and ϕ are drained shear strength parameters**. In our laboratory, the unconfined compression test we generally find out as per IS – 2720 (Part 10) - 1973.

viii) Un-consolidated Un-drained Test

This test has been performed for the determination of compressive strength of saturated cohesive soil in a tri-axial compression apparatus under conditions in which the cell pressure is maintained constant and thereby no change in the total water content of the specimen. The test has been performed for a specimen of 38mm diameter and a height of 76mm. The test we generally performed in the laboratory as per IS: 2720 (Part 11) – 1971 (Reaffirmed 1978).

ix) Compressibility characteristics

Consolidation tests were conducted on the samples 60 mm dia. And 20 mm thick in the odometer under incremental loading and two way drainage. On sandy silt / silty sand samples, these tests were not conducted as it was not possible to prepare test specimen and further due to the fact that the settlement of the granular deposits will be very rapid under load. Further, in case of granular deposits, the bearing capacity values are empirically determined (on the basis of 'N' values and also ϕ_{cd}) limiting the settlement as permissible level for different types of foundations. As in the case of cohesive deposits, the settlement of the structure due to consolidation (immediate and long term) of the cohesive deposit need be critically checked, to evaluate the settlement potentials and thus consolidation tests were conducted only on cohesive samples. Consolidation tests we generally performed in the laboratory as per IS: 2720 (Part 15) – 1986.

After completion of tests, the data have been compiled and the field bore-logs have been reviewed and finalised. Final bore-logs have been presented in this report.

Results of all tests have been presented both in tabular and graphical form as applicable and presented borehole-wise. Results of all boreholes are presented in Appendix – II.

5.0 GROUND CONDITION

On the basis of findings in the field, onsite identification & examination of samples the subsoil deposits of this site have been subdivided into **four (04) different strata for the site**. Following table gives a brief description about the subsoil conditions and subsoil parameters at site obtained at site.

Stratum & Thickness (m)	Description of Soil	N Value	Liquid Limit (%)	Plastic Limit (%)	Y_b KN/m^3	Shear Parameters		(m_v) $m^2/kN \times 10^{-4}$ Range(kPa)		
		Field N value				C (kPa)	Φ (degree)	25-50	50-100	100-200
I 2.50	Loose greyish brown silty sand	-	NP	NP	17.50*	-	-	-	-	-
II 15.00	Stiff greyish brown silty clay/clayey silt with rusty brown patches(CI)	12	42	18	18.40	50	-	2.00	2.20	1.80
III 14.50	Very stiff greyish brown silty clay/clayey silt with rusty brown patches, nodule pieces and sand (CI).	23	45	20	19.10	102	-	1.10	1.12	0.98
IV >8.45	Very stiff to hard greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces (CL-CI).	32	39	16	20.00*	150*	-	0.70*	0.70*	0.70*

* Suggested Value

Generalized Soil Profile With Design Parameters

The standing water level is encountered at an average depth of about 6.00m below Existing Ground Level however for design purpose the same should be considered at the ground level.

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SECTION – III

6.0 ENGINEERING APPRAISAL

The proposed structure for the sites will be Jhargram Medical College at Jhargram, West Bengal; it is expected to be moderately to highly loaded structure. Based upon the subsoil conditions obtained at this site aspect of both open foundations and deep foundations are discussed here. The designer may choose the suitable type of foundation based upon the load coming from the superstructure.

6.1 OPEN FOUNDATIONS

The net safe bearing capacity and settlement of open foundation is determined using the design soil parameters presented in the generalized soil profile of Section II of this report. Factor of safety has been considered as 2.50 and the ground water table considered at the ground level itself, conservative side. Values of net safe bearing capacity and settlement of footing under different imposed intensity have been presented in tabular form. Both shear and settlement criteria should be checked and considered.

It is desirable and convenient to rest all open foundation under similar stratum condition.

In order to facilitate selection of allowable bearing capacity for given allowable settlement, results of bearing capacity and settlement analysis are furnished in tabular form for foundation placed at 2.50m below EGL.

Footing Size (m^2)		Depth of foundation (m)	Safe Bearing Capacity (kPa)		Settlement(mm) corresponding to net safe bearing capacity(kPa)
Width	Length		Net Ultimate	Net Safe	(mm)
1.50	1.50	2.50	444	178	23
2.00	2.00	2.50	418	167	29
1.50	2.00	2.50	394	157	23
2.00	3.00	2.50	363	145	33
1.50	Strip	2.50	342	137	40
2.00	Strip	2.50	321	129	52

6.2 Deep Foundation

Deep foundation in the form of pile foundation is convenient solutions for heavily loaded structures.

6.2.1 Discussion on Estimation of Load Carrying Capacity of Piles

Normally two types of piles are used to transfer higher foundation loads to underlying soil. Load carrying capacity of pile depends primarily on two factors, (1) structural capacity of pile shaft and (2) resistance offered by surrounding soils by means of side friction and tip resistance. Accordingly, piles are classified as friction and end bearing types depending upon mechanism of load transfer. It is essential that the pile shaft be formed ensuring proper contact with surrounding soils. Also, proper seating of pile tip in firm soil is essential towards development of tip resistance. In case of driven piles, formation of proper pile shaft and proper seating of pile tip is not difficult. Moreover, driving resistance provides reasonable assessment of pile capacity during installation process.

The situation is quite different for bored pile. Possibility of formation of improper pile shaft and inadequate seating of pile tip are not uncommon. Therefore, performance of bored pile depends largely on the methodology, piling equipment, piling experience and quality control. Based on experience on large number of bored piling works, it is observed that, formation of proper pile shaft including proper seating should not be taken for granted.

Pile Dia.	Safe Vertical Capacity in Compression	Safe Vertical Capacity in Tension	Shaft Length	Bored Depth From EGL
(mm)	(kN)	(KN)	(m)	(m)
450	700	500	24.00	25.50
500	800	600	24.00	25.50
550	875	650	24.00	25.50
450	825	650	28.50	30.00
500	925	700	28.50	30.00
550	1025	750	28.50	30.00

Cut-off-level = 1.50m below EGL; Factor of Safety = 2.5

(Note: Pile capacity must be verified by initial load tests).

Lateral Load Carrying Capacities of Piles

Pile Dia. (mm)	Free Head		Fixed Head	
	Depth of Fixity (m)	Lateral Capacity (KN)	Depth of Fixity (m)	Lateral Capacity (KN)
450	3.67	15.2	4.25	39.2
500	4.08	16.9	4.73	43.6
550	4.49	18.6	5.20	47.9

Calculation is based upon considering 5mm of deflection at pile cut-off

Allowable increase in pile capacities under wind/seismic loading condition should be in accordance with the provisions of BIS. As per IS: 1904 – 1986 "Code of Practice for Design and Construction of Foundations in Soils: General Requirements" allowable increase in pile capacity may be considered up to 25% under DL + LL + WL combination when WL is more than 25% of DL and LL. For the seismic loading, as per Table-1 of IS: 1893 (Part 1): 2016 "Criteria for Earthquake Resistant Design of Structures" the allowable increase in pile capacity may be considered up to 50% when pile tip rests on and soil having N – value higher than 30. For piles resting on weaker strata, allowable increase in pile capacity under seismic loading may be considered as 25% as per Table-1 of IS: 1893 (Part 1): 2016.

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In order to assess adequacy of piling methodology, equipment etc., it is recommended to carry out trial boring and install test pile prior to commencement of working piles. The safe capacity of pile shall be verified by conducting actual load test on pile following provisions of BIS code of practice. The grade of concrete such pile shall be minimum M25.

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7.0 GENERAL RECOMMENDATIONS

a) Individual borehole profile / cross section & test results should be referred to assess the true subsoil formation at particular locations.

b) All open foundations shall be placed within Stratum-II. Any soft patch found at the foundation bed should be replaced with lean concrete.

c) Pile capacities should always be verified by conducting load test following provisions of relevant BIS Code of Practice and design load should be chosen accordingly.

d) Backfilling should be done with excavated earth in layers with proper compaction and addition of water, as required.

e) The surface of the excavated area should not be left exposed and immediate mud mat must be carried out.

f) Special care needs to be taken during excavation for foundations so that the founding stratum does not get disturbed by excavation process and especially by ground/seepage water.

g) The net safe allowable bearing capacities have been calculated without considering the influence of adjacent foundation.

h) The foundation bed should be properly shaped, levelled and properly compacted before laying the mud mat and the mud mat should also be compacted.

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B.Tech, M.E (Geo-tech)

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CALCULATION FOR BEARING CAPACITY AND SETTLEMENT OF SHALLOW FOUNDATIONS:

Stratum	Thickness (m)	Bulk Density (KN/m^3)	Cohesion value (kPa)	$m_v(m^2/KN) \times 10^{-4}$			Young's Modulus (E) (kPa)	Poisson's Ratio(μ)
				25-50 (kPa)	50-100 (kPa)	100-200 (kPa)		
I	2.50	17.50	-	-	-	-	-	-
II	15.00	18.40	50	2.00	2.20	1.80	25000	μ = 0.50

WIDTH x LENGTH x DEPTH OF FOOTING

Bf = 1.50 m, Lf = 1.50 m, Df = 2.50m

A. CALCULATION FOR BEARING CAPACITY

==========

Depth considered for bearing capacity parameters is 0.50 x width of foundation = 0.75 m below Foundation

(Considering General Shear Failure Condition)

Weighted Average

Cav.= 50 kPa

Øav.= 0

q_1 ult = $c.N_c.s_c.d_c.i_c + q\ (N_q-1)\ S_q\ d_q\ i_q + 0.5\ \gamma\ B\ N_\gamma\ S_\gamma\ d_\gamma\ i_\gamma\ w'$ [using IS:6403, general shear condition]

= $c.N_c.s_c.d_c.i_c$

= 444.35 kPa

q_{safe} (general) = q ult/F.S. = **177.74 kPa**

where Nc = 5.14, s_c=1.30, d_c=1+0.2(D_f/B). (N_Φ)^0.5 = 1.33, i_c = 1.00

where

i_c ,i_q, iγ are the inclination factors

Sc, Sq, Sγ are the shape factors

dγ,dq,dc are the depth factors

Nc,Nq and Nγ are the inclination factors

γ_{av} = weighted bulk density(KN/m^3)

B= width of the foundation (m)

C = cohesion value of soil (kPa)

W' = correction factor for water level

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B. CALCULATION FOR SETTLEMENT

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Settlement calculated for 178 kPa bearing pressure

Depth considered for settlement calculation 2 x width of foundation = **3.00m below Foundation**

Rigidity Factor (RF) = neglected, Depth Factor (DF) = 0.64 (IS: 8009(pt-1)1976, fig.12,

The thickness of stratum-II considered below the foundation is = 3.00m

ΔP is calculated at the centre of this stratum considering 2:1 dispersion = 3.00/2= 1.50m

Therefore ΔP = 178 x (1.50 x 1.50) /{(1.50+1.50) x (1.50+1.50)} = 178 x 0.25 = 44.50 kPa

Total Settlement for Stratum-II

= **Consolidated Settlement + Immediate Settlement**

Part I

Immediate Settlement = p x B x $(1-\mu^2)$ x If / Es

H immd at centre = 4 x p x (B/2) x $(1- \mu^2)$ x If / Es

Which is = **2 x p x B x $(1- \mu^2)$ x If / Es**

= 2 x 178 x 1.5 x $(1-0.5^2)$ x 0.41 / 25000

= 6.57 mm

Where p = imposed loading = 178 kPa

Influence Factor If = 0.41 [as per IS: 8009 Part-1, Fig. 11, H = 3.00, for centre H/[B/2] = 2H/B = 2x3.00/1.50= 4, L/B = 1]

B = width of foundation = 1.50m

μav (poisson's ratio) = 0.50 and Eav (modulus of elasticity) = 25000 kPa obtained as [E = 500 x Cu] (Ref Winterkorn & Fang (1975), Foundation Design by NV Nayak 4th Edition pg-111)

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Part – II

Consolidated Settlement

$$Sc = mv \times \Delta P \times H = 2.20 \times 10^{-4} \times 44.50 \times 3.00 = 0.02937m = 29.37mm$$

Total Settlement = Immediate Settlement + Consolidated Settlement

= 6.57 + 29.37

= 35.94 mm

Applying correction for depth factor over total settlement = 35.94 x 0.64 = 23.00 mm

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Sample Computation of Vertical Load Carrying Capacity of Bored Pile

(Cut-off level-1.50m)

1. **PILE GEOMETRY:**

Dia (mm)	(Bored) 500mm
Perimeter (π x D) m	3.14 x 0.50= 1.570m

2. **SUBSOIL PARAMETERS;**

(Refer from general soil profile)

Subsoil Strata	γ (KN/m^3)	Cohesion (kPa)	φ (Deg)	Values of α/K as per IS:2911 (Part1/Sec2)	Embedment Length (m)	Pile Bored Length
I	18.00	-	-	-	1.00	2.50
II	18.20	50	-	α = 1.00	15.00	15.00
III	19.40	102	-	α = 0.42	8.00	8.00
IV	20.00	160	-	α = 0.30	-	-

Skin friction = α x C x A_S [(Using formula for Pile in cohesive soil) IS: 2911(Part I/ Sec 2)-2010]

A_{si} = Surface area of pile stem

For 500mm Dia Pile

Skin friction

a. Skin friction in stratum I (F1) = Neglected

b. Skin friction in stratum II (F_2) = α x C x A_S

= 1 x 50 x 1.57 x 15.00

= 1177.50 **KN**

c. Skin friction in stratum III (F_3) = α x C x A_S

= 0.50 x 102 x 1.57 x 8.00

= 640.56 **KN**

'

'

d. End bearing for Stratum-III(F_4) = 9 x C x Ap

Where C= Cohesion value of Stratum-III

Ap = Area of cross section of the pile

= 9 x 102 x (π/4) x 0.50^2

= 180.158 KN

Total ultimate load = $F_1 + F_2 + F_3 + F_4$

= (1177.50 + 640.56 + 180.158) KN

= 1998.218 **KN**

Safe load = 1998.218 / 2.5 = 799.29 KN ≈ 800 **KN**

Uplift Capacity:

Uplift capacity of piles is obtained by applying a factor of safety of 3 over the ultimate load obtained through frictional resistance as per IS 2911 Part-I Sec 2 2010.

Uplift Capacity = (1177.50 + 640.56)/3.0 = 606.02 ≈ 600 **KN**

'

'

Computation for Lateral Capacity of Pile.

(Consider cut off level 1.50m)

Basic Assumptions

1) Reference codes IS 2911 (Part I/Section 2) – 2010, IS 14593: 1996 – 1998 & IS 456 – 2000.
2) Modulus of Subgrade reaction has been taken assuming the sub-soil as medium stiff Clay under submerged condition.
3) Concrete Grade of piles has been assumed as M25.

List of Notations.

I = Moment of Inertia of Pile Section (m^4)

E= Modulus of Elasticity of concrete (MN/m^2)

R= Relative Stiffness Factor.

z_f= Depth to point of Fixity in m

K_1= Modulus of Sub-grade Reaction of Clay (MN/m^3) (Refer IS-2911, Appendix – C)

H= Lateral Load in (KN)

Y= Maximum displacement allowed at Final load = 5mm = 0.005m

e= cantilever length above ground/ bed to the point of load application in m.

Lateral Load for free head piles

1) Pile Geometry

Dia = 500mm = 50cm Moment of Interia

$I = (\prod/64) \times (0.50)^4 = 3.07 \times 10^{-3}\ m^4$

2) Properties of Pile Material- Concrete Grade M25

Modulus of Elasticity (E) = $5000\sqrt{f_{ck}}$ [where f_{ck} = characteristic strength in N/mm^2]

$=5000\ \sqrt{25}$

$= 25 \times 10^3$ MPa

$= 25 \times 10^6$ KPa

Flexural Stiffness $EI = 7.67 \times 10^4$ kN-m^2

'

'

a) Depth of Fixity for free head condition

Value of z_f/R, from fig 2, of IS – 2911-2010 for (e/R=0), $z_f/R = 1.90$

Computing, value of Relative Stiffness Factor as per relationship given in Clause C-2.3.2 of Appendix C, IS: 2911

$R = \sqrt[4]{(5EI/K_1)}$ [where K_1 has been obtained as 18.0×10^3 from Table-4 IS: 2911 in kN/m^3]

$R = \sqrt[4]{(5 \times 7.67 \times 10^4 / 18.00 \times 10^3)}$

$= 2.15$ m

Now,

$z_f/R = 1.90$

$z_f = 1.90 \times 2.15$

$z_f = 4.08$ m

b) **Lateral Load Capacity for free head condition**

Computation has been based on equation given on cl C-4.2 of IS 2911 as follows.

$Y = \{H (e + z_f)^3 / 3EI\}$

$H = 3EI.Y/(e + z_f)^3$

Where

$e=0$

$EI = 7.67 \times 10^4$

$z_f = 4.08$ m

$Y = 0.005$ m

$\therefore Q = (3 \times 7.67 \times 10^4 \times 0.005) / (4.08)^3 = 16.90$ **kN**

'

c) **Depth of Fixity for fixed head condition**

Value of z_f/R, from fig 4, of IS – 2911-1979 for (e/R=0), $z_f/R = 2.20$

R = 2.15m

Now,

$z_f/R = 2.20$

$z_f = 2.20 \times 2.15$

$z_f = 4.73$ m

c. Lateral Load Capacity for fixed head condition

Computation has been based on equation given on cl C-4.2 of IS 2911 as follows.

$Y = \{H (e + z_f)^3/12EI\}$

$H = 12EI.Y/(e + z_f)^3$

Where

e=0

$EI = 7.67 \times 10^4$

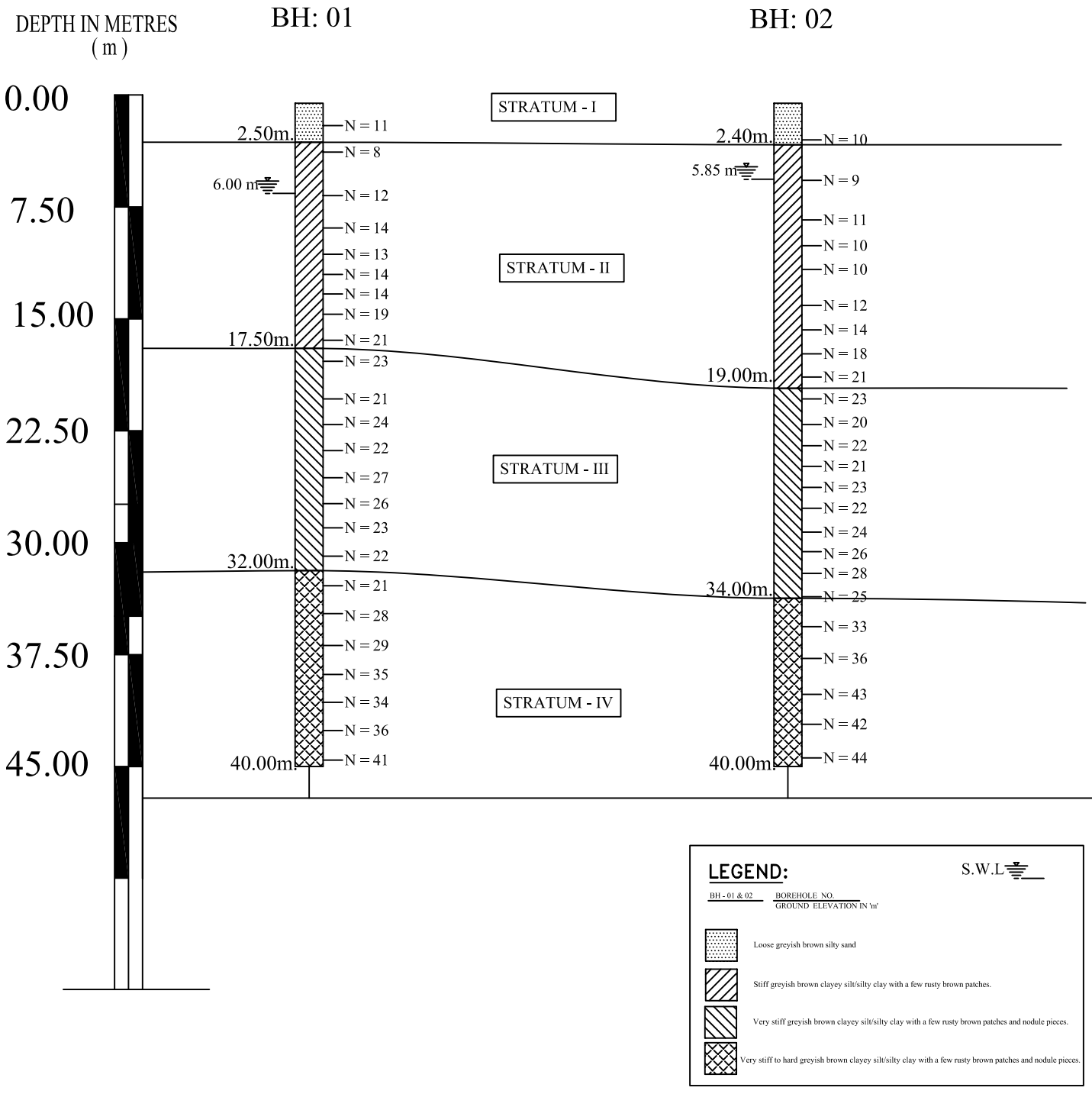
$z_f = 4.73$ m

Y = 0.005 m

$\therefore Q = (12 \times 7.67 \times 10^4 \times 0.005)/ (4.73)^3 = 43.60$ **kN**

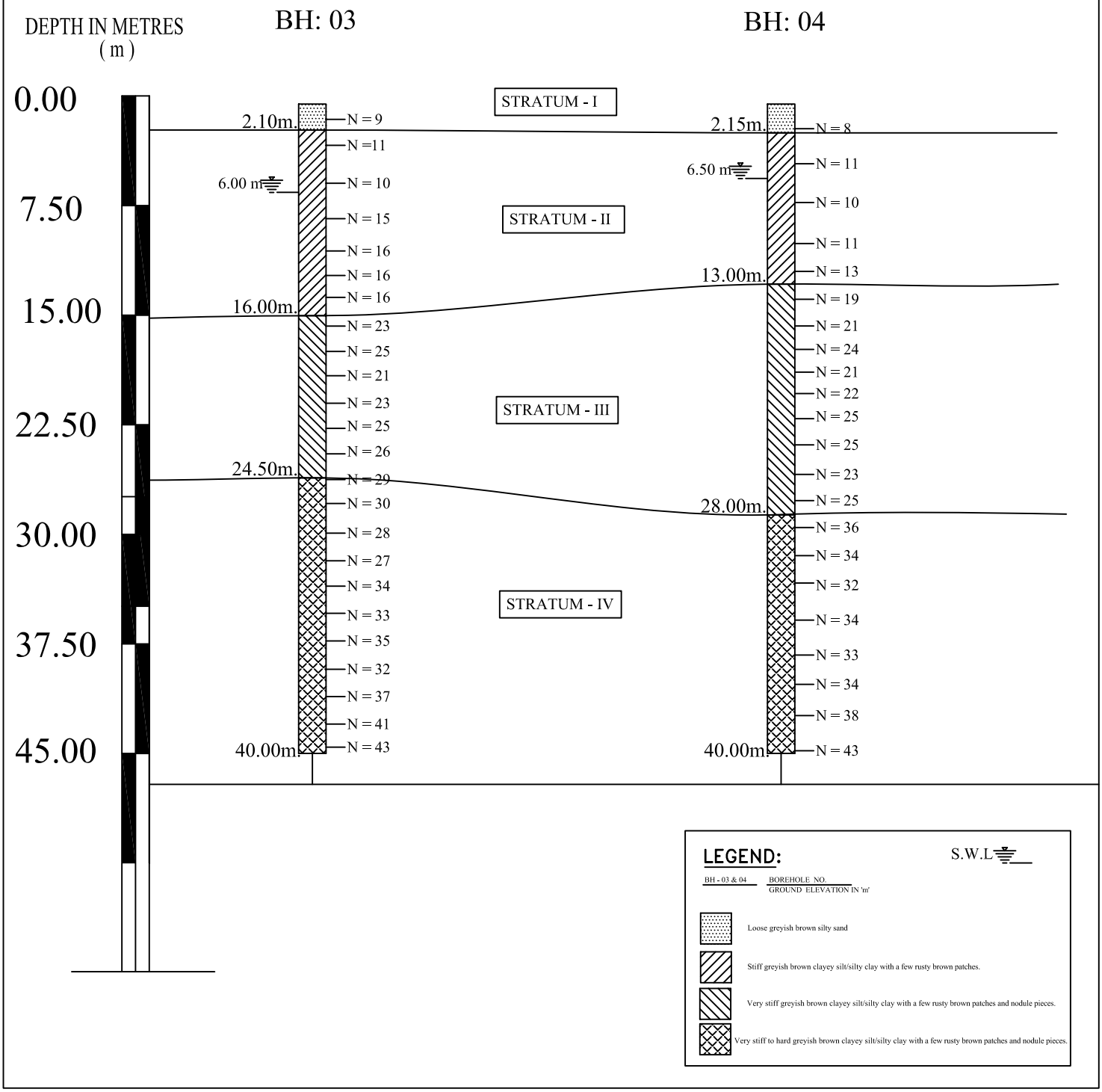
CROSS SECTION OF SOIL PROFILE

Jhargram Medical College



CROSS SECTION OF SOIL PROFILE

Jhargram Medical College



NIRMAN

ADMIN & REGD OFFICE: 4/B, SURYA SEN NAGAR, KOLKATA - 700 061

BORELOG

PROJECT : Geotechnical Investigation for Jhargram Medical College.

Boring method : Auger & Rotary Wash Boring.		**Record of:** **BH-01**
Boring diameter :150mm	Area : Jhargram Medical College at Junglekhas Mouza(JL No: - 395)	
	Orientation : Vertical	RL :
	Standing Water Level: 6.00m	Date Commenced: 19.07.2018
		Date Completed: 20.07.2018

Samples and In-situ test			Casing depth, (Level)	N Value	Date & Depth, (Level)	Description of Strata	Depth From EGL	Soil Group
Depth(m) (From)	Depth(m) (To)	Type of Test						
0.50	0.50	D				Loose greyish brown silty sand	2.50	
1.50	1.95	SPT		11				
3.00	3.45	U				Stiff greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.	17.50	
4.50	4.95	SPT		8				
6.00	6.45	U						
7.50	7.95	SPT		12				
9.00	9.45	SPT		14				
10.50	10.95	SPT		13				
12.00	12.45	SPT		14				
13.50	13.95	SPT		14				
15.00	15.45	SPT		19				
16.50	16.95	SPT		21				
18.00	18.45	SPT		23		Very stiff greyish brown silty clay/clayey silt with rusty brown patches, nodule pieces and high percentage of sand at 15.00m to 22.00m depth.	32.00	
19.50	19.95	SPT		21				
21.00	21.45	SPT		24				
22.50	22.95	SPT		22				
24.00	24.45	SPT		27				
25.50	25.95	SPT		26				
27.00	27.45	SPT		23				
28.50	28.95	SPT		22				
30.00	30.45	SPT		21				
31.50	31.95	U						
33.00	33.45	SPT		28		Very Stiff to hard greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.	40.45	
34.50	34.95	SPT		29				
36.00	36.45	SPT		35				
37.50	37.95	SPT		34				
39.00	39.45	SPT		36				
40.00	40.45	SPT		41				

Remarks :	D - Disturbed Samples	1 No.	WS- Water Sample	Nil	Prepared by
Bore hole terminated at 40.00m	UDS - Undisturded Samples	3 No.	SPT- Standard Penetration Test	24 No.	A.S

NIRMAN

ADMIN & REGD OFFICE: 4/B, SURYA SEN NAGAR, KOLKATA - 700 061

BORELOG

PROJECT : Geotechnical Investigation for Jhargram Medical College.

Boring method : Auger & Rotary Wash Boring.		Record of: BH-02
Boring diameter :150mm	Area : Jhargram Medical College at Junglekhas Mouza(JL No: - 395)	
	Orientation : Vertical	
	Standing Water Level: 5.85m	Date Commenced: 20.07.2018
		Date Completed: 21.07.2018

Samples and In-situ test			Casing depth, (Level)	N Value	Date & Depth, (Level)	Description of Strata	Depth From EGL	Soil Group
Depth(m) (From)	Depth(m) (To)	Type of Test						
0.50	0.50	D				Loose greyish brown silty sand		
1.50	1.95	SPT		10			2.40	
3.00	3.45	U				Stiff greyish brown clayey silt/silty clay with a few rusty brown patches, nodule pieces and high percentage of sand from 16.50m depth.		
4.50	4.95	SPT		9				
6.00	6.45	U						
7.50	7.95	SPT		11				
9.00	9.45	SPT		10				
10.50	10.95	SPT		10				
12.00	12.45	U						
13.50	13.95	SPT		12				
15.00	15.45	SPT		14				
16.50	16.95	SPT		18				
18.00	18.45	SPT		21			19.00	
19.50	19.95	SPT		23		Very stiff greyish brown clayey silt/silty clay with a few rusty brown patches and nodule pieces.		
21.00	21.45	SPT		20				
22.50	22.95	SPT		22				
24.00	24.45	SPT		21				
25.50	25.95	SPT		23				
27.00	27.45	SPT		22				
28.50	28.95	SPT		24				
30.00	30.45	SPT		26				
31.50	31.95	SPT		28				
33.00	33.45	SPT		25			34.00	
34.50	34.95	SPT		33		Very stiff to hard greyish brown clayey silt/silty clay with a few rusty brown patches and nodule pieces.		
36.00	36.45	SPT		36				
37.50	37.95	SPT		43				
39.00	39.45	SPT		42				
40.00	40.45	SPT		44			40.45	

Remarks :	D - Disturbed Samples	1 No.	WS- Water Sample	Nil	Prepared by
Bore hole terminated at 40.00m	UDS - Undisturded Samples	3 No.	SPT- Standard Penetration Test	24 No.	A.S

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ADMIN & REGD OFFICE: 4/B, SURYA SEN NAGAR, KOLKATA - 700 061

BORELOG

PROJECT : Geotechnical Investigation for Jhargram Medical College.

Boring method : Auger & Rotary Wash Boring.		**Record of:** **BH-03**
Boring diameter :150mm	Area : Jhargram Medical College at Junglekhas Mouza(JL No: - 395)	
	Orientation : Vertical	
	Standing Water Level: 6.00m	Date Commenced: 22.07.2018
		Date Completed: 24.07.2018

Samples and In-situ test			Casing depth, (Level)	N Value	Date & Depth, (Level)	Description of Strata	Depth From EGL	Soil Group
Depth(m) (From)	Depth(m) (To)	Type of Test						
0.50	0.50	D				Loose greyish brown silty sand		
1.50	1.95	SPT		9			2.10	
3.00	3.45	SPT		11		Stiff greyish brown silty clay with rusty brown patches and nodule pieces.		
4.50	4.95	U						
6.00	6.45	SPT		10				
7.50	7.95	U						
9.00	9.45	SPT		15				
10.50	10.95	U						
12.00	12.45	SPT		16				
13.50	13.95	SPT		16				
15.00	15.45	SPT		16			16.00	
16.50	16.95	SPT		23		Very stiff greyish brown silty clay/clayey silt with rusty brown patches,nodule pieces and high percentage of sand at 16.50m to 19.00m depth.		
18.00	18.45	SPT		25				
19.00	19.45	SPT		21				
20.50	20.95	SPT		23				
22.00	22.45	SPT		25				
23.50	23.95	SPT		26			24.50	
25.00	25.45	SPT		29		Very stiff to hard greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.		
26.50	26.95	SPT		30				
28.00	28.45	SPT		28				
29.50	29.95	SPT		27				
31.00	31.45	SPT		34				
32.50	32.95	SPT		33				
34.00	34.45	SPT		35				
35.50	35.95	SPT		32				
37.00	37.45	SPT		37				
38.50	38.95	SPT		41				
40.00	40.45	SPT		43			40.45	

Remarks :	D - Disturbed Samples	1 No.	WS- Water Sample	Nil	Prepared by
Bore hole terminated at 40.00m	UDS - Undisturded Samples	3 No.	SPT- Standard Penetration Test	24 No.	A.S

NIRMAN

ADMIN & REGD OFFICE: 4/B, SURYA SEN NAGAR, KOLKATA - 700 061

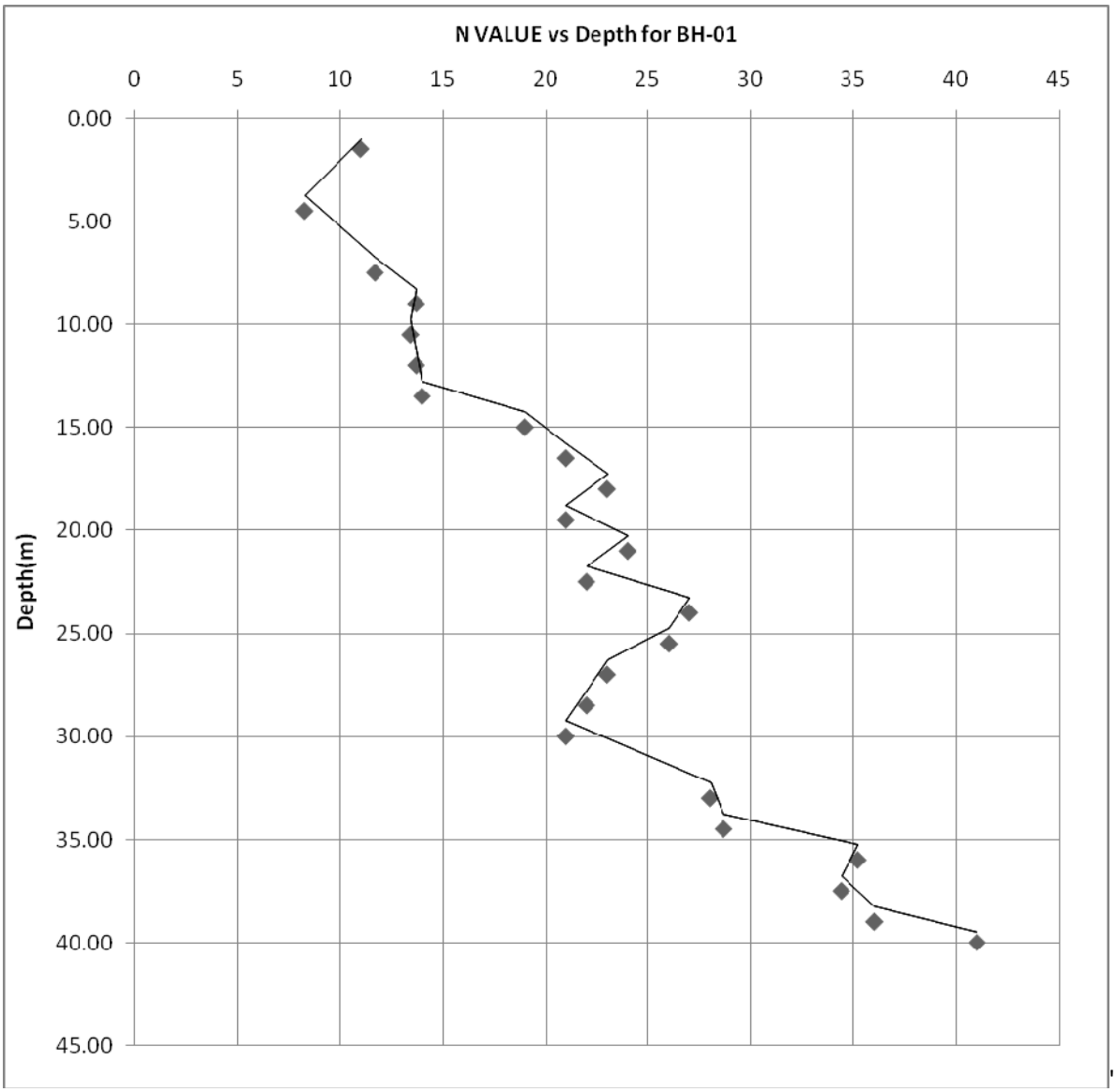
BORELOG

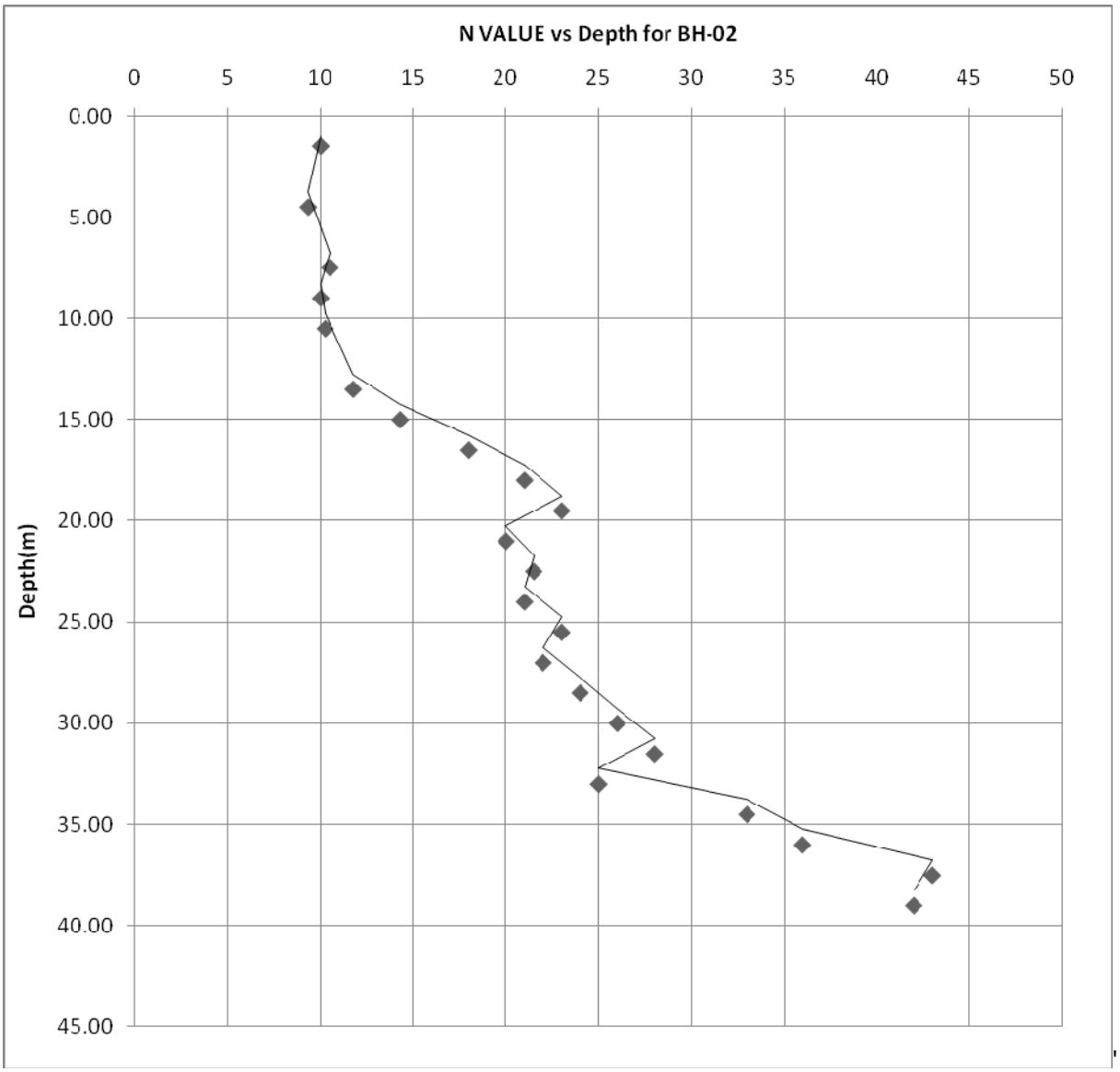
PROJECT : Geotechnical Investigation for Jhargram Medical College.

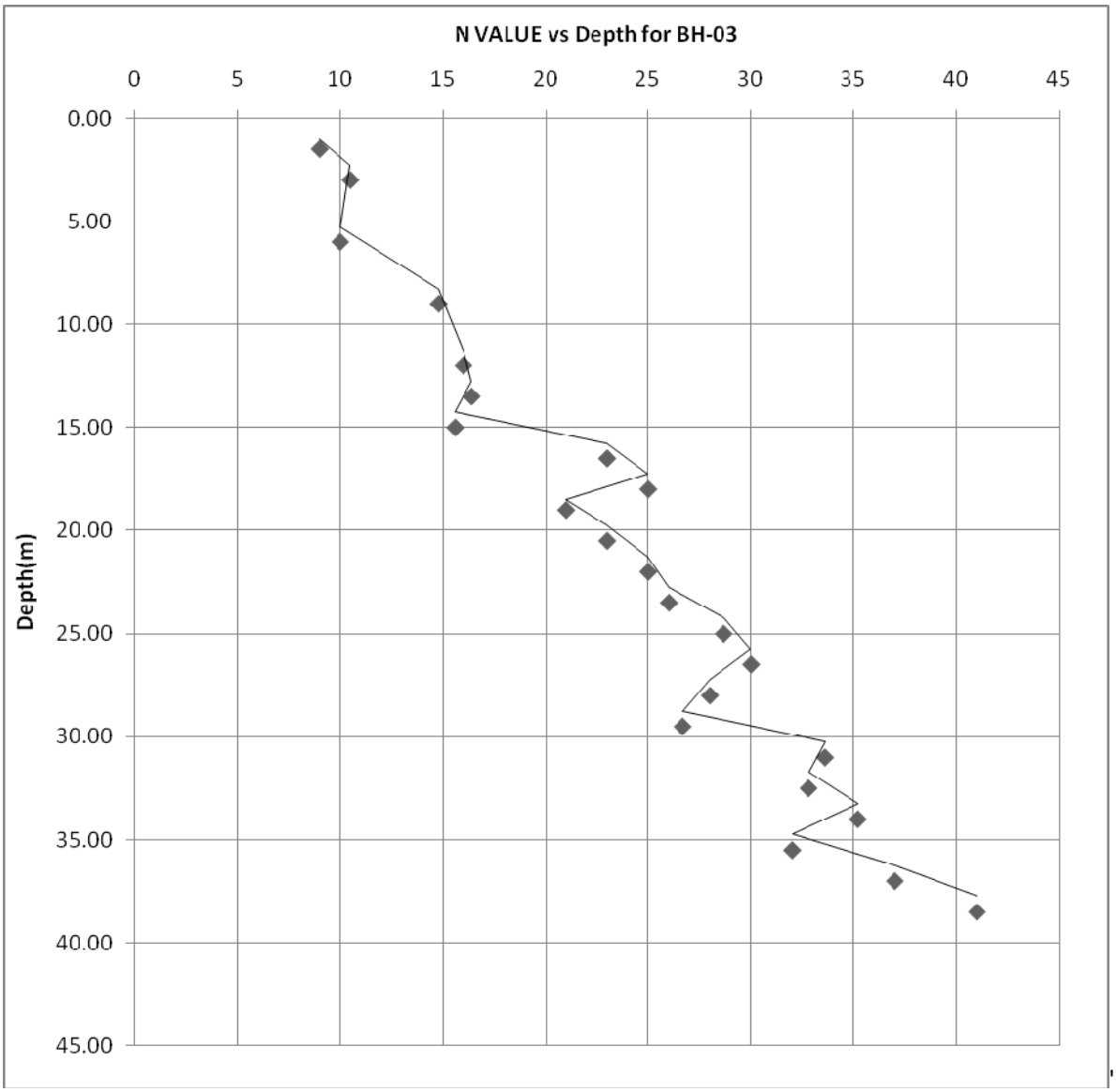
Boring method : Auger & Rotary Wash Boring.		**Record of:** **BH-04**
Boring diameter :150mm	Area : Jhargram Medical College at Junglekhas Mouza(JL No: - 395)	
	Orientation : Vertical	RL :
	Standing Water Level: 6.50m	Date Commenced: 24.07.2018
		Date Completed: 26.07.2018

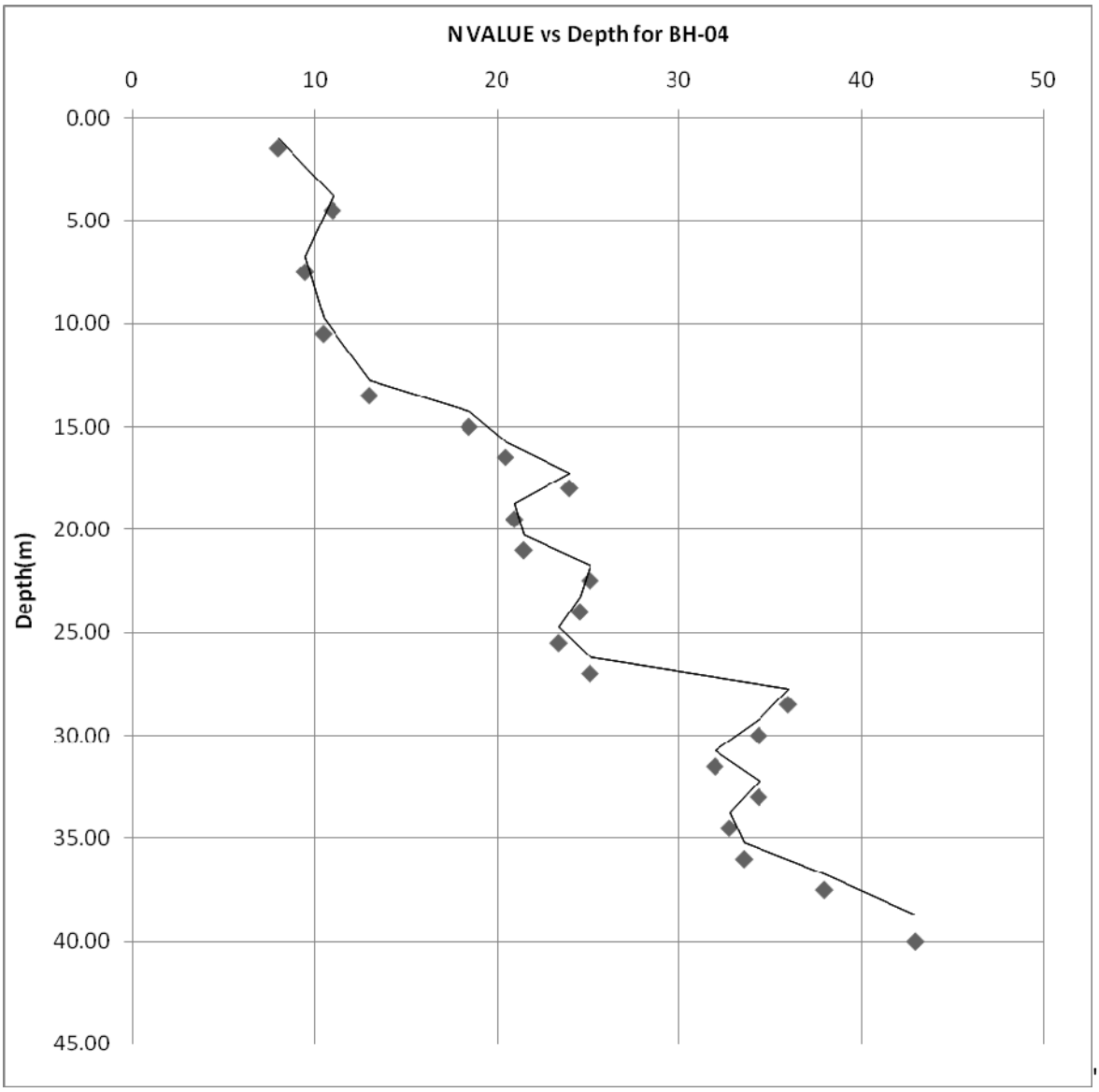
Samples and In-situ test			Casing depth, (Level)	N Value	Date & Depth, (Level)	Description of Strata	Depth From EGL	Soil Group
Depth(m) (From)	Depth(m) (To)	Type of Test						
0.50	0.50	D				Loose greyish brown silty sand	2.15	
1.50	1.95	SPT		8				
3.00	3.45	U				Stiff greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.	13.00	
4.50	4.95	SPT		11				
6.00	6.45	U						
7.50	7.95	SPT		10				
9.00	9.45	U						
10.50	10.95	SPT		11				
12.00	12.45	U						
13.50	13.95	SPT		13				
15.00	15.45	SPT		19		Very stiff greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.	28.00	
16.50	16.95	SPT		21				
18.00	18.45	SPT		24				
19.50	19.95	SPT		21				
21.00	21.45	SPT		22				
22.50	22.95	SPT		25				
24.00	24.45	SPT		25				
25.50	25.95	SPT		23				
27.00	27.45	SPT		25				
28.50	28.95	SPT		36		Very stiff to hard greyish brown silty clay/clayey silt with rusty brown patches and nodule pieces.	40.45	
30.00	30.45	SPT		34				
31.50	31.95	SPT		32				
33.00	33.45	SPT		34				
34.50	34.95	SPT		33				
36.00	36.45	SPT		34				
37.50	37.95	SPT		38				
40.00	40.45	SPT		43				

Remarks :			D - Disturbed Samples	1 No.	WS- Water Sample	Nil	Prepared by
Bore hole terminated at 40.00m			UDS - Undisturded Samples	4 No.	SPT- Standard Penetration Test	22 No.	A.S


N VALUE vs Depth for BH-01
0
5
10
15
20
25
30
35
40
45
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Depth(m)


N VALUE vs Depth for BH-02
0
5
10
15
20
25
30
35
40
45
50
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Depth(m)


N VALUE vs Depth for BH-03
0
5
10
15
20
25
30
35
40
45
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Depth(m)


N VALUE vs Depth for BH-04
0
10
20
30
40
50
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Depth(m)

LABORATORY TEST RESULTS

Borehole No.	Sampling Depth (m)	Type	Natural Moisture Content(%)	Liquid Limit (%)	Plastic Limit (%)	Shrinkage Limit (%)	GRAIN SIZE ANALYSIS (%)				SHEAR TEST (kPa)					Specific Gravity	DENSITY (KN/m^3)	
							Gravel	Sand	Silt	Clay	UC	UU		DS			Bulk	Dry
												C	ϕ	c	ϕ			
1	1.50-1.95	SPT		NP	NP			81	19					1.12	31			
1	3.00-3.45	UDS	22	44	17	12		42	33	25		46	12			2.65	18.4	15.1
1	6.00-6.45	UDS	24	41	19	14		37	40	23	56					2.66	18.8	15.2
1	9.00-9.45	SPT		38	16			51	29	20								
1	15.00-15.45	SPT		NP	NP			65	27	8				2.30	33			
1	21.00-21.45	SPT		NP	NP			65	26	9				0.82	33			
1	25.50-25.95	SPT		46	15			13	61	26								
1	30.00-30.45	SPT		48	18			11	62	27								
1	31.50-31.95	UDS	21	45	16			14	62	24	102					2.69	19.9	16.4
1	35.00-35.45	SPT		46	15			11	61	28								
1	39.00-39.45	SPT		43	17			16	61	23								
2	3.00-345	UDS	25	38	20	14		39	42	19		52	7			2.64	18.6	14.9
2	6.00-6.45	UDS	23	40	17	12		41	39	20	51					2.65	18.9	15.4
2	12.00-12.45	UDS	22	39	16	11		46	35	19	63					2.66	19.2	15.7
2	16.50-16.95	SPT		NP	NP			66	26	8				2.23	32			
2	18.00-18.45	SPT		NP	NP			61	32	7								
2	24.00-24.45	SPT		45	18			12	64	24								
2	31.50-31.95	SPT		47	19			14	59	27								
2	36.00-36.45	SPT		37	17			21	59	20								
2	40.00-40.45	SPT		41	20			13	65	22								

UC : Unconfined Compression Test. UU : Unconsolidated Undrained Tri-axial Shear Test.
Specific Gravity.

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LABORATORY TEST RESULTS

Borehole No.	Sampling Depth (m)	Type	Natural Moisture Content(%)	Liquid Limit (%)	Plastic Limit (%)	Shrinkage Limit (%)	GRAIN SIZE ANALYSIS (%)				SHEAR TEST (kPa)					Specific Gravity	DENSITY (KN/m^3)	
							Gravel	Sand	Silt	Clay	UC	UU		DS			Bulk	Dry
												C	ϕ	c	ϕ			
3	1.50-1.95	SPT		NP	NP		1	82	17					1.4	30			
3	4.50-4.95	UDS	24	41	19	14		38	39	23		53	9			2.64	18.4	14.8
3	7.50-7.95	UDS	22	39	17	12		41	39	20	56					2.64	18.8	15.4
3	10.50-10.95	UDS	21	38	15			46	36	18	66					2.65	19.1	15.8
3	16.50-16.95	SPT		NP	NP			59	31	10				1.55	32			
3	18.00-1845	SPT		NP	NP			55	34	11								
3	23.50-23.95	SPT		46	21			9	65	26								
3	28.00-28.45	SPT		42	19			10	67	23								
3	34.00-34.45	SPT		37	15			22	59	19								
3	40.00-40.45	SPT		39	16			19	60	21								
4	1.50-1.95	SPT		NP	NP			83	17					1.67	29			
4	3.00-3.45	UDS	25	42	18	12		38	38	24		51	5			2.64	18.6	14.9
4	6.00-6.45	UDS	22	38	16			44	35	21	54					2.66	18.4	15.1
4	9.00-9.45	UDS	23	40	18			41	36	23	59					2.65	18.9	15.4
4	12.00-12.45	UDS	21	37	16	11		46	36	18		64	6			2.67	19.4	16.0
4	18.00-1845	SPT		NP	NP			64	27	9								
4	22.50-22.95	SPT		43	19			12	64	24								
4	27.00-27.45	SPT		45	20			11	63	26								
4	33.00-33.45	SPT		38	16			17	63	20								
4	37.50-37.95	SPT		37	15			21	61	18								

UC : Unconfined Compression Test. UU : Unconsolidated Undrained Tri-axial Shear Test.
Specific Gravity.

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RELATIVE DENSITY		
TEST NO	**DEPTH (m)**	**Relative Density (%)**
BH-01	0.50	16
BH-02	0.50	18
BH-03	0.50	17
BH-04	0.50	21

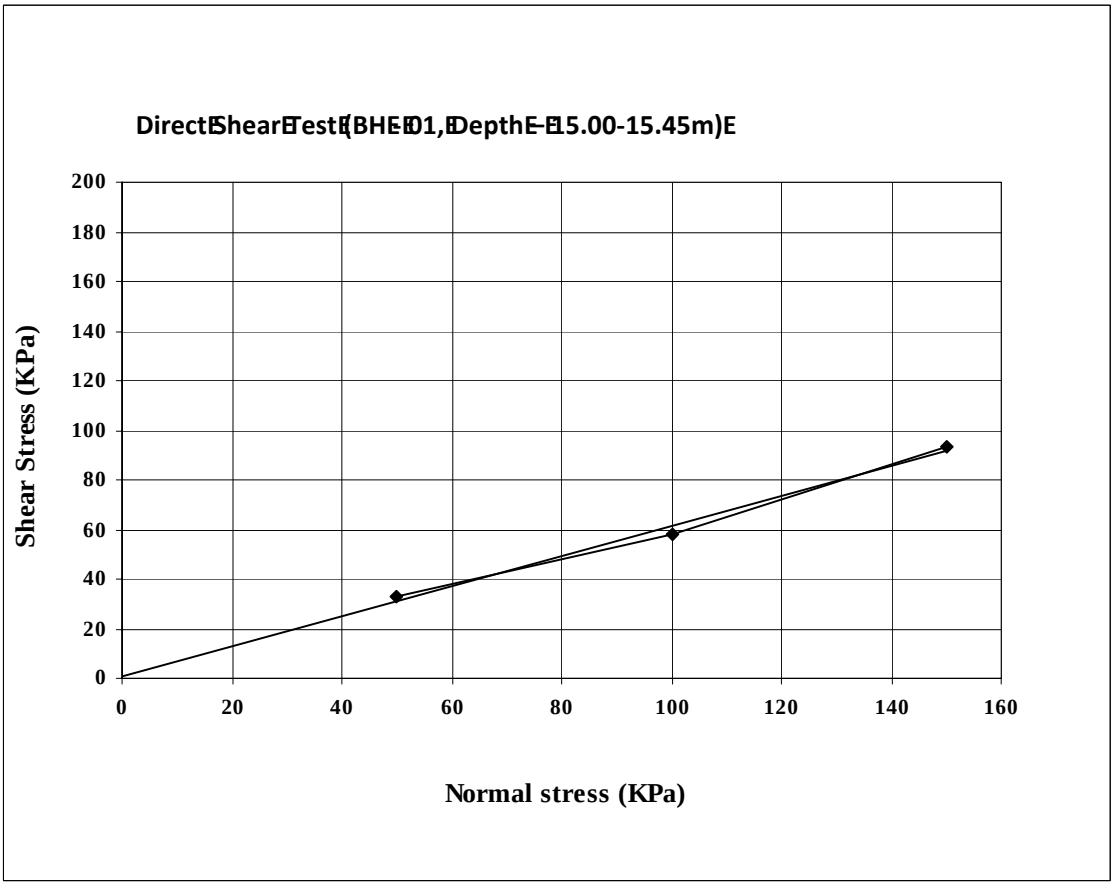
CONSOLIDATION TEST RESULTS

m_V M^2/KN X10-^{4}

Borehole Number	Depth (m)	Pressure Range in kg/cm^2							
		00-0.10	0.10-0.25	0.25-0.50	0.50-1.00	1.00-2.00	2.00-4.00	4.00-8.00	8.00-16.00
01	3.00-3.45	0.50	0.67	1.60	2.50	2.20	1.38	0.86	0.51
01	31.50-31.95	0.32	0.56	1.10	1.12	0.98	0.66	0.48	0.26
02	6.00-6.45	0.50	0.33	2.40	2.00	1.80	1.40	0.93	0.59
02	12.00-12.45	0.46	0.69	1.85	2.10	2.23	1.67	0.82	0.48
03	4.50-4.95	0.50	0.67	2.00	2.20	1.80	1.28	0.83	0.51
03	10.50-10.95	0.41	0.78	1.42	1.56	1.55	1.32	0.88	0.47
04	3.00-3.45	0.48	0.76	1.78	2.36	2.14	1.49	0.77	0.43
04	9.00-9.45	0.52	0.68	1.91	2.05	2.14	1.72	0.86	0.53

Direct Shear Test Results

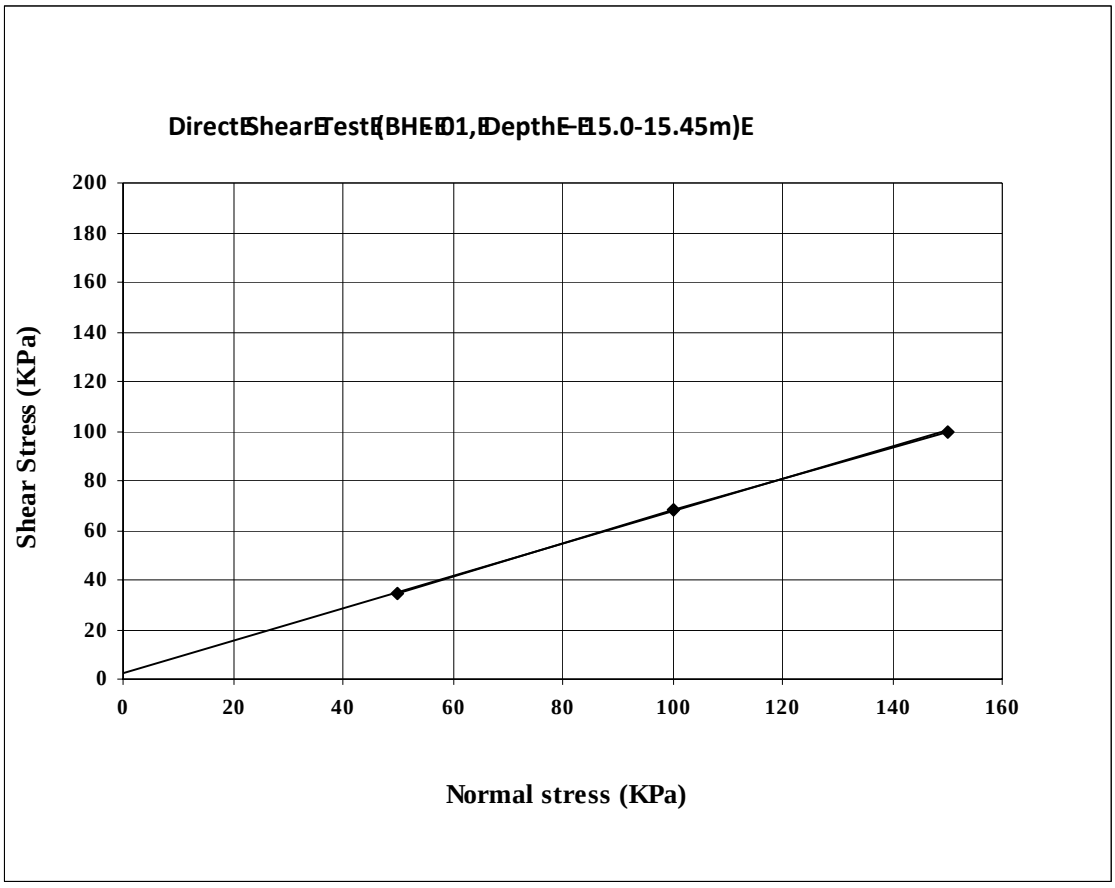
BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
1	1.50-1.95	DS'	30	18.0	13.2	1.12	31



'

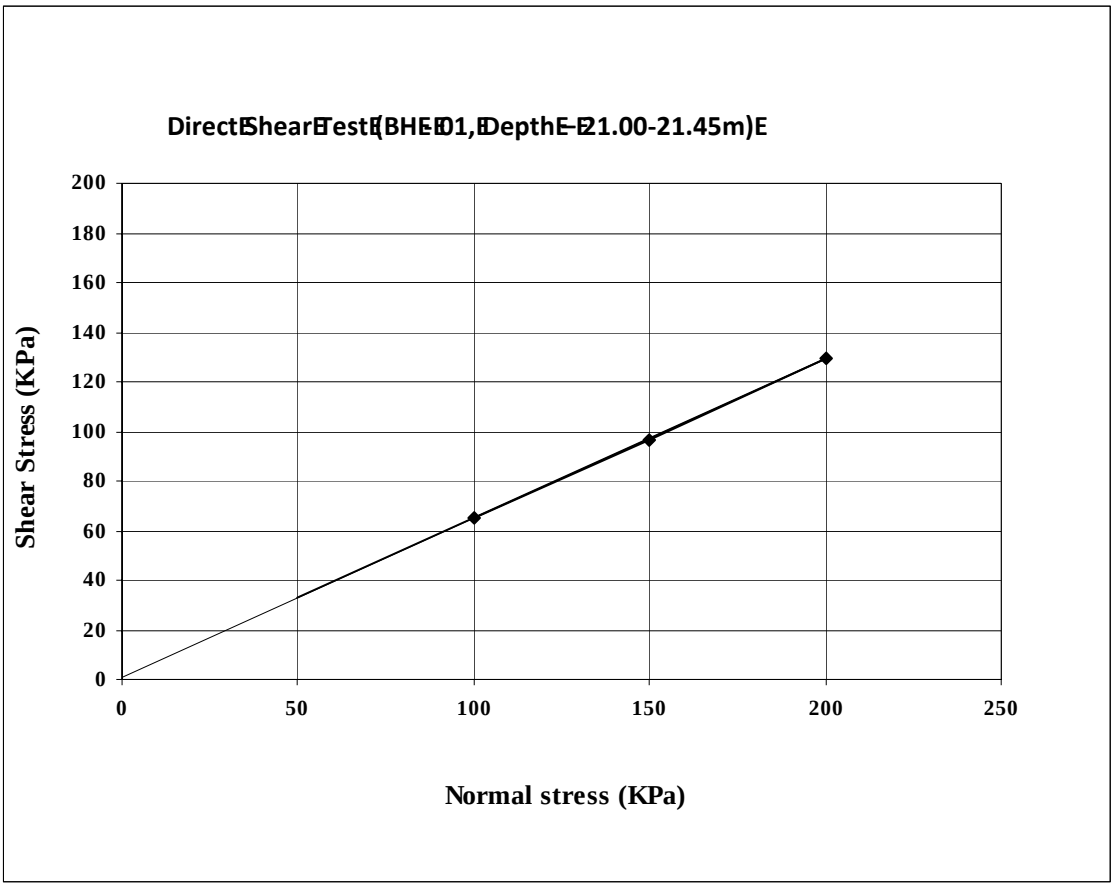
Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
1	15.00-15.45	DS'	31	18.7	14.3	2.3	33



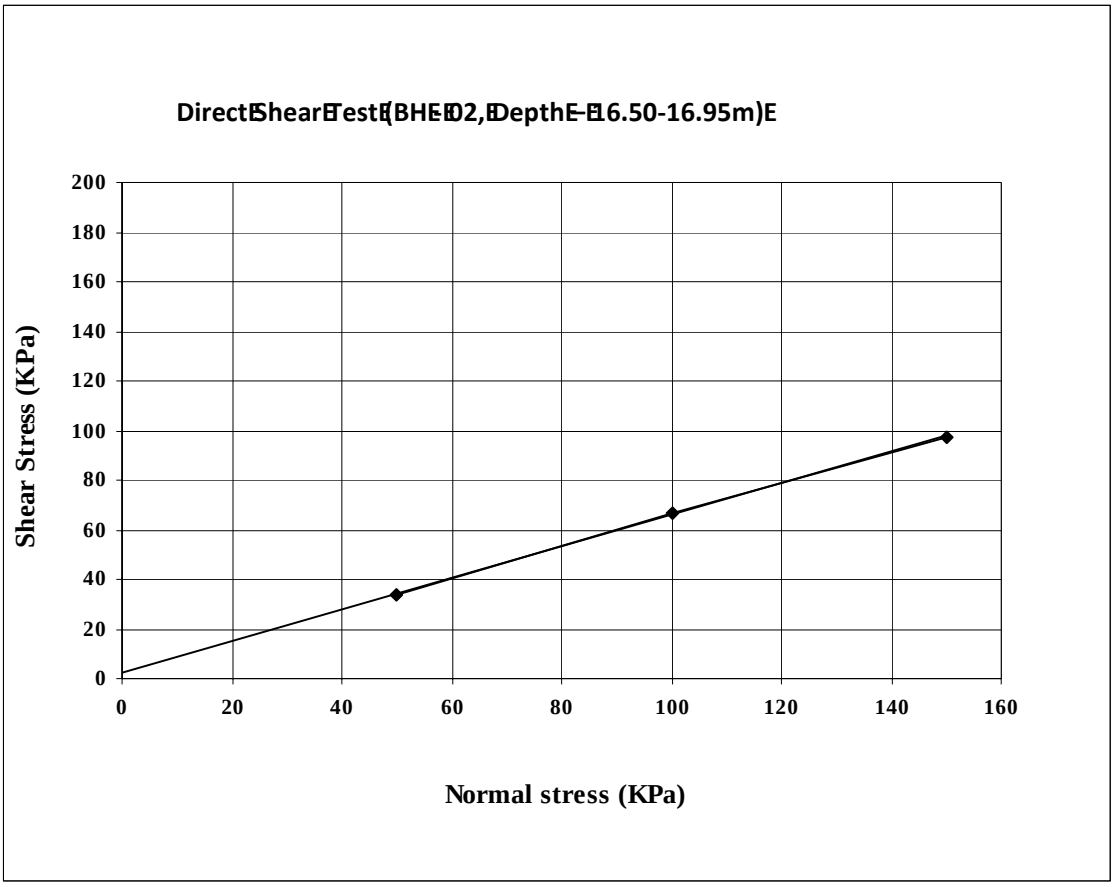
Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
1	21.00-21.45	DS'	26	19.6	15.6	0.82	33



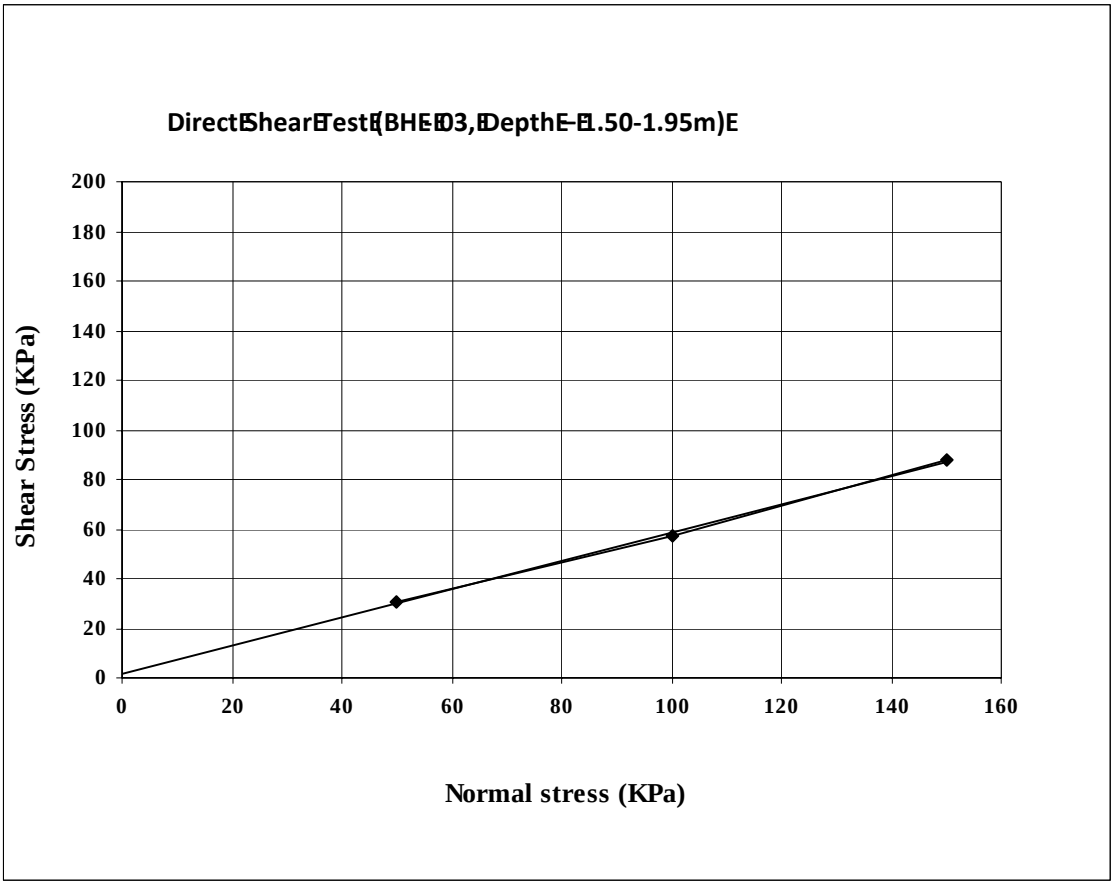
Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
02	16.50-16.95	DS'	32	18.6	14.1	2.23	32



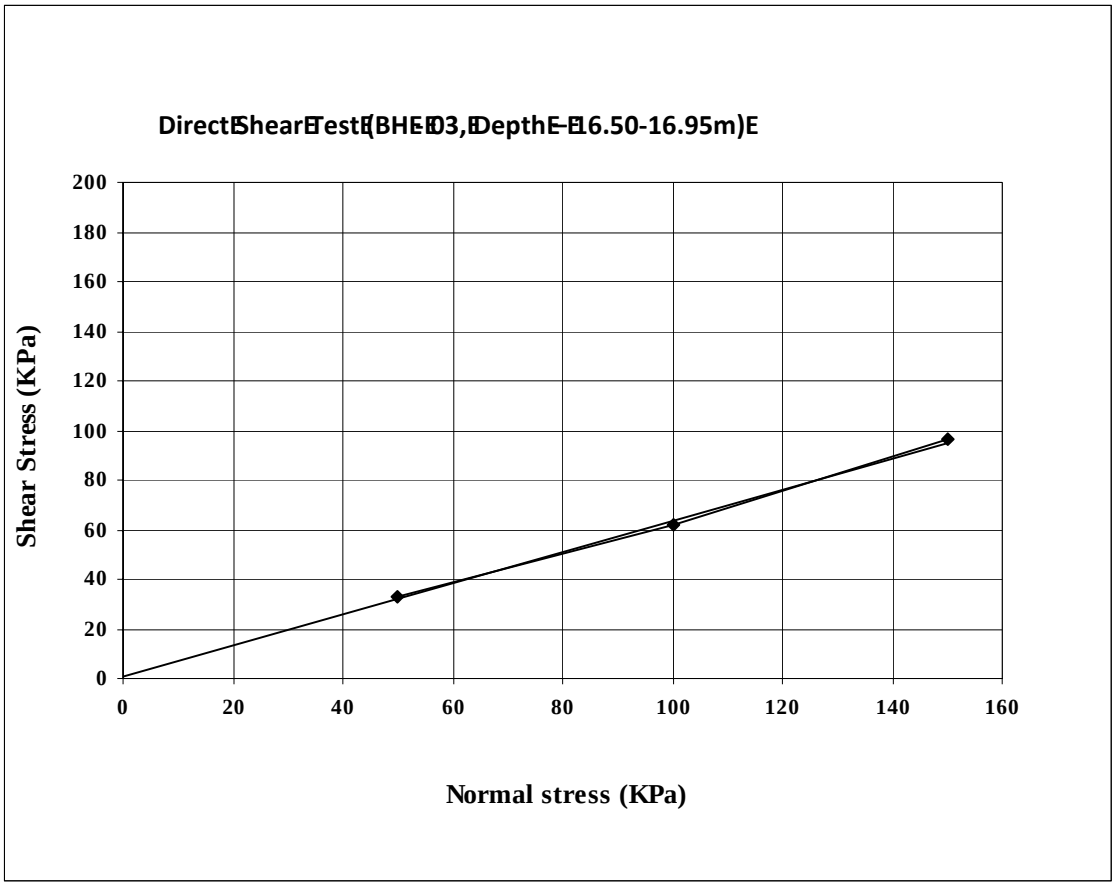
Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
03	1.50-1.95	DS'	37	17.9	13.1	1.395	30



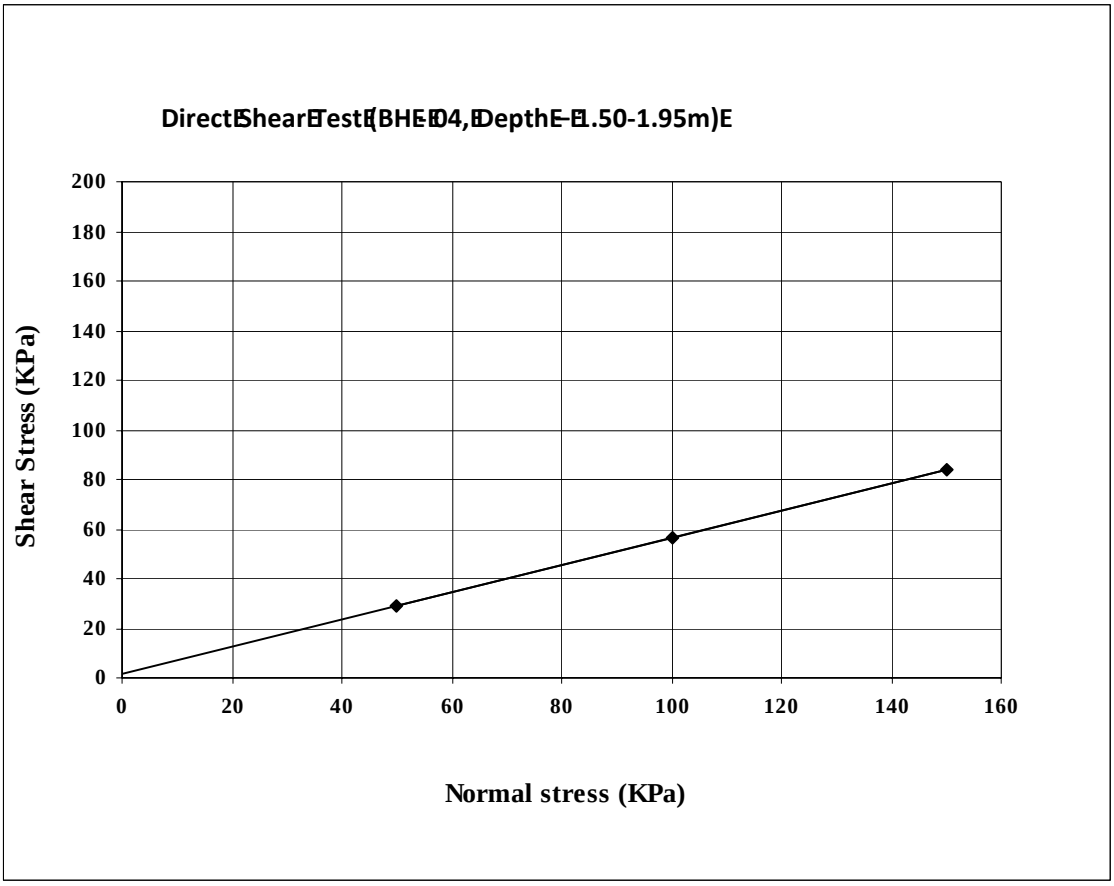
Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
03	16.50-16.95	DS'	33	18.5	13.9	1.55	32

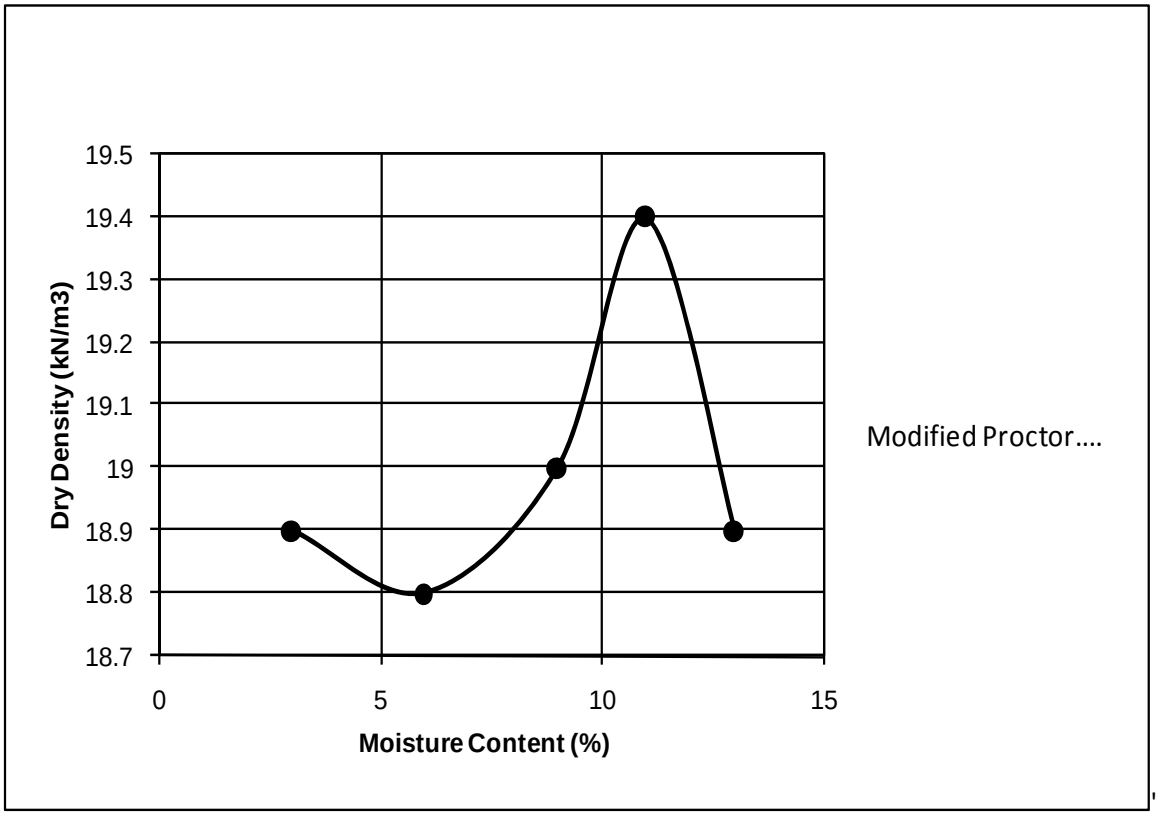


Direct Shear Test Results

BH No.	Depth (m)	Type of Test	Water Content (%)	Bulk Density (KN/m^3)	Dry Density (KN/m^3)	Cohesion (kPa)	Angle of Internal Friction (Degrees)
4	1.50-1.95	DS'	37	18.1	13.2	1.67	29



MODIFIEDPROCTORE



BH-01''

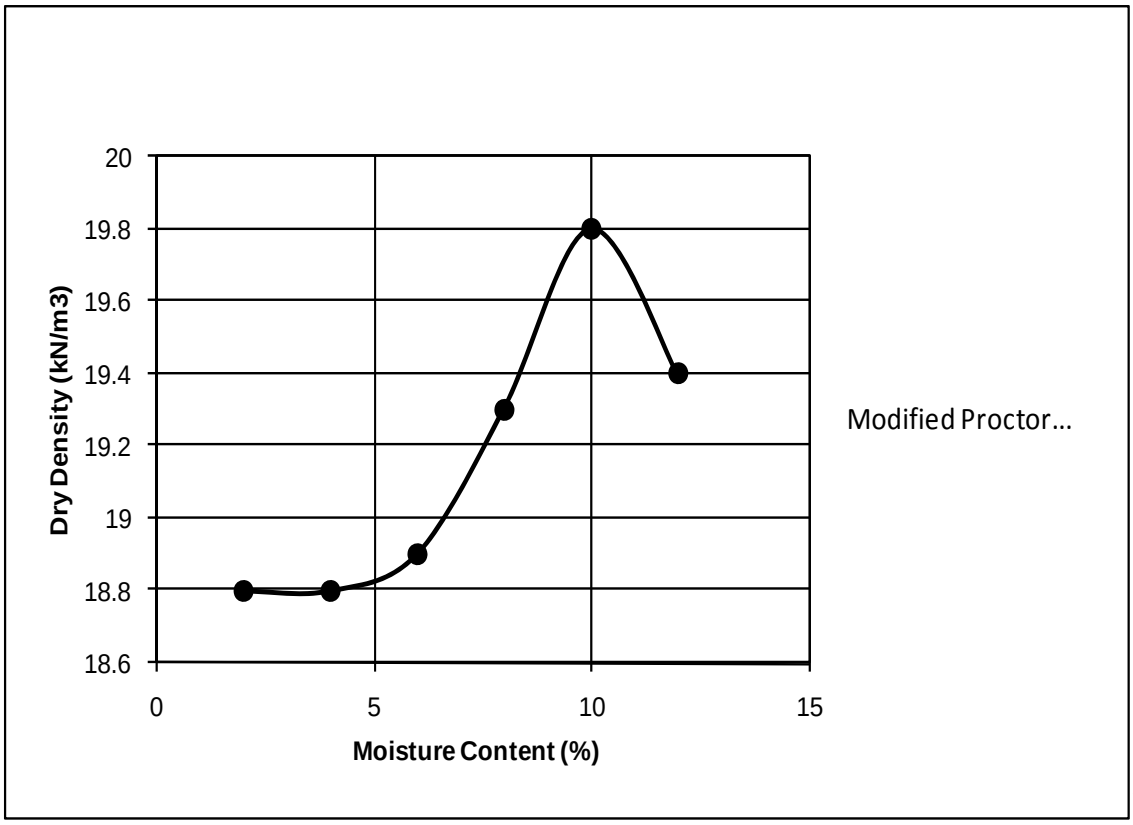
Depth'-'0.50M'

Optimum'moisture'content:'11%'

Maximum'dry'density:'19.4'kN'/m3'
Soil'type:'Silty'Sand.'

E

MODIFIEDPROCTOR'



BH'–'02''

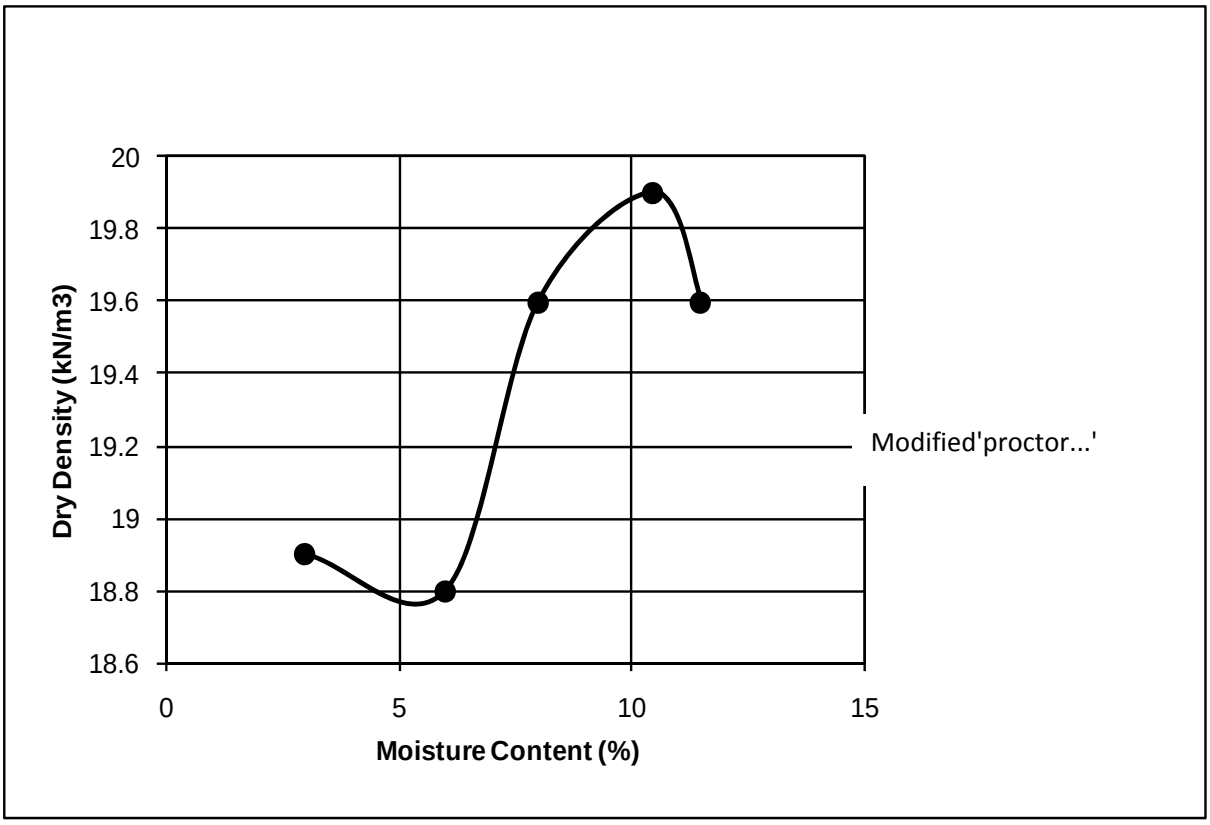
Depth'–'0.50m'

Optimum'moisture'content:'10%'

Maximum'dry'density:'19.8'kN'/m3'

Soil'type:'Silty'Sand.'

MODIFIED PROCTOR'



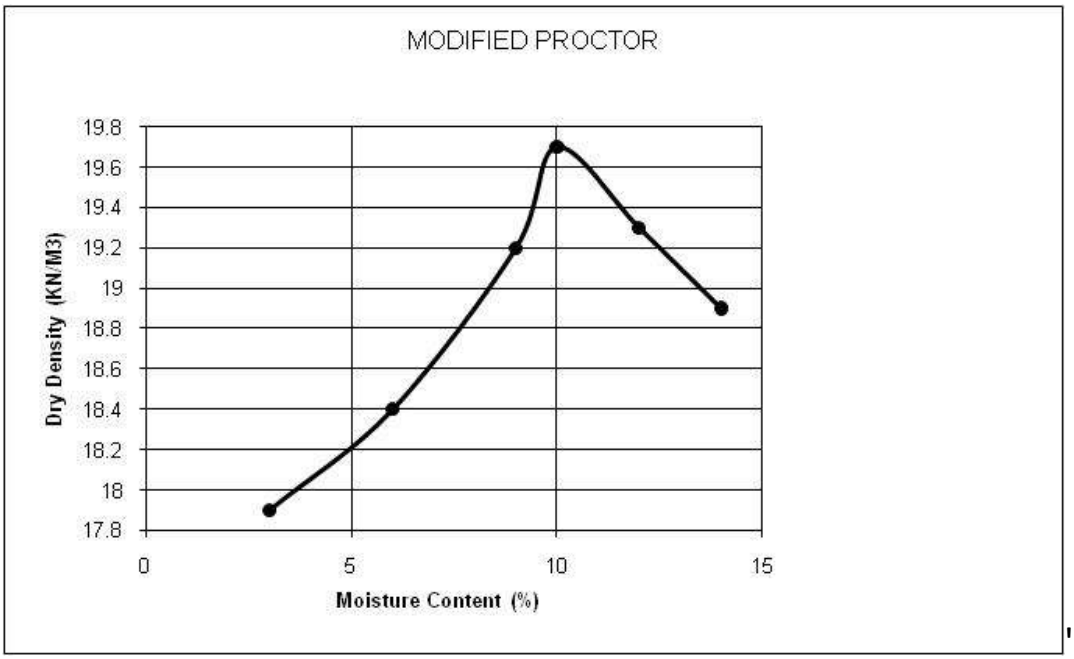
BH-03'

Depth'–'0.50m'

Optimum'moisture'content:'10.5%'

Maximum'dry'density:'19.9'kN'/m3'
Soil'type:Silty'Sand''

MODIFIEDPROCTORE



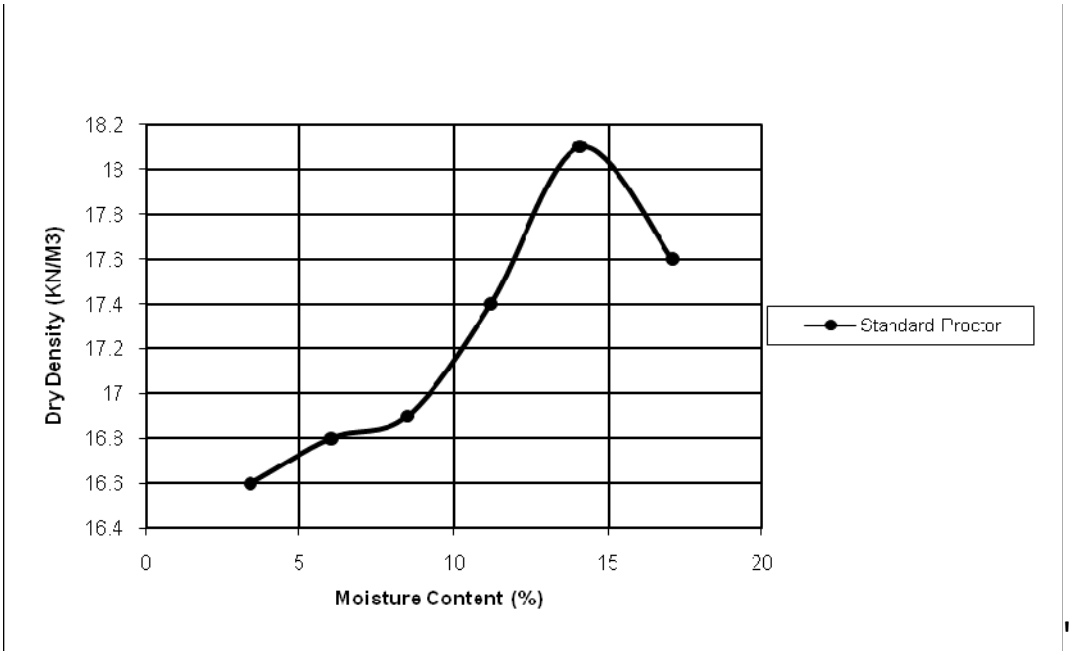
BH-04'

Depth'–'0.50m'

Optimum'moisture'content:'10%'

Maximum'dry'density:'19.7'kN'/m3'
Soil'type:Silty'Sand'

STANDARD'PROCTOR'



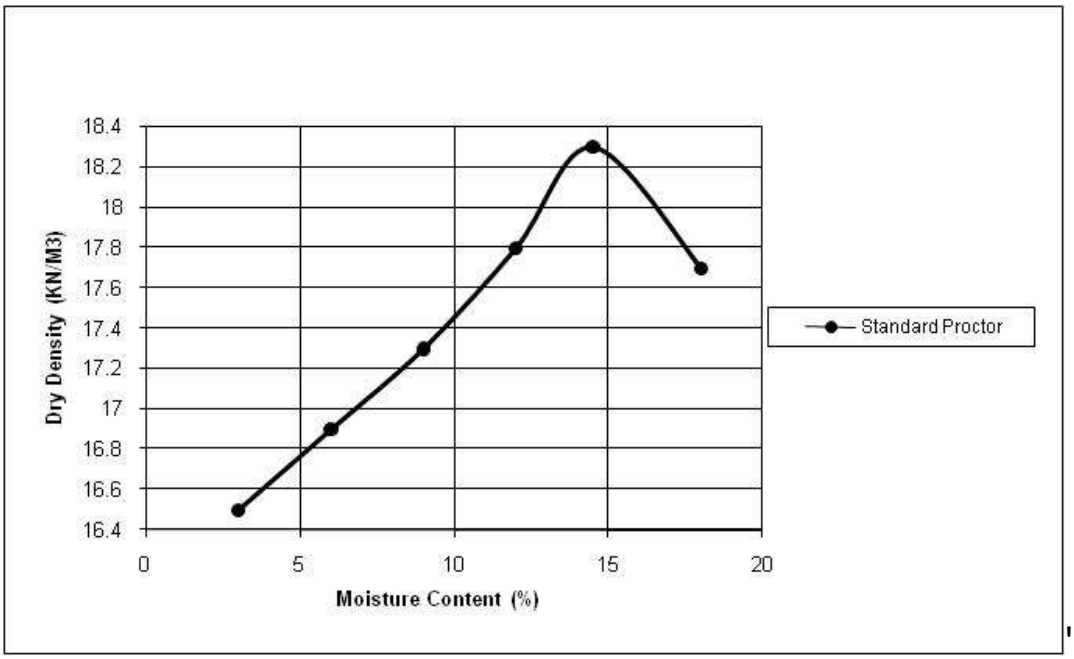
BH-01'

Depth'–'0.50m'

Optimum'moisture'content:'14.1%'

Maximum'dry'density:'18.1'kN'/m3'
Soil'type:Silty'Sand'

STANDARD'PROCTOR'



BH-02'

Depth'–'0.50m'

Optimum'moisture'content:'14.5%'

Maximum'dry'density:'18.3'kN'/m3'
Soil'type:Silty'Sand'

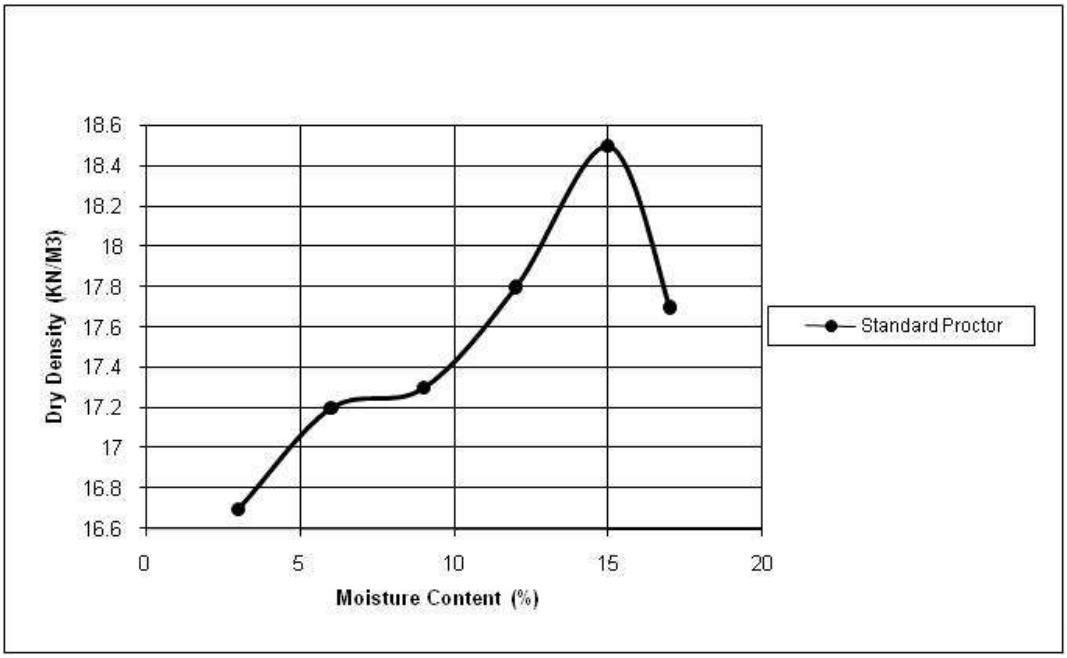
'

'

STANDARD'PROCTOR'

'

'



'

'

'

BH-03'

Depth'–'0.50m'

Optimum'moisture'content:'15.0%'

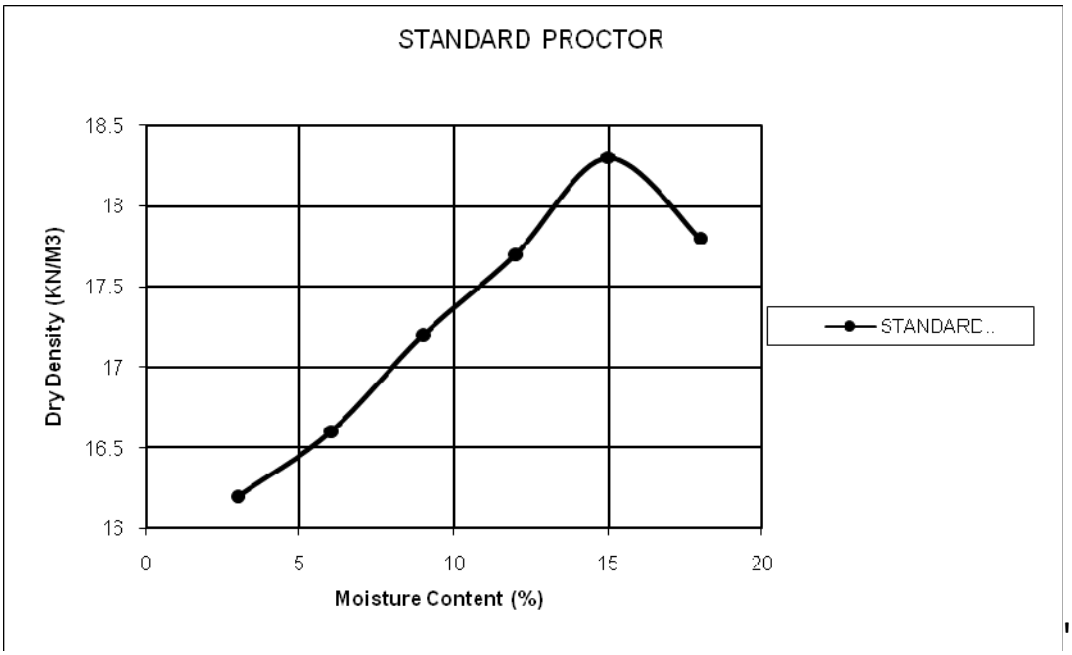
Maximum'dry'density:'18.5'kN'/m3'
Soil'type:Silty'Sand'

'

'

'

STANDARD'PROCTOR'



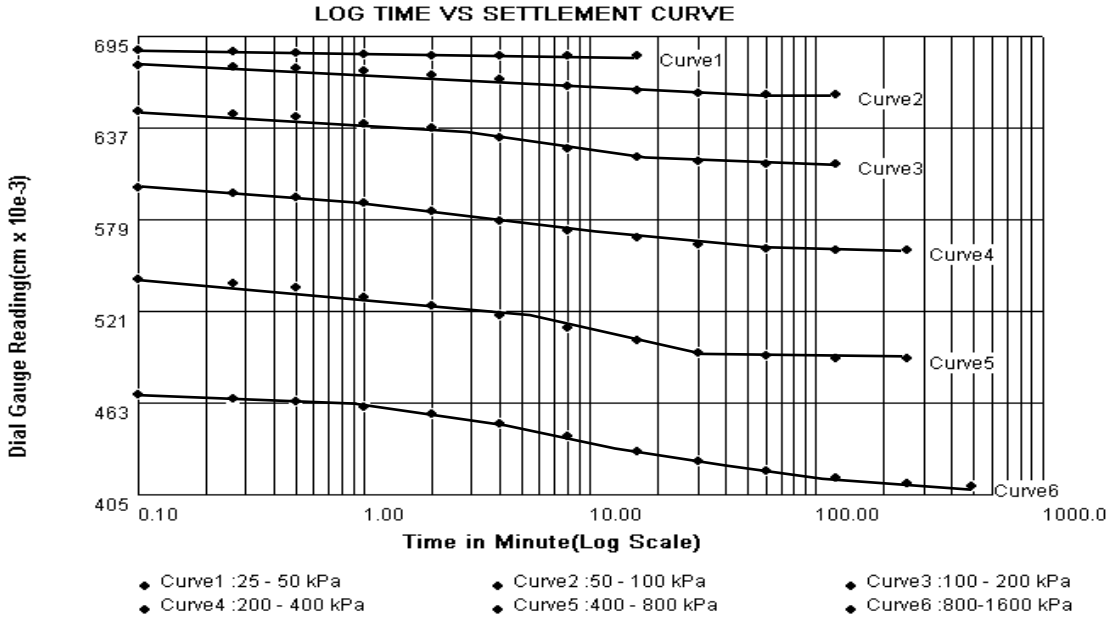
BH-04'

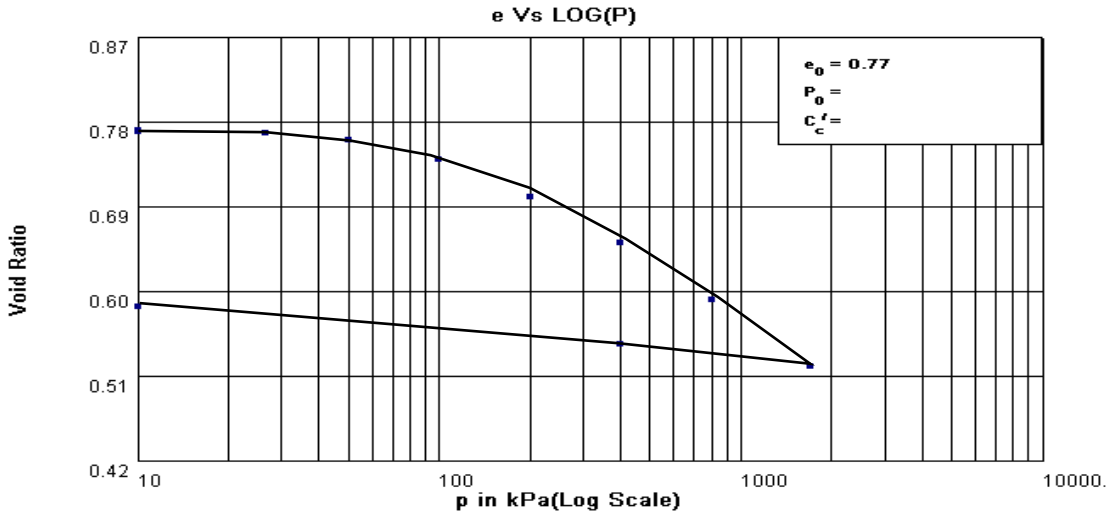
Depth'–'0.50m'

Optimum'moisture'content:'15.0%'

Maximum'dry'density:'18.3'kN'/m3'
Soil'type:Silty'Sand'

Borehole No. BH-1 Depth (m): 3.00-3.45





CONSOLIDATION TEST CURVES

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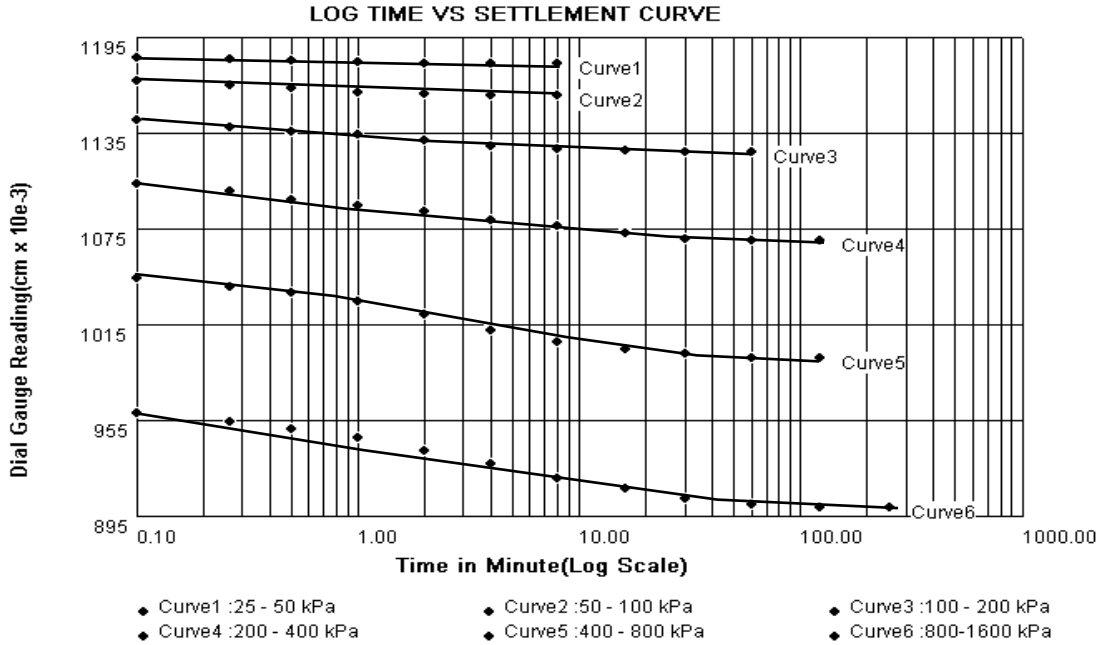
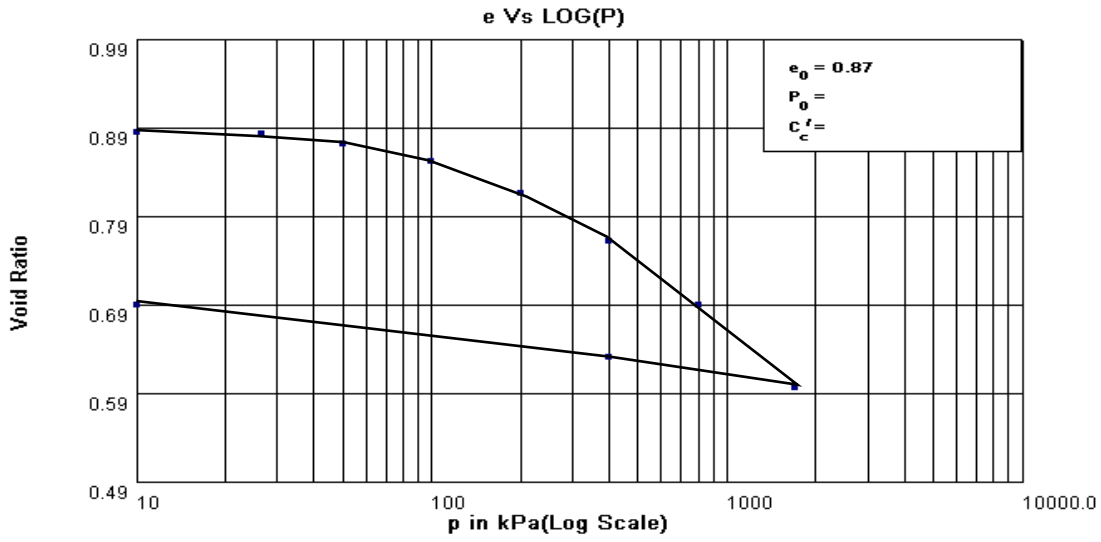
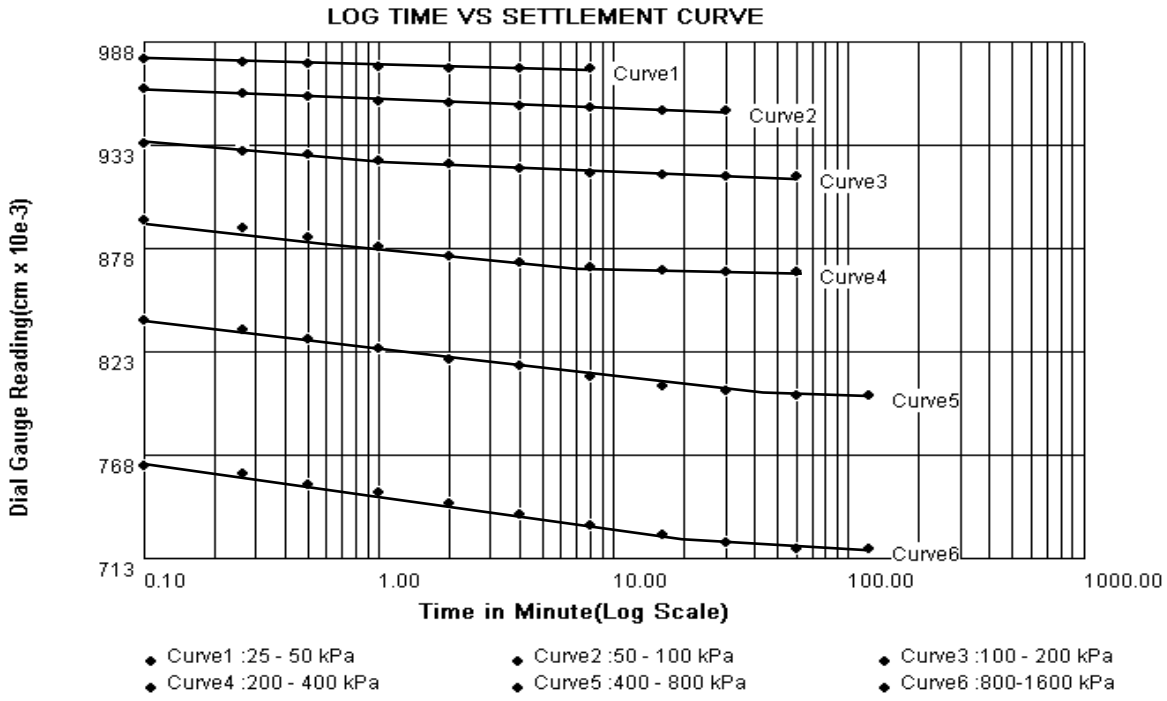
Borehole No. BH2 Depth (m): 6.00-6.45

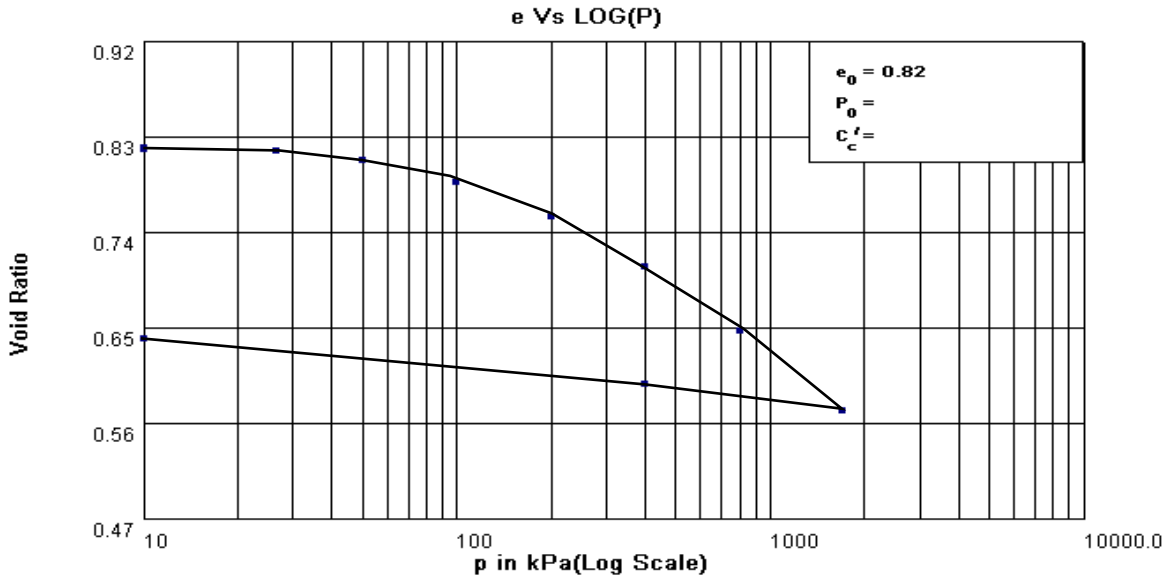




CONSOLIDATION TEST CURVES

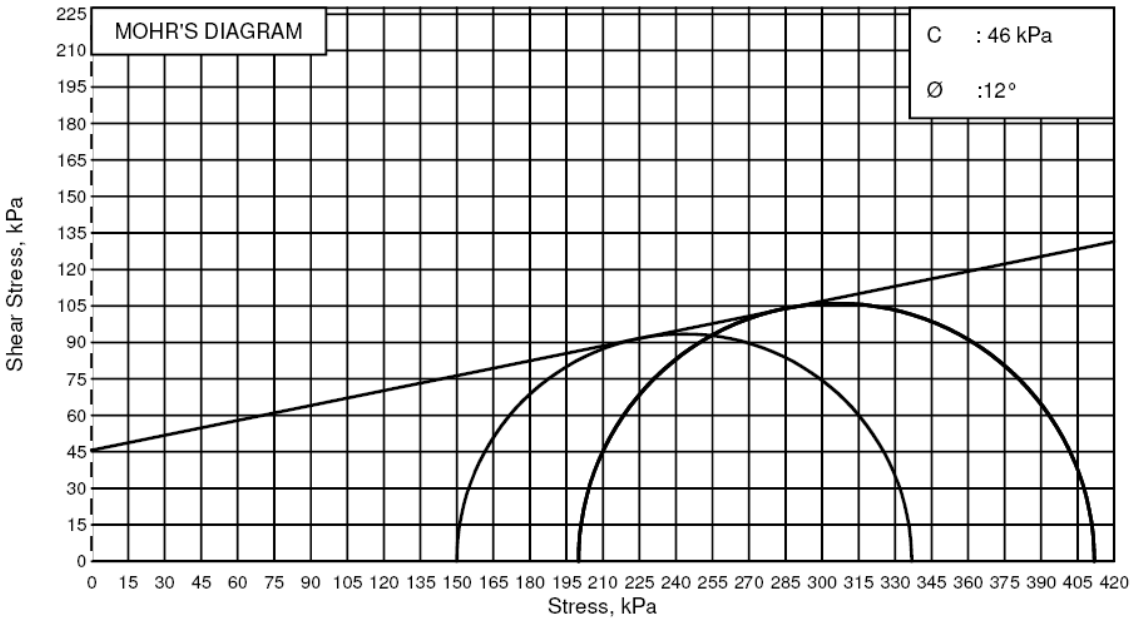
Borehole No. : D3 Depth (m): 4.50-4.95





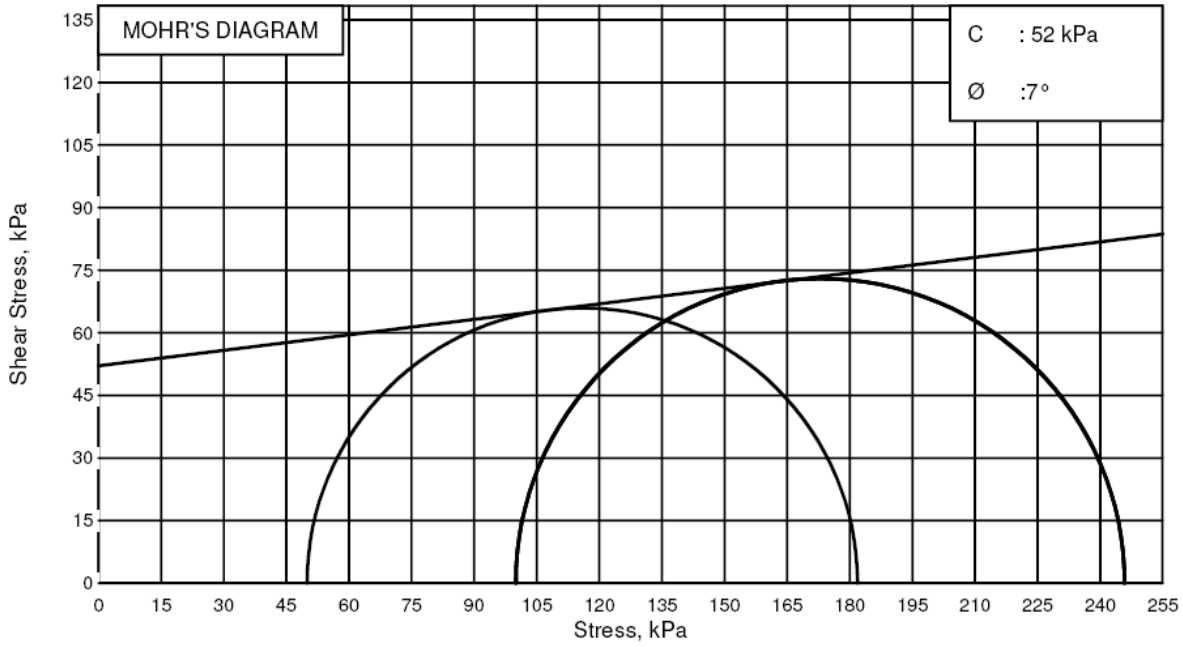
CONSOLIDATION TEST CURVES

BH-01 **Depth: 3.00-3.45m**



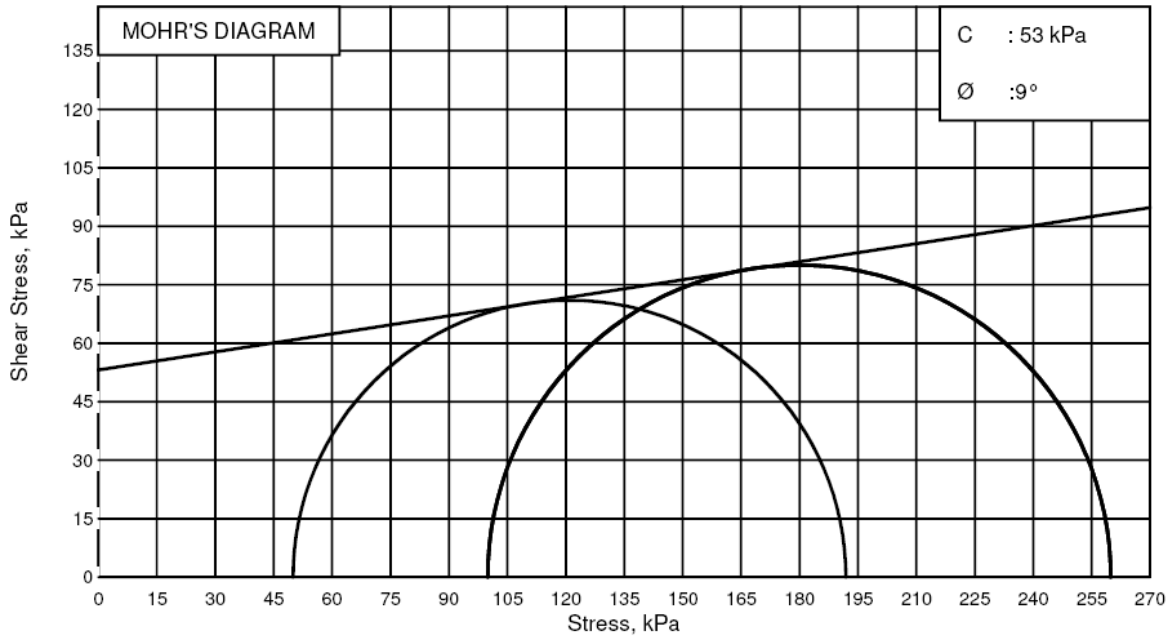
TRIAXIAL TEST CURVES

BH-02 **Depth: 3.00-3.45m**



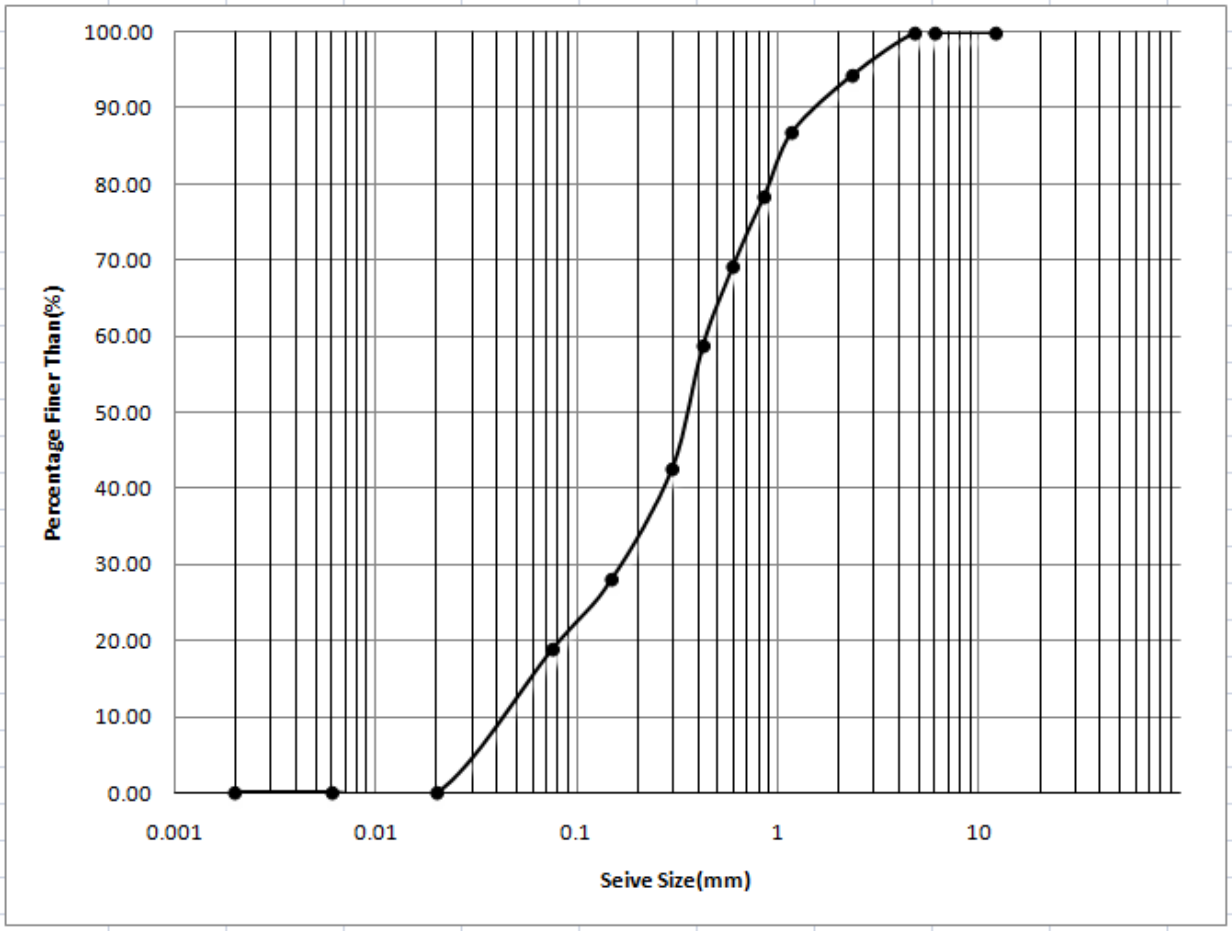
TRIAXIAL TEST CURVES

BH-03 **Depth: 4.50-4.95m**



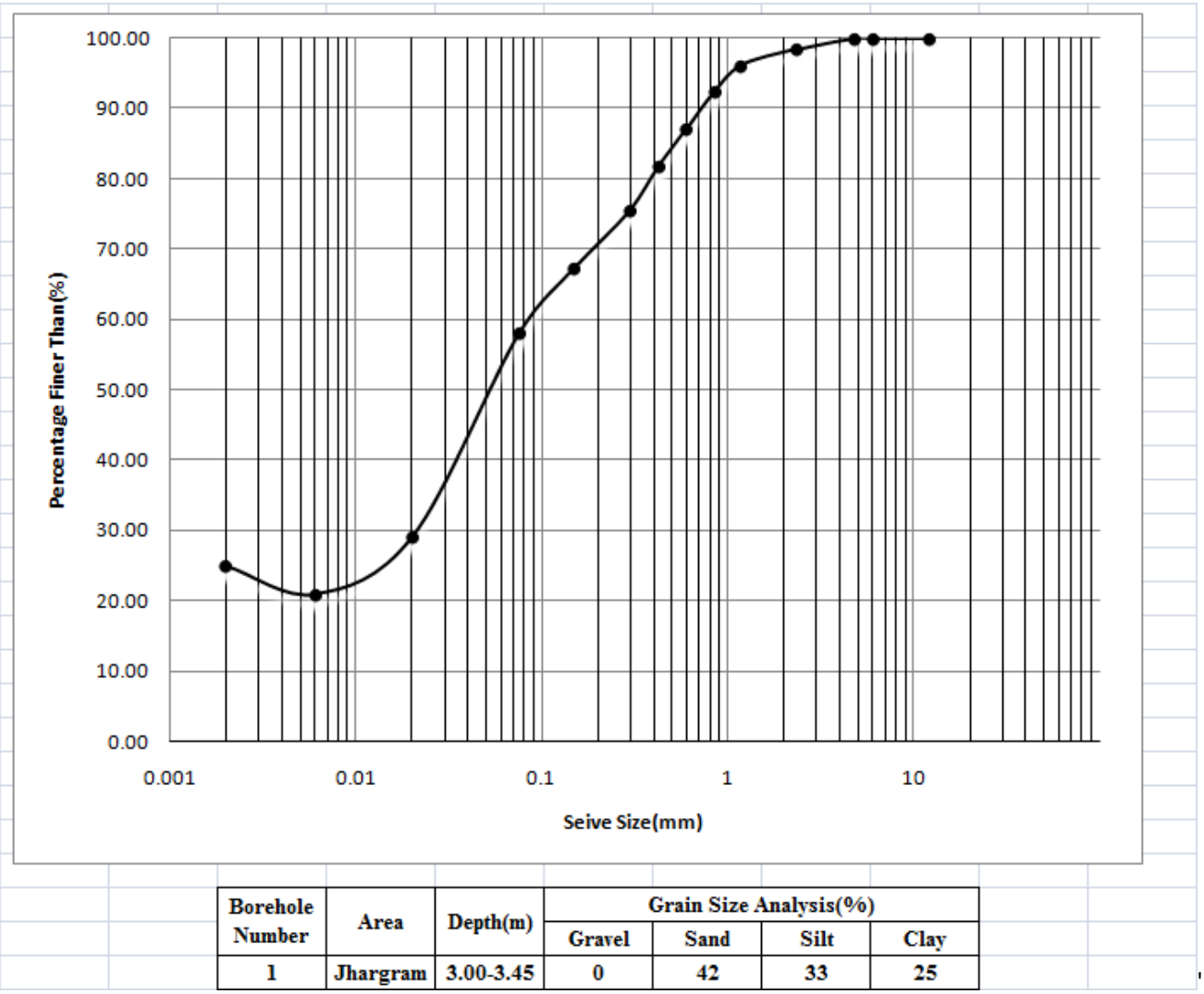
TRIAXIAL TEST CURVES

GRAIN SIZE CURVE



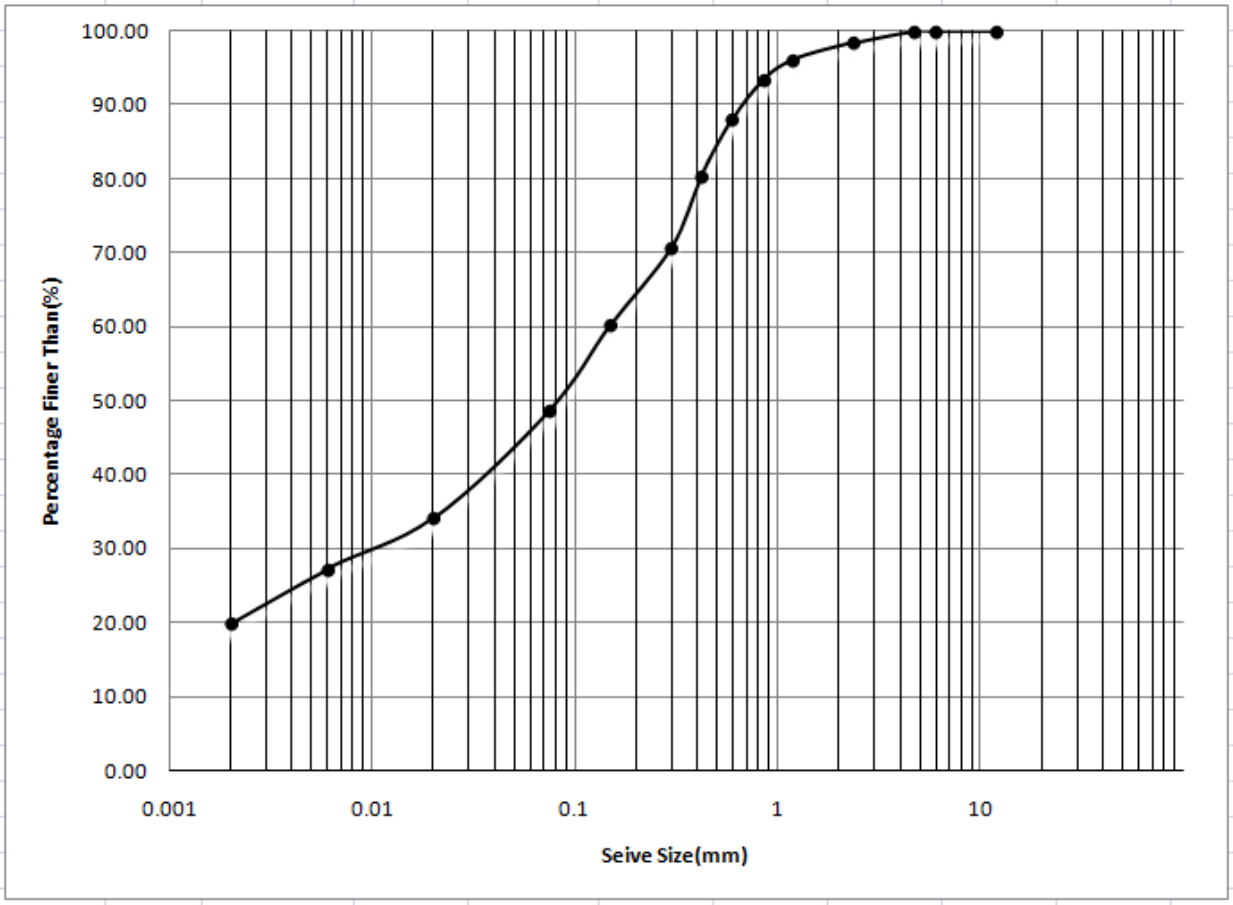
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	1.50-1.95	0	81	19	0

GRAIN SIZE CURVE



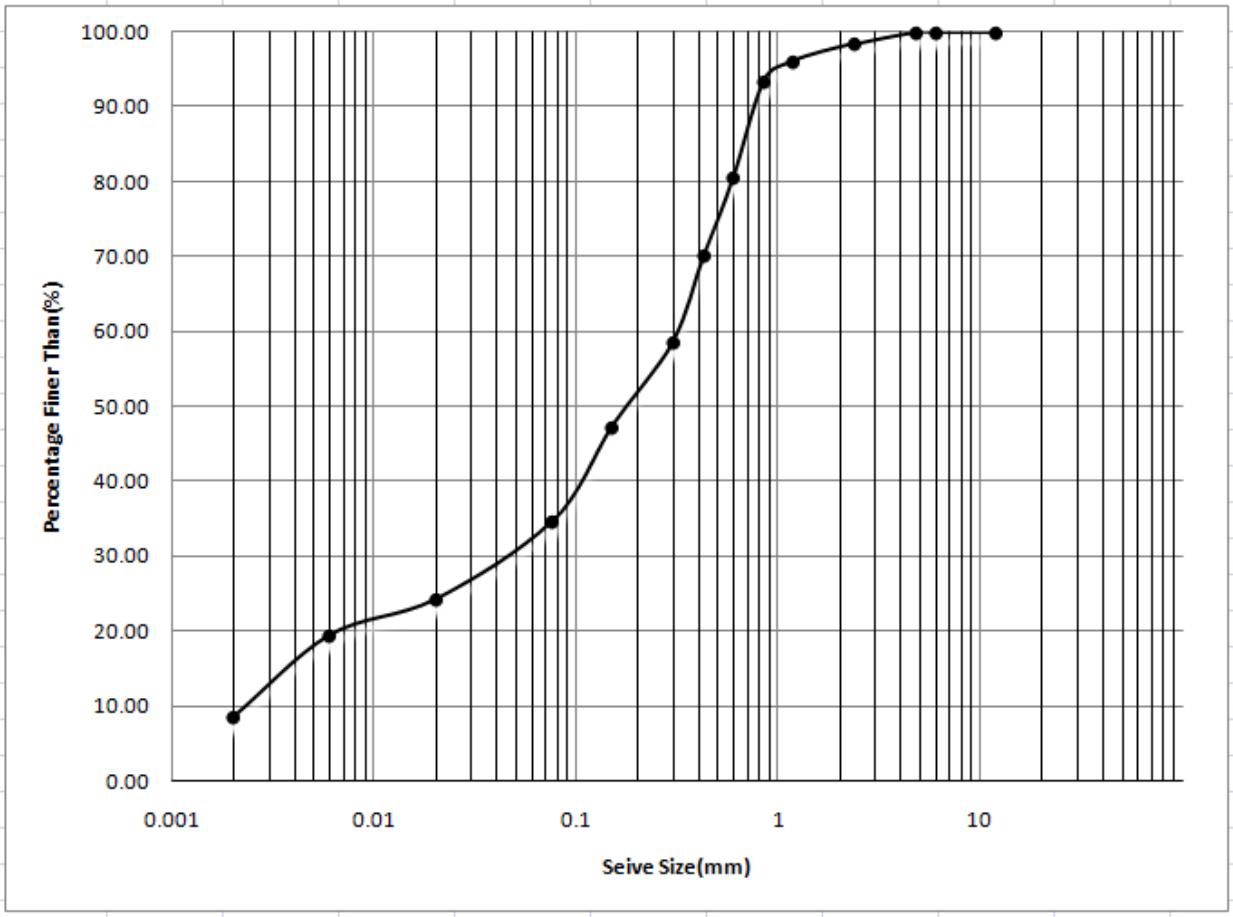
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	3.00-3.45	0	42	33	25

GRAIN SIZE CURVE



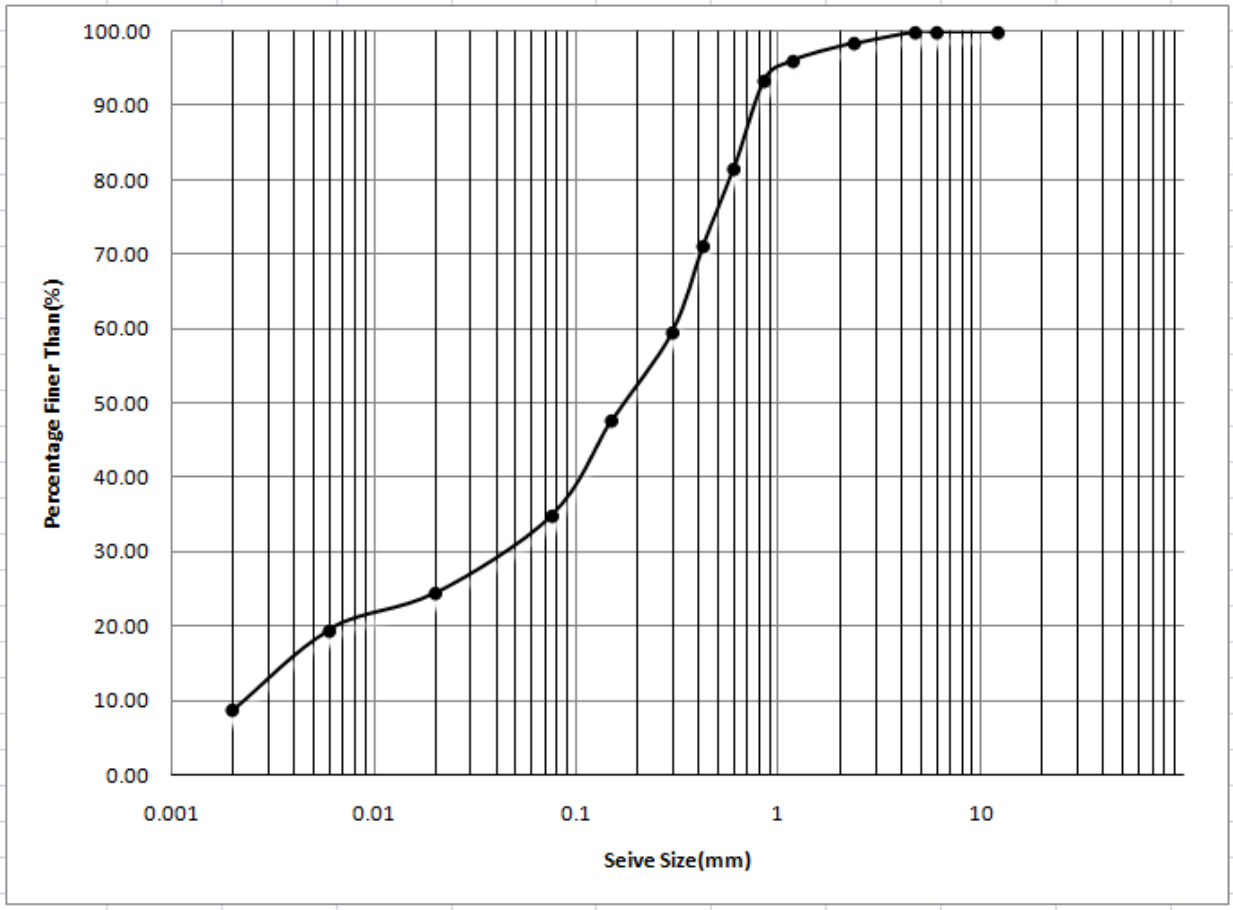
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	9.00-9.45	0	51	29	20

GRAIN SIZE CURVE



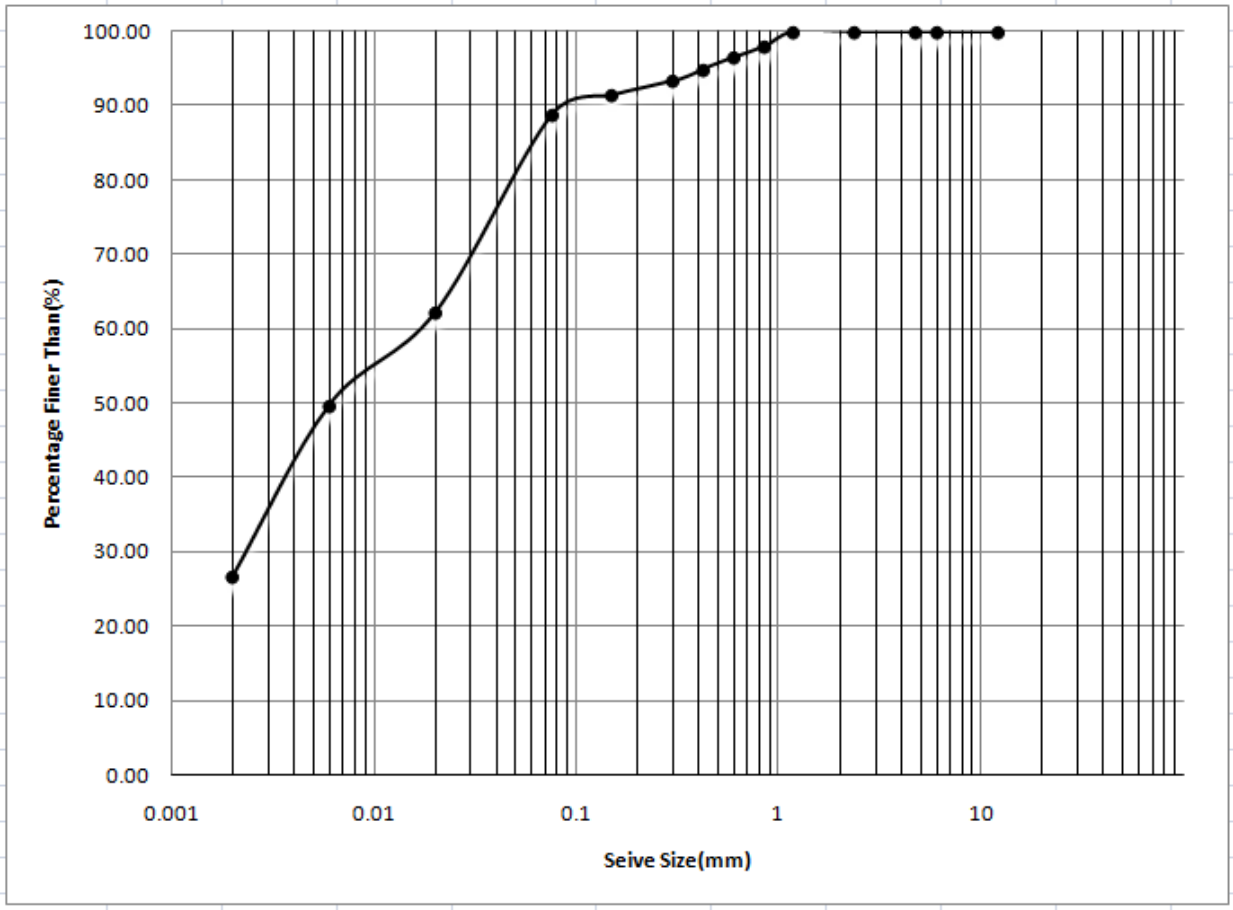
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	15.00-15.45	0	65	26	8

GRAIN SIZE CURVE



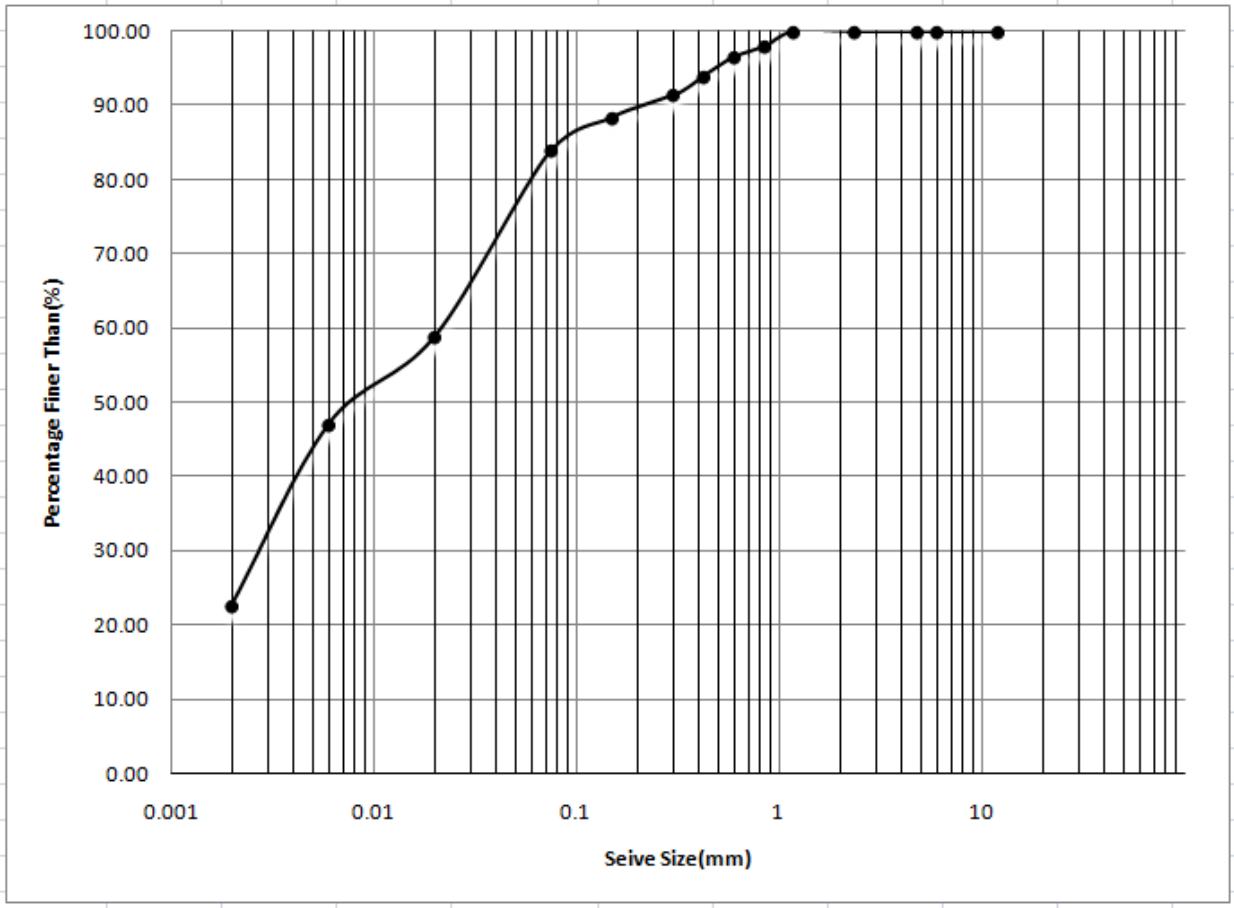
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	21.00-21.45	0	65	26	9

GRAIN SIZE CURVE



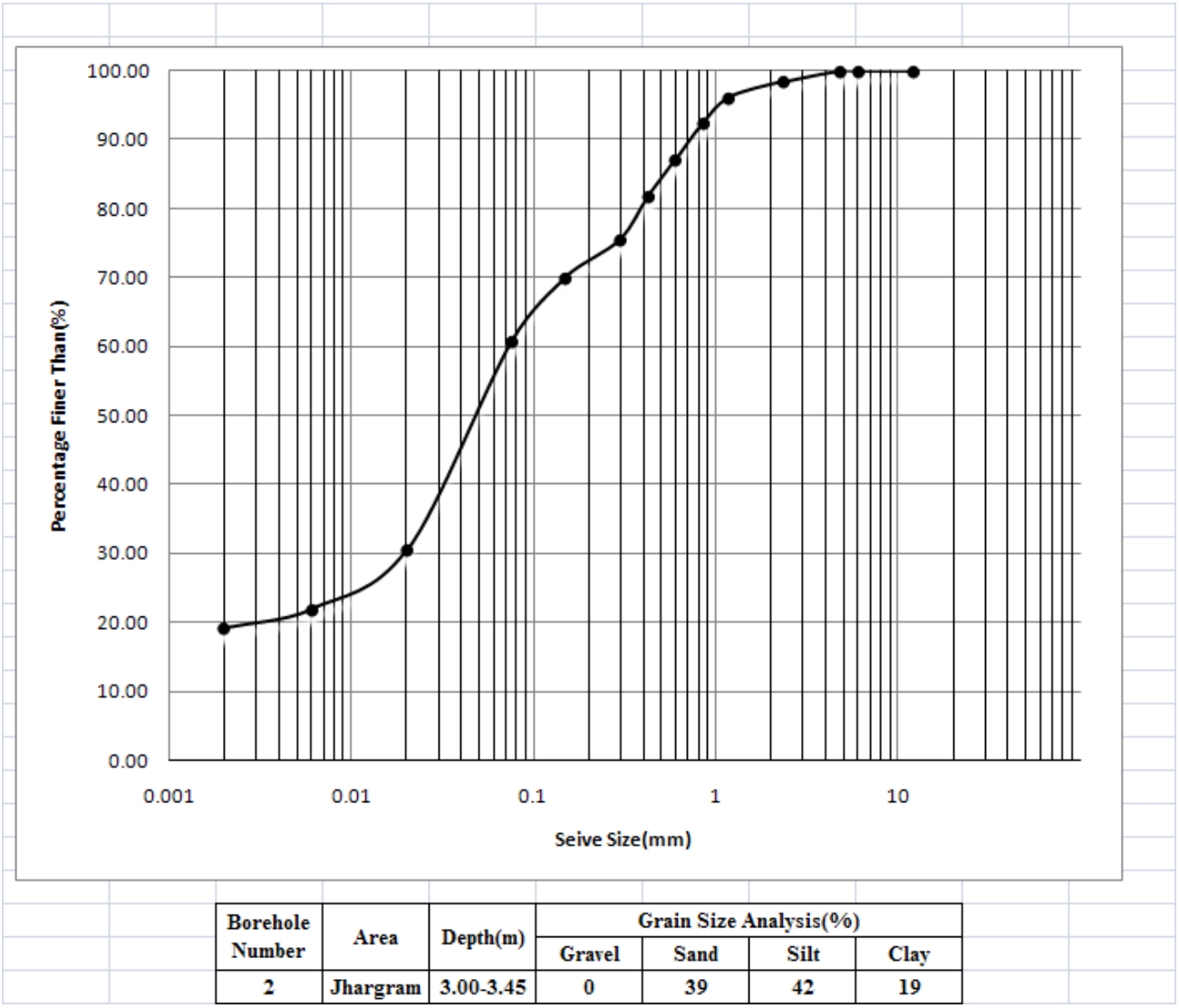
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	30.00-30.45	0	11	62	27

GRAIN SIZE CURVE



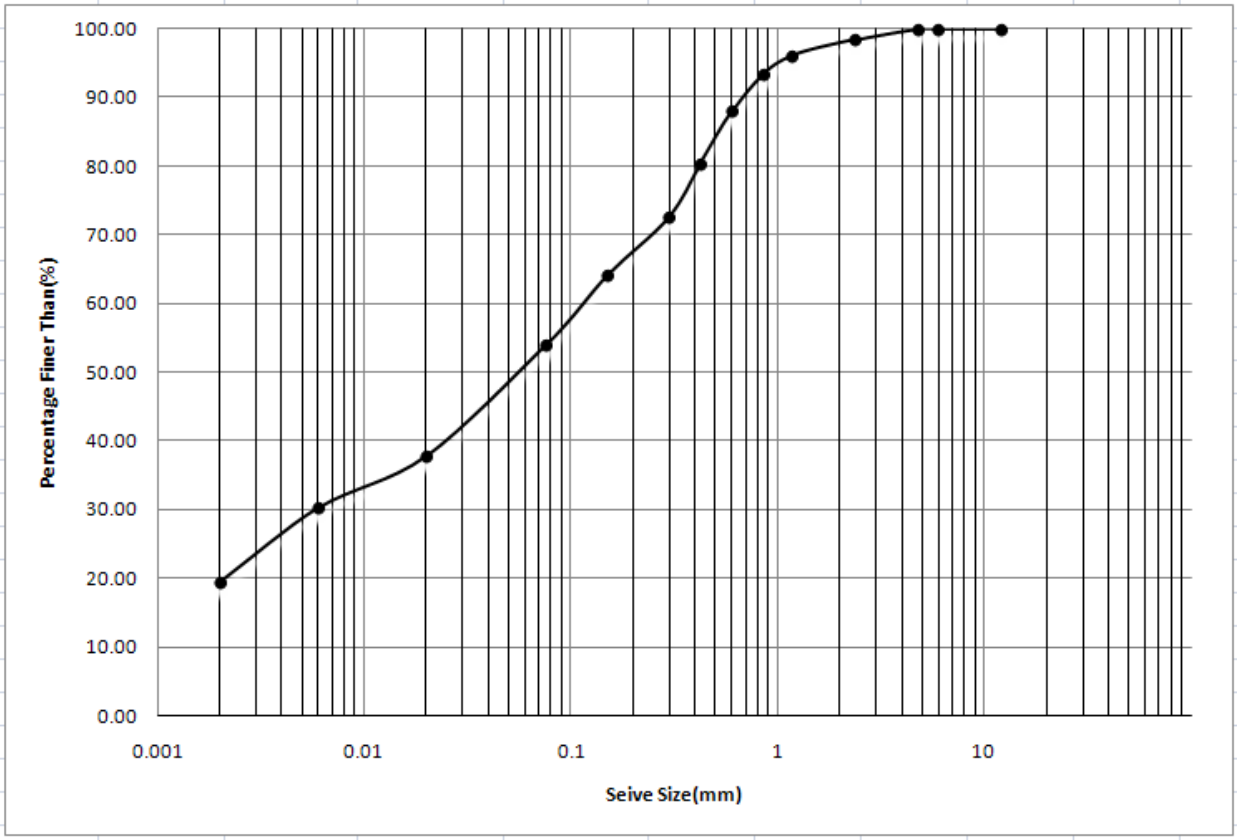
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
1	Jhargram	39.00-39.45	0	16	61	23

Grain Size Curve



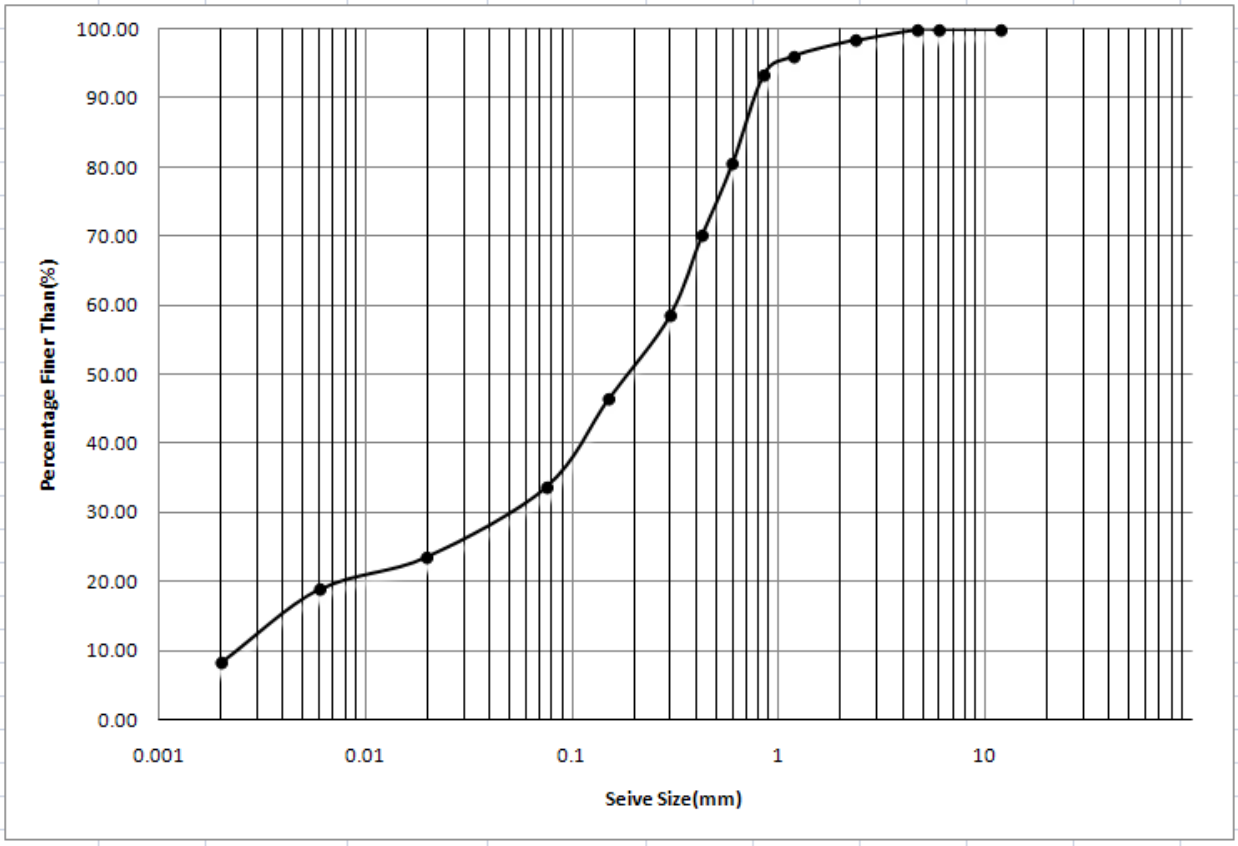
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	3.00-3.45	0	39	42	19

Grain Size Curve



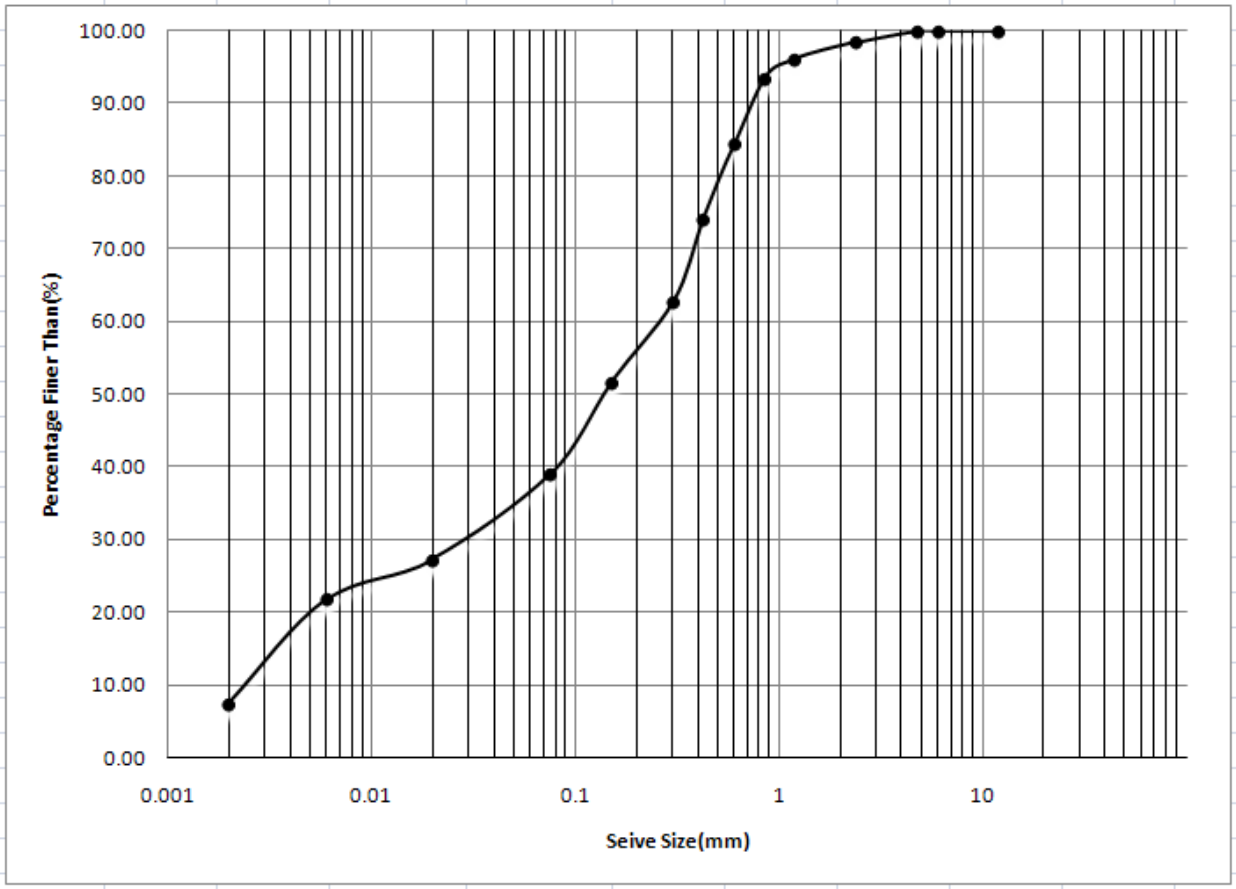
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	12.00-12.45	0	46	35	19

Grain Size Curve



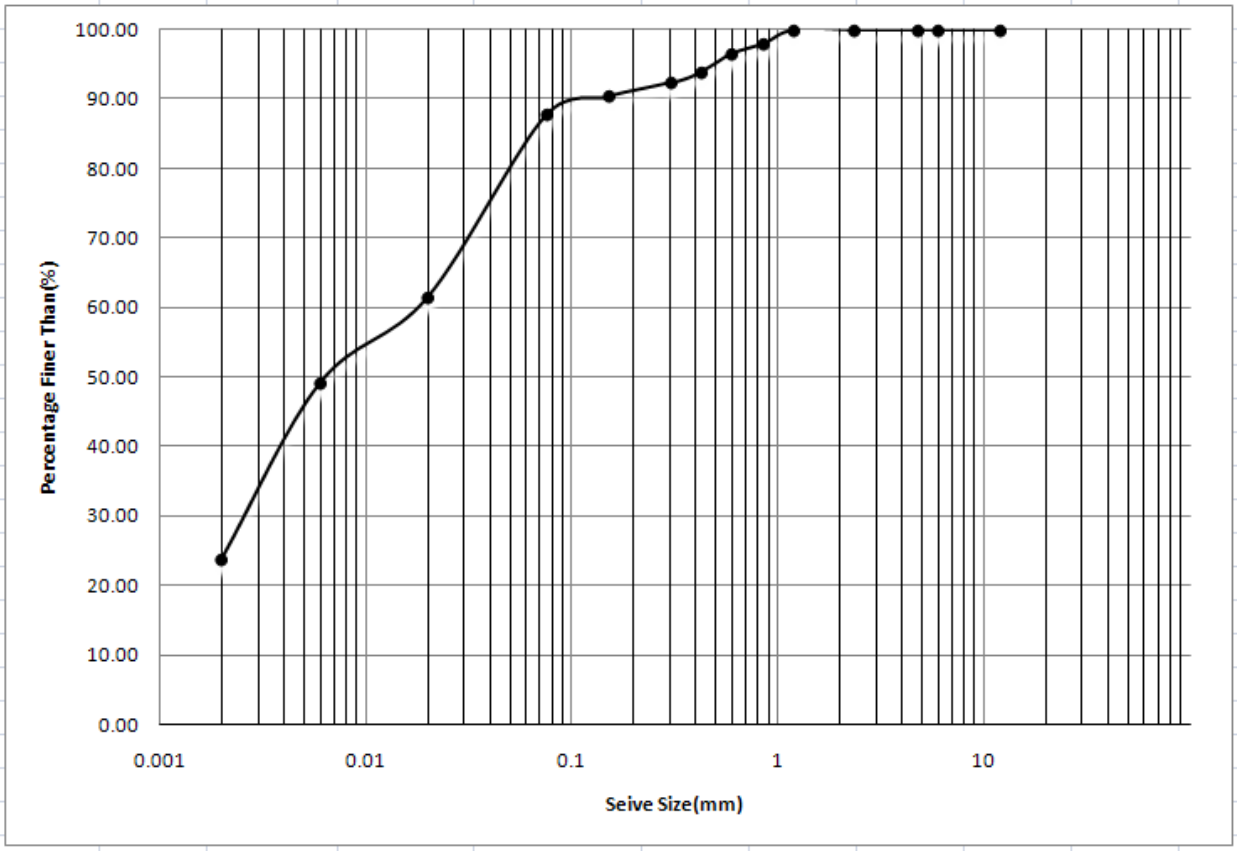
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	16.50-16.95	0	66	26	8

Grain Size Curve



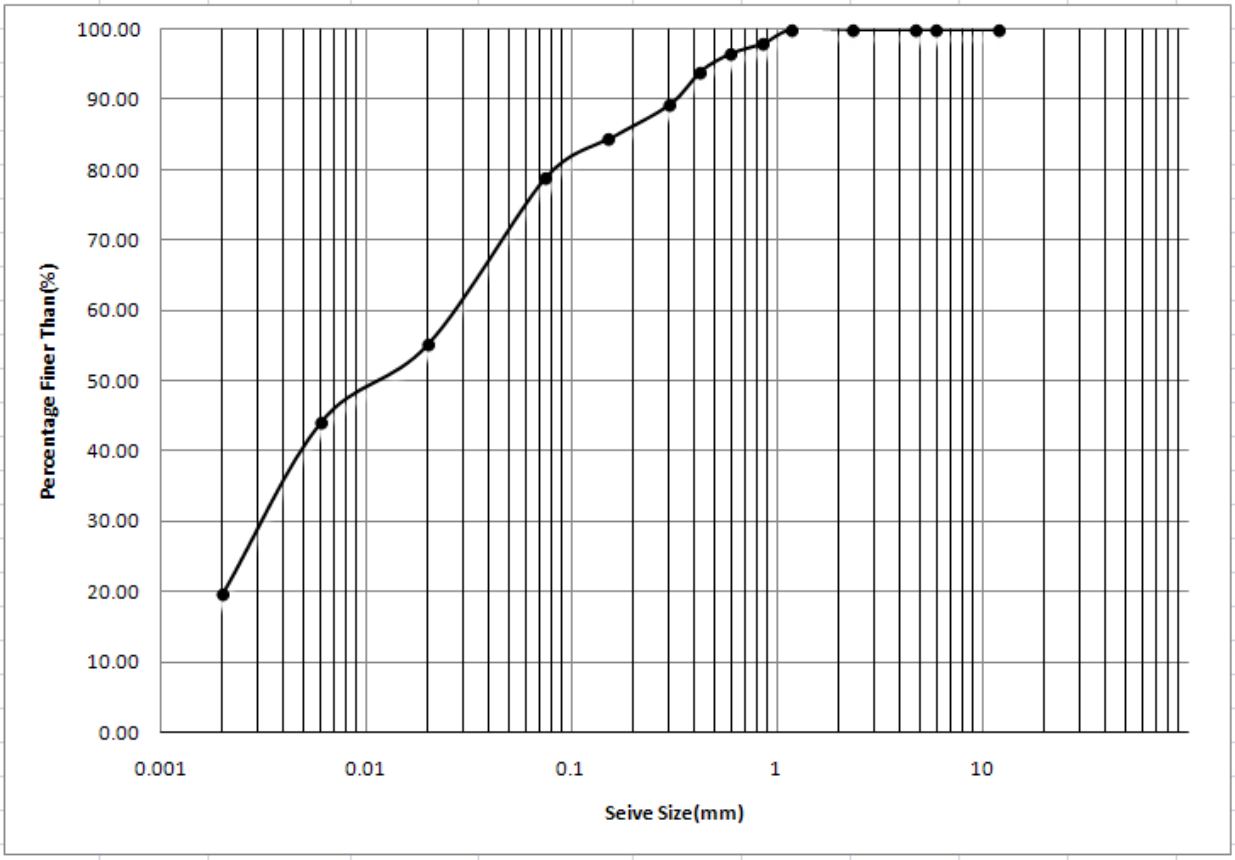
Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	18.00-18.45	0	61	32	7

Grain Size Curve



Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	24.00-24.45	0	12	64	24

Grain Size Curve



Borehole Number	Area	Depth(m)	Grain Size Analysis(%)			
			Gravel	Sand	Silt	Clay
2	Jhargram	36.00-36.45	0	21	59	20

SECTION 5.3

Site-wise Area & Floor Statement of the 4 (Four) Medical Colleges

Section 5. 3 : Sitewise Area & Floor Statement of the 4 (Four) Medical Colleges

Category	Description	Required area in Sqm.				Floors	Consideration	Proposed type of super structure	Proposed type of foundation	Consideration for foundation
		Arambagh	Barasat	Jhargram	Tamluk					
Academic Block	Academic Block including Animal House	26400	26400	26400	26400	G+6	Consider 150 intake.	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Pile foundation	G+6
Sub Total		**26400**	**26400**	**26400**	**26400**		-	-	-	-
Boys Hostel Building for Students, Interns and Residents	Student Hostel	5206	5206	5206	5206	G+9	230 Beds	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Pile foundation	G+9
	Interns Hostel	1925	1925	1925	1925		75 Beds			
	Residents Hostel	1369	1369	1369	1369		50 Beds			
Area =		**8500**	**8500**	**8500**	**8500**		-	-	-	-
Girls Hostel Building for Students, Interns and Residents	Student Hostel	5206	5206	5206	5206	G+9	230 Beds	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Pile foundation	G+9
	Interns Hostel	1925	1925	1925	1925		75 Beds			
	Residents Hostel	1369	1369	1369	1369		50 Beds			
Area =		**8500**	**8500**	**8500**	**8500**		-	-	-	-
Sub Total for Two Hostel Block (Boys and Girls)		**17000**	**17000**	**17000**	**17000**		-	-	-	-
Staff Quarter	Nurses Accommodation	3090	3090	3090	3090	G+6	100 Nurses Accommodation (Minnimum Corridor width 2.1 M)	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Pile foundation	G+9
	Teaching Staff Quarter	4600	4600	4600	4600	G+9	24 Flats, 140 Sqm/Flat (Minnimum Corridor width 2.1 M) & 16 Nos guest room at 1st floor			G+9
	Non-teaching Staff Quarter	5560	5560	5560	5560	G+9	54 Flats, 80 Sqm/Flat (Minnimum Corridor width 2.1 M)			G+9
Sub Total		**13250**	**13250**	**13250**	**13250**		-	-	-	-

Section 5. 3 : Sitewise Area & Floor Statement of the 4 (Four) Medical Colleges

Category	Description	Required area in Sqm.				Floors	Consideration	Proposed type of super structure	Proposed type of foundation	Consideration for foundation
		Arambagh	Barasat	Jhargram	Tamluk					
Other	Central Workshop & Maintenance office.	430	430	430	430	G+1	-	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Suitable foundation design as per soil test report	G+2
	Garbage Store	90	90	90	90	G	-	With GCI sheet roofing.		G
Sub Total		**520**	**520**	**520**	**520**		-	-	-	-
OPD	OPD Building	11000	11000	11000	11000	G+9	(Minnimum Corridor width 4.00 M to 5.00M)	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Pile foundation	G+9
Electrical Substation	Substation	500	500	500	500	G+1	-	RCC frame structure with minimum 250mm thick outer wall & 150mm thick internal wall.	Suitable foundation design as per soil test report	G+2
Sub Total		**11500**	**11500**	**11500**	**11500**		-	-	-	-
Total	**Total Builtup area in SQM.**	**68670**	**68670**	**68670**	**68670**		-	-	-	-
	Total Builtup area in SQFT.	**739164**	**739164**	**739164**	**739164**		-	-	-	-

SECTION 5.4A

Schedule of finishes

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
	ACADEMIC BUILDING & OTHER BUILDINGS		
1	**ENTRANCE LOBBY**	Designed Granite Stone flooring with borders	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
2	**RECORDS & STORE ROOM**	Kota Stone	Acrylic emulsion Paint upto soffit of slab
3	**COMMON ROOM (Boys and Girls)**	Premium quality Double Charged Designer Vitrified tiles with or without spacer as per approved design.	Acrylic Emulsion paint upto soffit of the slab
4	**KITCHEN BLOCK**	Ceramic tiles	Dado +Acrylic Emulsion paint upto soffit of the slab
5	**OTHER ROOMS**	Premium quality Double Charged Designer Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
6	**CORRIDOR & LOBBY**	Granite Stone with borders in different shade	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
7	**LIFT LOBBY**	Granite Stone with borders in different shade	Acrylic Emulsion paint upto soffit of the slab
8	**BODY STORAGE ROOM WITH STORAGE TANK**	Full body Vitrified tiles	Dado + Acrylic emulsion paint upto soffit of slab
9	**RECEPTION/ WAITING**	Granite Stone with borders in different shade	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
10	**STAIRCASE WITH SS HAND RAIL**	Granite Stone with borders in different shade	Dado + Acrylic emulsion paint above & upto soffit of the slab
11	**ACCOUNT OFFICER, TUTOR, DEMONSTRATOR, DOCTOR'S**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Acrylic Emulsion paint upto soffit of the slab
12	**PRINCIPAL & MSVP ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Decorative wall panelling with teak wood veneered & Acrylic emulsion paint upto 100mm high above false ceiling as required with Acrylic Distemper paint above.
13	**HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR, ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
14	**COLLEGE COUNCIL ROOM**	Stone Polymer Composite (SPC) tiles flooring	Decorative wall panelling with teak wood veneered & Acrylic emulsion paint upto 100mm high above false ceiling as required with Acrylic Distemper paint above.

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
15	**All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM**	Premium quality Double Charged Designer Vitrified tiles	Dado +Acrylic Emulsion paint upto soffit of the slab
16	**ALL LIBRARY AREA**	Premium quality Double Charged Designer Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
17	**LECTURE HALL/THEATRE**	Kota Stone	Acoustic Wall Panelling upto false ceiling & Putty over plaster above false ceiling
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Steps-Polished granite stone. Ramp area-Flamed finish granite stone granite stone	-
19	**TOILETS**	Ceramic tiles	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	IPS flooring	Acrylic Distemper Paint upto soffit of the false ceiling
21	**LIFT WELL**	-	Plastered wall with white cement wash
22	**STRONG ROOM**	IPS flooring	
23	**LIFT MACHINE ROOM**	IPS flooring	
24	**UTILITY SHAFT**	IPS flooring	Plastered wall with white cement wash
25	**TERRACE**	Roof Treatment	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
	BOYS & GIRLS HOSTEL BUILDING		
1	**ENTRANCE LOBBY**	Designed Granite Stone flooring with borders	Acrylic Emulsion paint upto soffit of the slab
2	**CORRIDOR & LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
3	**LIFT LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
4	**ROOMS**	Premium quality Double Charged Designer Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
5	**KITCHEN BLOCK**	Ceramic tiles	Dado +Acrylic Emulsion paint upto soffit of the slab
6	**DINING HALL**	Combination of Kota Stone & Black Stone	Dado +Acrylic Emulsion paint upto soffit of the slab
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	IPS flooring	Acrylic Distemper Paint upto soffit of the false ceiling
8	**LIFT WELL**	-	-
9	**LIFT MACHINE ROOM**	IPS flooring	Acrylic distemper upto the soffit of slab
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Steps-Polished granite stone. Ramp area-Flamed finish granite stone granite stone	-
11	**STAIRCASE WITH SS HAND RAIL**	Granite Stone	Dado + Acrylic emulsion paint above & upto soffit of the slab
12	**TOILETS**	Ceramic tiles	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
13	**UTILITY SHAFT**	IPS flooring	Plastered wall with white cement wash

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
14	**TERRACE**	Roof Treatment	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING		
1	**ENTRANCE LOBBY**	Designed Granite Stone flooring with borders	Acrylic Emulsion paint upto soffit of the slab
2	**CORRIDOR & LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
3	**LIFT LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
4	**ROOMS**	Premium quality Double Charged Designer Vitrified tiles with borders in different shade	Acrylic Emulsion paint upto soffit of the slab
5	**KITCHEN BLOCK**	Kota stone slab	Dado +Acrylic Emulsion paint upto soffit of the slab
6	**DINING HALL**	Combination of Kota Stone & Black Stone	Dado +Acrylic Emulsion paint upto soffit of the slab
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	IPS flooring	Acrylic Distemper Paint upto soffit of the false ceiling
8	**LIFT WELL**	-	-
9	**LIFT MACHINE ROOM**	IPS flooring	-
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Steps-Polished granite stone. Ramp area-Flamed finish granite stone granite stone	-
11	**STAIRCASE WITH SS HAND RAIL**	Granite Stone	Dado + Acrylic emulsion paint above & upto soffit of the slab
12	**TOILETS**	Ceramic tiles	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
13	**UTILITY SHAFT**	IPS flooring	Plastered wall with white cement wash

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
14	**TERRACE**	Roof Treatment	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING		
1	**ENTRANCE LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
2	**CORRIDOR & LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
3	**LIFT LOBBY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
4	**DRAWING ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Acrylic Emulsion paint upto soffit of the slab
5	**BED ROOMS**	Premium quality Double Charged Designer Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
6	**KITCHEN**	Ceramic tiles	Dado +Acrylic Emulsion paint upto soffit of the slab
7	**DINING ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Dado +Acrylic Emulsion paint upto soffit of the slab
8	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	IPS flooring	Acrylic Distemper Paint upto soffit of the false ceiling
9	**LIFT WELL**	-	-
10	**LIFT MACHINE ROOM**	IPS flooring	Acrylic distemper upto the soffit of slab
11	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Steps-Polished granite stone. Ramp area-Flamed finish granite stone granite stone	-
12	**STAIRCASE WITH SS HAND RAIL**	Granite Stone	Dado + Acrylic emulsion paint above & upto soffit of the slab
13	**TOILETS**	Ceramic tiles	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
14	**UTILITY SHAFT**	IPS flooring	Plastered wall with white cement wash
15	**TERRACE**	Roof Treatment	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
	OPD BUILDING		
1	**ENTRANCE LOBBY**	Designed Granite Stone flooring with borders	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
2	**CORRIDOR & LOBBY**	Granite Stone with borders in different shade	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
3	**LIFT LOBBY**	Granite Stone with borders in different shade	Acrylic Emulsion paint upto soffit of the slab
4	**OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Acrylic Emulsion paint upto soffit of the slab
5	**LABORATORY, SAMPLE COLLECTION ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Dado +Acrylic Emulsion paint upto soffit of the slab
6	**TOILETS**	Ceramic tiles	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
7	**SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Acrylic Emulsion paint upto soffit of the slab
8	**RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION**	Granite Stone with borders in different shade	Dado + Acrylic emulsion paint upto 100mm high above false ceiling and Acrylic Distemper paint above
9	**PHARMACY**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
10	**X-RAY ROOM, CITY SCAN SHOULD IN CONFIRMITY WITH AERB REGULATION**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
11	**DARK ROOM**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
12	**USG ROOM, MRI ROOM ROOM**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
13	**ECO ROOM, EEG ROOM, ECG ROOM**	Full body Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	FLOORING	WALL FINISH
		Description	Description
14	**STAIRCASE WITH SS HAND RAIL**	Granite Stone	Dado + Acrylic emulsion paint above & upto soffit of the slab
15	**OT AREA**	Designed Granite Stone flooring	Granite clading upto ceiling
16	**RECOVERY ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Dado +Acrylic Emulsion paint upto soffit of the slab
17	**AUDIOMETRY ROOM**	Premium quality Double Charged Designer Vitrified tiles	Acoustic Wall Panelling upto false ceiling & Putty over plaster above false ceiling
18	**OFFICE**	Premium quality Double Charged Designer Vitrified tiles	Acrylic Emulsion paint upto soffit of the slab
19	**DAY CARE WARD**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Dado +Acrylic Emulsion paint upto soffit of the slab
20	**BABY CARE ROOM**	Premium quality Double Charged Designer Vitrified tiles with granite stone borders	Dado +Acrylic Emulsion paint upto soffit of the slab
21	**RECORDS & STORE ROOM**	Kota Stone	Acrylic emulsion Paint upto soffit of slab
22	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	IPS flooring	Acrylic Distemper Paint upto soffit of the false ceiling
23	**UTILITY SHAFT**	IPS flooring	Plastered wall with white cement wash
24	**TERRACE**	Roof Treatment	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
	ACADEMIC BUILDING & OTHER BUILDINGS			
1	**ENTRANCE LOBBY**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint over putty & primer.
2	**RECORDS & STORE ROOM**	-	150mm high	Acrylic emulsion paint
3	**COMMON ROOM (Boys and Girls)**	-	150mm high	Acrylic emulsion paint
4	**KITCHEN BLOCK**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
5	**OTHER ROOMS**	-	150mm high	Acrylic emulsion paint.
6	**CORRIDOR & LOBBY**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint over putty & primer.
7	**LIFT LOBBY**	150mm Dado & 2100mm high Granite dado on lift fascia wall with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint over putty & primer.
8	**BODY STORAGE ROOM WITH STORAGE TANK**	Digital Ceramic tile dado upto 2100mm high	-	Acrylic emulsion paint
9	**RECEPTION/ WAITING**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint over putty & primer.
10	**STAIRCASE WITH SS HAND RAIL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom	-	Acrylic Emulsion paint on waist slab
11	**ACCOUNT OFFICER, TUTOR, DEMONSTRATOR, DOCTOR'S**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
12	**PRINCIPAL & MSVP ROOM**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
13	**HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR, ROOM**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
14	**COLLEGE COUNCIL ROOM**	-	150mm high	Combination of Mineral Fibre tile and Seamless Gypsum board

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
15	**All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Powder Coated Metal False Ceiling
16	**ALL LIBRARY AREA**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
17	**LECTURE HALL/THEATRE**	-	150mm high	Acoustic False Ceiling
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
19	**TOILETS**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Powder Coated Metal False Ceiling
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**		300mm cement punning	Acrylic Distemper Paint
21	**LIFT WELL**	-	-	-
22	**STRONG ROOM**	Acrylic Distemper Paint	300 mm high cement punning	Acrylic Distemper Paint
23	**LIFT MACHINE ROOM**	Acrylic distemper upto the soffit of slab	300mm high cement punning	White wash
24	**UTILITY SHAFT**	-	-	White cement wash
25	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
	BOYS & GIRLS HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
2	**CORRIDOR & LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
3	**LIFT LOBBY**	150mm Dado & 2100mm high Granite dado on lift fascia wall with High Impact Vinyl Corner Guards.	-	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
4	**ROOMS**	-	150mm high	Acrylic emulsion paint
5	**KITCHEN BLOCK**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
6	**DINING HALL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top.	-	Acrylic emulsion paint
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**		300mm cement punning	Acrylic Distemper Paint
8	**LIFT WELL**	Plastered wall with white cement wash	-	-
9	**LIFT MACHINE ROOM**	-	300mm high cement punning	White wash
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
11	**STAIRCASE WITH SS HAND RAIL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom	-	Acrylic emulsion paint
12	**TOILETS**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
13	**UTILITY SHAFT**	-	-	White cement wash

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
2	**CORRIDOR & LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
3	**LIFT LOBBY**	150mm Dado & 2100mm high Granite dado on lift fascia wall with High Impact Vinyl Corner Guards.	-	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
4	**ROOMS**	-	150mm high	Acrylic emulsion paint
5	**KITCHEN BLOCK**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
6	**DINING HALL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top	-	Acrylic emulsion paint
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	-	300mm cement punning	Acrylic Distemper Paint
8	**LIFT WELL**	Plastered wall with white cement wash	-	-
9	**LIFT MACHINE ROOM**	Acrylic distemper upto the soffit of slab	300mm high cement punning	White wash
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
11	**STAIRCASE WITH SS HAND RAIL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom	-	Acrylic emulsion paint
12	**TOILETS**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
13	**UTILITY SHAFT**	-	-	White cement wash

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING			
1	**ENTRANCE LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
2	**CORRIDOR & LOBBY**	-	150mm high	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
3	**LIFT LOBBY**	150mm Dado & 2100mm high Granite dado on lift fascia wall with High Impact Vinyl Corner Guards.	-	Acrylic emulsion paint. False ceiling required to camouflage exposed service lines with combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
4	**DRAWING ROOM**	-	150mm high	Acrylic emulsion paint
5	**BED ROOMS**	-	150mm high	Acrylic emulsion paint
6	**KITCHEN**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
7	**DINING ROOM**	-	150mm high	Acrylic emulsion paint
8	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	-	300mm cement punning	Acrylic Distemper Paint
9	**LIFT WELL**	Plastered wall with white cement wash	-	-
10	**LIFT MACHINE ROOM**	-	300mm high cement punning	White wash
11	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
12	**STAIRCASE WITH SS HAND RAIL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom	-	Acrylic emulsion paint
13	**TOILETS**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
14	**UTILITY SHAFT**	-	-	White cement wash
15	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
	OPD BUILDING			
1	**ENTRANCE LOBBY**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint over putty & primer.
2	**CORRIDOR & LOBBY**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Acrylic emulsion paint
3	**LIFT LOBBY**	150mm Dado & 2100mm high Granite dado on lift fascia wall with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Acrylic emulsion paint
4	**OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
5	**LABORATORY, SAMPLE COLLECTION ROOM**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Powder Coated Metal False Ceiling
6	**TOILETS**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Powder Coated Metal False Ceiling
7	**SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM**	-	150mm high	Acrylic emulsion paint
8	**RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	150mm high	Acrylic emulsion paint
9	**PHARMACY**	-	150mm high	Combination of seamless Magnesia board and Fiber cement tile. Painted with Acrylic emulsion paint with putty & primer.
10	**X-RAY ROOM, CITY SCAN SHOULD IN CONFIRMITY WITH AERB REGULATION**	-	150mm high	Acrylic emulsion paint
11	**DARK ROOM**	-	150mm high	Acrylic emulsion paint
12	**USG ROOM, MRI ROOM ROOM**	-	150mm high	Powder Coated Metal False Ceiling
13	**ECO ROOM, EEG ROOM, ECG ROOM**	-	150mm high	Powder Coated Metal False Ceiling

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DADO	SKIRTING	CEILING FINISH
		Description	Description	Material
14	**STAIRCASE WITH SS HAND RAIL**	Digital Ceramic tile dado upto 2100mm high with 150mm high granite border on top & bottom	-	Acrylic emulsion paint
15	**OT AREA**	-	-	Powder Coated Metal False Ceiling
16	**RECOVERY ROOM**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
17	**AUDIOMETRY ROOM**	-	150mm high	Acoustic False Ceiling
18	**OFFICE**	-	150mm high	Acrylic emulsion paint
19	**DAY CARE WARD**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter. with High Impact Vinyl 150 mm high Wall Guards and Corner Guards.	-	Acrylic emulsion paint
20	**BABY CARE ROOM**	Digital Ceramic tile dado upto 2100mm high from ffl with highlighter.	-	Acrylic emulsion paint
21	**RECORDS & STORE ROOM**	-	150mm high	Acrylic emulsion paint
22	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	-	300mm cement punning	Acrylic Distemper Paint
23	**UTILITY SHAFT**	-	-	White cement wash
24	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
	ACADEMIC BUILDING & OTHER BUILDINGS			
1	**ENTRANCE LOBBY**	PU polished Teak Wood frame	PU polished Teak Wood shutter	2.40 m
2	**RECORDS & STORE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
3	**COMMON ROOM (Boys and Girls)**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
4	**KITCHEN BLOCK**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.40 m
5	**OTHER ROOMS**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
6	**CORRIDOR & LOBBY**	-	-	-
7	**LIFT LOBBY**	-	-	-
8	**BODY STORAGE ROOM WITH STORAGE TANK**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
9	**RECEPTION/ WAITING**	-	-	-
10	**STAIRCASE WITH SS HAND RAIL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs.	2.40 m
11	**ACCOUNT OFFICER, TUTOR, DEMONSTRATOR, DOCTOR'S**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
12	**PRINCIPAL & MSVP ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
13	**HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR, ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
14	**COLLEGE COUNCIL ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
15	**All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
16	**ALL LIBRARY AREA**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
17	**LECTURE HALL/THEATRE**	Door frame for 65mm thick Accoustic Door Shutter	65mm thick Accoustic Door Shutter	2.40 m
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
19	**TOILETS**	For Front door Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm For other door PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm	For Front door Bothside prelaminated 35mm thick solid flush type door shutter For other door Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm	2.40 m
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.40 m
21	**LIFT WELL**	-	-	-
22	**STRONG ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.40 m
23	**LIFT MACHINE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
24	**UTILITY SHAFT**	Powder Coated Aluminium Door frame	Powder Coated Aluminum door shutter with fire resistant pre-laminated cement bonded particle board	2.10 m
25	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
	BOYS & GIRLS HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	Powder Coated Aluminium Door frame	Partly glazed partly panneled with prelaminated plywood board powder coated Aluminium door shutter	2.10 m
2	**CORRIDOR & LOBBY**	-	-	-
3	**LIFT LOBBY**	-	-	-
4	**ROOMS**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
5	**KITCHEN BLOCK**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
6	**DINING HALL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
8	**LIFT WELL**	-	-	
9	**LIFT MACHINE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
11	**STAIRCASE WITH SS HAND RAIL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs.	2.10 m
12	**TOILETS**	For Front door Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm For other door PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm	For Front door Bothside prelaminated 35mm thick solid flush type door shutter For other door Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm	2.10 m
13	**UTILITY SHAFT**	Powder Coated Aluminium Door frame	Powder Coated Aluminum door shutter with fire resistant pre-laminated cement bonded particle board	2.10 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
2	**CORRIDOR & LOBBY**	-	-	-
3	**LIFT LOBBY**	-	-	-
4	**ROOMS**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
5	**KITCHEN BLOCK**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
6	**DINING HALL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
8	**LIFT WELL**	-	-	
9	**LIFT MACHINE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
11	**STAIRCASE WITH SS HAND RAIL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs.	2.10 m
12	**TOILETS**	For Front door Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm For other door PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm	For Front door Bothside prelaminated 35mm thick solid flush type door shutter For other door Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm	2.10 m
13	**UTILITY SHAFT**	Powder Coated Aluminium Door frame	Powder Coated Aluminum door shutter with fire resistant pre-laminated cement bonded particle board	2.10 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING			
1	**ENTRANCE LOBBY**	Powder Coated Aluminium Door frame	Partly glazed partly panneled with prelaminated plywood board powder coated Aluminium door shutter	2.10 m
2	**CORRIDOR & LOBBY**	-	-	
3	**LIFT LOBBY**	-	-	-
4	**DRAWING ROOM**	-	-	-
5	**BED ROOMS**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
6	**KITCHEN**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.10 m
7	**DINING ROOM**	-	-	
8	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
9	**LIFT WELL**	-	-	
10	**LIFT MACHINE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.10 m
11	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	
12	**STAIRCASE WITH SS HAND RAIL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs.	2.10 m
13	**TOILETS**	For Front door Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm For other door PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm	For Front door Bothside prelaminated 35mm thick solid flush type door shutter For other door Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm	2.10 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
14	**UTILITY SHAFT**	Powder Coated Aluminium Door frame	Powder Coated Aluminum door shutter with fire resistant pre-laminated cement bonded particle board	2.10 m
15	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
	OPD BUILDING			
1	**ENTRANCE LOBBY**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
2	**CORRIDOR & LOBBY**	-	-	-
3	**LIFT LOBBY**	-	-	-
4	**OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
5	**LABORATORY, SAMPLE COLLECTION ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
6	**TOILETS**	For Front door Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm For other door PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm	For Front door Bothside prelaminated 35mm thick solid flush type door shutter For other door Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm	2.40 m
7	**SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
8	**RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION**	-	-	
9	**PHARMACY**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
10	**X-RAY ROOM, CITY SCAN SHOULD IN CONFIRMITY WITH AERB REGULATION**	Lead lined FD 120 Fire rated door system including appropriate frame as per satisfaction of employer		2.40 m
11	**DARK ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
12	**USG ROOM, MRI ROOM ROOM**	Lead lined FD 120 Fire rated door system including appropriate frame as per satisfaction of employer		2.40 m
13	**ECO ROOM, EEG ROOM, ECG ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	DOOR		
		FRAME	SHUTTER	Height from FFL
14	**STAIRCASE WITH SS HAND RAIL**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs.	2.40 m
15	**OT AREA**	Powder coated metal OT Door shutter with frame of suitable design as per satisfaction of employer		2.40 m
16	**RECOVERY ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
17	**AUDIOMETRY ROOM**	Door frame for 65mm thick Accoustic Door Shutter	65mm thick Accoustic Door Shutter	2.40 m
18	**OFFICE**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
19	**DAY CARE WARD**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
20	**BABY CARE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
21	**RECORDS & STORE ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	Bothside prelaminated 35mm thick solid flush type door shutter	2.40 m
22	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Powder coated MS door frame confirming to IS 4351 letest publication with minimum sheet metal thickness 1.60mm	46mm thick powder coated Steel Metal Door Shutter	2.40 m
23	**UTILITY SHAFT**	Powder Coated Aluminium Door frame	Powder Coated Aluminum door shutter with fire resistant pre-laminated cement bonded particle board	2.40 m
24	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
	ACADEMIC BUILDING & OTHER BUILDINGS			
1	**ENTRANCE LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
2	**RECORDS & STORE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
3	**COMMON ROOM (Boys and Girls)**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
4	**KITCHEN BLOCK**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.00 m	2.40 m
5	**OTHER ROOMS**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
6	**CORRIDOR & LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
7	**LIFT LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
8	**BODY STORAGE ROOM WITH STORAGE TANK**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
9	**RECEPTION/ WAITING**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
10	**STAIRCASE WITH SS HAND RAIL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
11	**ACCOUNT OFFICER, TUTOR, DEMONSTRATOR, DOCTOR'S**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
12	**PRINCIPAL & MSVP ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
13	**HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR, ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
14	**COLLEGE COUNCIL ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
15	All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
16	ALL LIBRARY AREA	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
17	LECTURE HALL/THEATRE	-	-	-
18	MAIN ENTRANCE ENTRY STEPS & RAMP	-	-	-
19	TOILETS	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron)with MS Grill.	1.50 m	2.40 m
20	ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
21	LIFT WELL	-	-	-
22	STRONG ROOM	-	-	-
23	LIFT MACHINE ROOM	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
24	UTILITY SHAFT	-	-	-
25	TERRACE	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
	BOYS & GIRLS HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
2	**CORRIDOR & LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
3	**LIFT LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
4	**ROOMS**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
5	**KITCHEN BLOCK**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.00 m	2.10 m
6	**DINING HALL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
8	**LIFT WELL**	-	-	-
9	**LIFT MACHINE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
11	**STAIRCASE WITH SS HAND RAIL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
12	**TOILETS**	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.50 m	2.10 m
13	**UTILITY SHAFT**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING			
1	**ENTRANCE LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
2	**CORRIDOR & LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
3	**LIFT LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
4	**ROOMS**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
5	**KITCHEN BLOCK**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.00 m	2.10 m
6	**DINING HALL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
7	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
8	**LIFT WELL**	-	-	-
9	**LIFT MACHINE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
10	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
11	**STAIRCASE WITH SS HAND RAIL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
12	**TOILETS**	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.50 m	2.10 m
13	**UTILITY SHAFT**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
14	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING			
1	**ENTRANCE LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
2	**CORRIDOR & LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
3	**LIFT LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
4	**DRAWING ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
5	**BED ROOMS**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
6	**KITCHEN**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.00 m	2.10 m
7	**DINING ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
8	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
9	**LIFT WELL**	-	-	-
10	**LIFT MACHINE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
11	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	-
12	**STAIRCASE WITH SS HAND RAIL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.75 m	2.10 m
13	**TOILETS**	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.50 m	2.10 m

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
14	**UTILITY SHAFT**	-	-	-
15	**TERRACE**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
	OPD BUILDING			
1	**ENTRANCE LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
2	**CORRIDOR & LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
3	**LIFT LOBBY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
4	**OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
5	**LABORATORY, SAMPLE COLLECTION ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
6	**TOILETS**	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron) with MS Grill.	1.50 m	2.40 m
7	**SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
8	**RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
9	**PHARMACY**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
10	**X-RAY ROOM, CITY SCAN SHOULD IN CONFIRMITY WITH AERB REGULATION**	-	-	-
11	**DARK ROOM**	-	-	-
12	**USG ROOM, MRI ROOM ROOM**	-	-	-
13	**ECO ROOM, EEG ROOM, ECG ROOM**	-	-	-

SECTION 5.4A : SCHEDULE OF FINISHES

SL. No.	TYPE OF ROOM	Window		
		Description	Sill height from FFL	Lintel height from FFL
14	**STAIRCASE WITH SS HAND RAIL**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
15	**OT AREA**	-	-	-
16	**RECOVERY ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
17	**AUDIOMETRY ROOM**	-	-	-
18	**OFFICE**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
19	**DAY CARE WARD**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
20	**BABY CARE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
21	**RECORDS & STORE ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
22	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) with MS Grill.	0.90 m	2.40 m
23	**UTILITY SHAFT**	-	-	-
24	**TERRACE**	-	-	-

SECTION 5.4B

Schedule of finishes (Common items)

SECTION 5.4B : SCHEDULE OF FINISHES (Common Items)		
Sl. No	**Particular**	**Description**
1	**Collapsable gate / Rolling Grill**	Collapsable gate / Chain link type Rolling Grill to be provided along with door at all entry & exit point of the Academic building as per approved architectural drawing to the satisfaction of employer.
		Collapsable gate to be provided along with door at all entry & exit point of each department in the Academic building as per approved architectural drawing to the satisfaction of employer.
		Collapsable gate to be provided along with door at main entry & exit point of the Hostel buildings, Residential Quarters building, and other buildings as per approved architectural drawing to the satisfaction of employer.
		Collapsable gate to be provided at entry point along with door of each Residential Quarters as per approved architectural drawing to the satisfaction of employer.
2	EXTERNAL DEVELOPMENT	
	a) Parking Area	80 mm thick Paver Block at eaternal parking / Paver tiles at covered parking under stilt floor after getting approval from the employer.
	b) Footpath	60 mm thick Paver Block at footpath.
	c) External / Internal Roads of Medical College Campus	Concrete road (Grade of concrete minimum M40) with maximum gross vehicle weight (GVW) 31 tonnes with maximum axle load 19 tonnes carrying capacity
	d) Kerb Channel & Kerb Stone	PCC M20 Precast Block
	e) Compound Wall all sides of Medical College Campus.	RCC Column, Brick work with MS Grill & other decorative materials as directed & to the satisfaction of the employer.
3	WINDOW/LouverS	
a)	All External Windows	Polyester powder coated aluminium glazed sliding window (minimum thickness of polyester powder coating 50 micron) frame as per approved drawing (with section thickness minimum 1.5 mm) with MS Grill. Each shutter width should be more than 600mm. Minimum 5 mm or more Thick Glass as per requirement
b)	Window Sill (External and Internal-300mm / 150mm Wide respectively)	Moulded Granite cladding inside & outside
c)	Louvers	Polyester powder coated aluminium Louver window with unbreakable PVC glazing (minimum thickness of polyester powder coating 50 micron) with MS Grill. Minimum 5 mm or more Thick Glass as per requirement.

SECTION 5.4B : SCHEDULE OF FINISHES (Common Items)		
Sl. No	**Particular**	**Description**
4	EXTERNAL FACADE of Academic building	a) The following materials may be used for external finishes of Academic building under Medical College project. Design as per satisfaction of employer. i) Structural Glazing. ii) Glass mosaic tiles. iii) Exterior paint over plastered surface. iv) Exterior textured paint over plastered surface. v) ACP cladding. vi) Stone cladding. vii) Metal louvers. viii) GFRC. ix) Designer Balustrade. x) Exterior high pressure compact laminate.
5	EXTERNAL FACADE of Hostel buildings	b) The following materials may be used for external finishes of Hostel buildings under Medical College project. Design as per satisfaction of employer. i) Glass mosaic tiles. ii) Exterior paint over plastered surface. iii) ACP cladding. iv) Metal louvers. v) GFRC. vi) Designer Balustrade. vii) Exterior high pressure compact laminate.
6	EXTERNAL FACADE of Quarters buildings	c) The following materials may be used for external finishes of Quarters under Medical College project. Design as per satisfaction of employer. i) Exterior paint over plastered surface. ii) Metal louvers. iii) GFRC. iv) Designer Balustrade. v) Exterior high pressure compact laminate.
7	EXTERNAL FACADE of OPD buildings	d) The following materials may be used for external finishes of OPD buildings under Medical College project. Design as per satisfaction of employer. i) Structural Glazing. ii) Glass mosaic tiles. iii) Exterior paint over plastered surface. iv) Exterior textured paint over plastered surface. v) ACP cladding. vi) Stone cladding. vii) Metal louvers. viii) GFRC. ix) Designer Balustrade. x) Exterior high pressure compact laminate.

SECTION 5.4C

Item-wise specification

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
1)	**MS Door Frame**	**:**	Powder coated pressed steel door frames (profile - C) conforming to IS: 4351, manufactured from commercial mild steel sheet of 1.60 mm thickness, including jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50x25 mm, or base ties of 1.60 mm, pressed mild steel welded or rigidly fixed together by mechanical means, including M.S. pressed butt hinges 2.5 mm thick with mortar guards, lock strikeplate and shock absorbers as specified and as directed by Engineerin-charge:
2)	**Flush Door shutter**	**:**	Bothside prelaminated 35mm thick solid flush type door shutter of deluxe decorative quality, conforming to I:S 2202 timber frame consisting of top and bottom rail and side styles of well seasoned timber 65mm wide each and the entire frame fitted with 27.5mm wide battens places both ways in order to made the door of solid core and internal lipping with teak, mahogony or rose wood approved lamination sheet using phenol formaldehyde as glue etc.
3)	**Door frame for 65mm thick Accoustic Door Shutter**	**:**	Supplying fitting & fixing frames for Fire resistant acoustic door shutters 1st class Malaysian Hardwood Frame (densified to 810 kg/cum) and pressure treated with fire retardant chemicals in vacuum impregnation vessel under 160 psi pressure as per IS:401and kiln seasoned to moisture below 15% as per IS:1141 of section 120 mm X 70 mm spray quoted with 2 coats of intumescent paint of minimum 200 micron, with standard double acoustic seal (equivalent to Hafele) placed along two faces of rebate for sound insulation and single row of Brush-Type intumescent strip of size 10 mmx 4 mm affixed in the slit of the Frame for fire and smoke sealing, etc. complete as per direction of Engineer inCharge including a protective coat of painting at the contact surfaces of the frame.
4)	**65mm thick Accoustic Door Shutter**	**:**	65mm thick asbestos free - fire, heat and smoke resistant composite Accoustic Door Shutter complying with fire performanceFD120 as per IS:3614 (part -II)-comprising of 2x 8 mm Calcium Silicate boards over Chemically treated (with Fire retardant chemicals in pressure impregnation vessels under 160 psi pressure as per IS:401 and kiln seasoned to moisture below 15% as per IS:1141) internal timber (Malaysian Hard Wood,densified to 810kg/cum) frame work of 100 mm x32 mm with 32mm thick infill of ceramic fiber (density 128Kgs/cum), vermaculite mix faced with 6 mm Fire retardant High Density fire board, internally lipped with hardwood beading, and pasted in Hydraulic Press under 25 MPa, spray coated with 2 coats of in-tumescent paint of minimum 200 micron, and with 1 row of Brush- Type intumescent strip of size10mmx 4mm affixed on peripheral slit on all edges of shutter except bottom for fire and smoke sealing and placement of 3 mm thick rubber membrane, at the inside face, sandwiched between calcium silicate board & high density fire retardant board, without any external lipping as per direction of Engineer -in -charge complete in all respect.
5)	**46mm thick Steel Metal Door Shutter**	**:**	46mm thick Door shutter of 1.20mm thick slip coated pre-galvanised steel sheet confirming to ASTM A527/ASTM A525, JIS G 3302, IS 277. Zinc coating 80-120 g.sqm. Lock formed panels with internal stiffeners of 3mm thick made of GP 3.00mm thick hinge reinforceing, hardware mounting plates and lock protection. Shutter filled with paper honeycomb thickness of 150 gsm, load bearing capacity 1-1.5 ton/sqm. External finish should be powder coated surface finished with thermosetting polyurethane paint of aliphatic grade, scratch resistance. Polyurethane powder coat thickness 60 - 65 microns

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
6)	**Metal Fire proof Door**	**:**	Steel Metal Fire proof Door Shutter with a fire rating of a minimum of 2hrs as per manufacturer specification.
7)	**PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm**	**:**	PVC Door Frame of size 50x47 mm with a wall thickness of 5 mm (± 0.2 mm), made out of single piece extruded PVC profile, with mitred cut joints and joint with 2 nos of PVC bracket of size 190 mm x 100 mm long arms of cross section size 35 x 15 mm & self driven self taping screws, the vertical door profiles to be reinforced with 40x20 mm M.S. rectangular tube of 0.8 mm , including providing EPDM rubber gasket weather seal throughout the frame, including jointing 5 mm PVC frame strip with PVC solvent cement on the back of the profile. The door frame to be fixed to the wall using 8 x100 mm long anchor fasteners complete, all as per manufacturer's specification and direction of Engineer-in- charge.
8)	**Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm**	**:**	35 mm thick factory made Solid panel PVC Door shutter, made out of single piece extruded soild PVC profiles, 5 mm (± 0.2 mm) thick, having styles & rails (except lock rail) of size 95 mmx 35 mm x 5 mm, out of which 75 mm shall be flat and 20 mm shall be tapered (on both side), having one side thickness of 15 mm integrally extruded on the hinge side of the profile for better screw holding power, including reinforcing with MS tube of size 40 mm X 20 mm x 1 mm, joints of styles & rails to be mitered cut & joint with the help of PVC solvent cement, self driven self tapping screws & M.S. rectangular pipes bracket of size 190 mm X 100 mm of cross section size 35 mm x 17 mm x 1 mm at each corner. Single piece extruded 5 mm thick solid PVC Lock rail of size 115 mm x 35 mm, out of which 75 mm to be flat and 20 mm to be tapered at both ends, having 15mm solid core in middle of rail section integrally extruded, fixing the styles & rails with the help of solvent and self driven self tapping screws of 125 mm x 11 mm, including providing 5 mm Single piece solid PVC extruded sheet inserted in the door as panel, all complete as per manufacturer's specification and direction of Engineer-in-charge. Decorative finish (wood grained finish)
9)	**Kota stone & Black stone flooring**	**:**	18 mm. to 22 mm. thick, kota stone & black stone slab set in 20 mm thick (avg) cement mortar (1:4) in floor, stair & lobby including pointing in cement slurry with admixture of pigment matching the stone shade, including grinding & mirror polishing as per direction of Engineer - in - charge. [Slurry for bedding @ 4.4 kg/Sq.m and pointing @2.0 kg/Sq.m]
10)	**Granite stone flooring**	**:**	Granite slab 15mm to 18mm thick in floor, lobby, stair, landing and treads etc. over 20mm (avg) thick base of cement morter (1:2) laid with white cement slurry @ 4.40Kg per Square meter before placing of granite and jointed with white cement slurry @ 2.0 Kg per square meter with necessary pigments and complete as per direction of Engineer-in-charge including
11)	**Granite dado on lift fascia wall**	**:**	Granite slabs 15mm to 18 mm. thick with uniform texture & without decorative veins in columns, wall, facia, rise etc. with 15 mm thick [avg] cement mortar (1:2) including making suitable arrangements to hold the stones properly by brass / copper hooks including pointing in cement mortar (1:2) (1 white cement : 2 marble dust) with admixture of pigment matching the stone shades all complete as per direction of the Engineer-in-charge including all materials, labours, scaffolding, staging, curing and roughening of concrete surface complete. [Using cement slurry at back side of granite @ 4.4 kg/sq.m & white cement slurry for joint filling @ 1.8 kg/sq.m]

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
12)	**Premium quality Double Charged Designer Vitrified tiles flooring**	**:**	600mm x 600mm Premium quality Double Charged Designer Vitrified tiles of approved brand (size not less than 600 mm X 600 mm X 10 mm thick) in floor, skirting etc. set in 20 mm sand cement mortar (1:4) and 2 mm thick cement slurry back side of tiles using cement @ 2.91Kg./sqM or using polymerised adhesive (6 mm thick layer applied directly over finished artificial stone floor/Mosaic etc without any backing course) laid after application slurry using 1.75 Kg of cement per sqM below mortar only, joints grouted with admixture of white cement and colouring pigment to match with colour of tiles / epoxy grout materials of approved make as directed and removal of wax coating of top surface of tiles with warm water and polishing the tiles using soft and dry cloth upto mirror finish complete as per direction of Engineer-in-Charge.
13)	**Full Body Vitrified tiles flooring**	**:**	600mm x 600mm Full Body vitrified tiles of approved brand (size not less than 600 mm X 600 mm X 10 mm thick) in floor, skirting etc. set in 20 mm sand cement mortar (1:4) and 2 mm thick cement slurry back side of tiles using cement @ 2.91Kg./sqM or using polymerised adhesive (6 mm thick layer applied directly over finished artificial stone floor/Mosaic etc without any backing course) laid after application slurry using 1.75 Kg of cement per sqM below mortar only, joints grouted with admixture of white cement and colouring pigment to match with colour of tiles / epoxy grout materials of approved make as directed and removal of wax coating of top surface of tiles with warm water and polishing the tiles using soft and dry cloth upto mirror finish complete as per direction of Engineer-in-Charge.
14)	**Wooden flooring**	**:**	8mm thick Laminated Wooden Flooring Work conforming to EN13329:2006 with plank size not less than 1200mmX 190 mm (with unilin/tongue-groove locking arrangement) having 0.2mm thk top abrasive layer over a decorative layer followed by a High-density fibreboard (HDF) having density > 940 kg/m3 substrate core over a rasin saturated backing layer and installing through unilin or tongue- groove system (having locking strength not less than 1000 kg/m) over a 2 mm thk underlayer polyurethene foam on polythene sheet 250 micron, over a smooth, flat, hard subfloor free from moisture (< 8%), grease etc. complete in all respect with requisite accessories like end profile, transition profile, reducer 'T' profile etc. wherever required and preparation of base including all other incidental works as per direction & satisfaction of Engineer in charge.Category: High Footfall ; Class-23; Abrasion resistance:-AC4 Thk on Swelling:- < 15%; Impact resistance:- IC 2
15)	**IPS flooring**	**:**	Artificial stone in flooring, dado, staircase etc with cement concrete (1:2:4) with stone chips, laid in panels as directed with topping made with ordinary or white cement (as necessary) and marble dust in proportion (1:2) including smooth finishing and rounding off corners including raking out joints or roughening of concrete surface and application of cement slurry before flooring works using cement @ 1.75 kg/sq.m all complete including all materials and labour. 35 mm. thick with mm. thick topping using grey cement.
16)	**Ceramic tiles flooring**	**:**	600mm x 600mm 1st quality Ceramic tiles in floors & 4 nos. of key stones (10mm) fixed with araldite at the back of each tile & finishing the joints with white cement mixed with colouring oxide if required to match the colour of tiles including roughening of concrete surface, if necessary or by synthetic adhesive & grout materials etc. Laying with Sand Cement Mortar (1:4) 20 mm thick & 2 mm thick cement slurry at back side of tiles using cement @ 2.91 Kg/Sq.m & joint filling using white cement slurry @ 0.20kg/Sq.m.

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
17)	**Ceramic tiles on walls**	**:**	300mm x 450mm for toilets & 300mm x 600mm for rest portion best quality digital printed Ceramic tiles in coloured decorative on walls & 4 nos. key stones (10mm) fixed with adhesive 4.5 mm thick at the back of each tile & finishing the joints with white cement mixed with colouring oxide if required to match the colour of tiles including roughening of concrete surface, if necessary or by synthetic adhesive & grout materials etc. With polymerised adhesive and epoxy grout pointing including spacer - 2mm (When tiles are laid over existing hard ready surface) all complete as per direction of Engineer-in-charge.
18)	**Stone Polymer Composite (SPC) tiles flooring**	**:**	Stone Polymer Composite (SPC) Luxury Performance Tiles with tile thickness 4.00mm in any shape and size as per approved design fixing in Click-N-Lock Technology over IPS flooring.
19)	**Acoustic Wall Panelling**	**:**	a) Above 1.20m to false ceiling Providing, Fitting and fixing of wall panel up by G.I. frame work with 600 x 300mm c/c to be fixed on wall, all the framing materials of GI section made of approved brand. Thereafter Synth PF 50 mm thick having density of 20 Kgs/Cu.M tie up with Galvanized wire mesh and Galvanized wire, to avoid sagging. On top provide Acoustical panel fabric finish of woodfibre core of size 1200 x 600x20 mm with H -Spline of NRC upto 0.95, Fire class 1&P having density of 400 kg/M3. to maintain the functional activities & aesthetic decor of the hall. This kinds of treatment to be provided on both side wall of the Hall. Design of wall to be made for popper sound reproduction. b) Above flooring to 1.20m Wall panelling with Melamine faced 3 layered flat pressed wood particle board of approved make and brand as per direction of Engineer - in - Charge of requisite grade bonded with phenol formaldehyde synthetic resin conforming to IS: 848-1974 (Prelaminated particle board confirming to IS 3087 -1985 and IS 12823 - 1990 one side decorative laminated exterior grade 12mm thick) including the cost of supporting frame work with GI grid. c) For decoration: i) Porviding & Fixing of wall panel by G.I. frame work with 600 x 300mm c/c to be fixed on wall, all the framing materials. There after Synth PF 50 mm thick having density of 20 Kgs/Cu.M. tie up by Galvanized wire mesh and galvanized wire to avoid sagging. On top of GI frame provide wooden slats of 16mm thick 128mm x 2440mm x16mm toungue and groove edges for seamless mounting having density of 750-800 kg/m3. with fleece melamine finish. NRC is upto 0.75 with a pitch of L-16 of 2mm grooves with FR grade, colour to be approved. This run of wall panelling to be provided on both side and back wall of the hall partialy. Design of wall to be made for popper sound reproduction. ii) Providing & Fixing of wall panel by G.I. frame work with 600 x 300mm c/c to be fixed on wall, all the framing materials of ultra section made of Saint Gobain. There after Synth PF 50 mm thick having density of 20 Kgs/Cu.M. tie up by Galvanized wire mesh and galvanized wire to avoid sagging. On top of GI frame provide 12mm thick BWR ply and 4 mm thick teak with freanch polish finish Provide 50 x 20 mm wooden molded bit to be fixed between the edge area. To match aesthetic decor and functional activities. This run of wall panelling to be provided on both side and back wall of the hall partialy. Design of wall to be made for popper sound reproduction.

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
20)	**Interior grade Acrylic Primer**	**:**	Solvent based Interior grade Acrylic Primer of approved quality and brand on plastered or cencrete surface old or new surface to receive Distemper/ Acrylic emulsion paint including scraping and preparing the surface throughly, complete as per manufacturer's specification and as per direction of the EIC. Two Coats
21)	**Exterior grade Acrylic primer**	**:**	Exterior grade Acrylic primer of approved quality and brand on plastered or cencrete surface old or new surface to receive decorative textured (matt finish) or smooth finish acrylic exterior emulsion paint including scraping and preparing the surface throughly, complete as per manufacturer's specification and as per direction of the EIC. Two Coats
22)	**Synthetic oil bound primer for steel or other metal surface**	**:**	Priming one coat on steel or other metal surface with synthetic oil bound primer of approved quality including smoothening surfaces by sand papering etc.
23)	**Synthetic oil bound primer on timber or plastered surface**	**:**	Priming one coat on timber or plastered surface with synthetic oil bound primer of approved quality including smoothening surfaces by sand papering etc.
24)	**Acrylic Emulsion Paint**	**:**	Applying Acrylic Emulsion Paint of approved make and brand on walls and ceiling including sand papering in intermediate coats including putty: (Two coats Luxury Quality)
25)	**Acrylic Distemper Paint**	**:**	Acrylic Distemper to interior wall, ceiling with a coat of solvent based interior grade acrylic primer (as per manufacturer's specification) including cleaning and smoothning of surface. Two Coats
26)	**Acrylic exterior emulsion paint**	**:**	Protective and Decorative Acrylic exterior emulsion paint of approved quality, as per manufacturer's specification and as per direction of Engineer-in-Charge to be applied over acrylic primer as required. (Super Protective 100% Acrylic Emulsion Two Coat) with 10 years of manufacturer's waranty
27)	**Textured exterior high class matt finish paint**	**:**	Protective and Decorative Textured exterior high class matt finish paint of approved quality, composed of special Tharmoplastic Resin containing fine crystalline additives derive from Granite as per manufacturer's specification and as per direction of EIC to be applied over acrylic primer as required. (Two Coat) with 10 years of manufacturer's waranty
28)	**Cement based paint**	**:**	Applying decorative cement based paint of approved quality after preparing the surface including scraping the same thoroughly (plastered or concrete surface) as per manufacturer's specification. (Two Coat)
29)	**Synthetic enamel paint**	**:**	Best quality synthetic enamel paint of approved make and brand including smoothening surface by sand papering etc. including using of approved putty etc. on the surface, if necessary : On timber or plastered surface & On steel or other metal surface

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
30)	**White Wash**	**:**	White washing including cleaning and smoothening surface thoroughly. Three coats The white washing is to be done with 5 parts of stone lime and one part of shell lime with necessary gum (2 Kg. per Cu.M. of lime) using indigo as necessary and to be mixed as per standard practice. The operation for each coat shall consist of four consecutive strokes of the brush, one horizontally from right to left and the next from left to right and the third stroke bottom to upward and the fourth from top to down ward before the previous stroke dries. Each coat shall be allowed to dry before the next coat applied. No portion of the surface shall be left out initially to be patched up later on. The brush shall be dipped in white wash, pressed lightly against the wall of the container and then applied by lightly pressing against the surface with full swing of hand. The white wash on ceiling should be done prior to that on walls.
31)	**Polyurethane (PU) Polishing**	**:**	Polyurethane Polishing to woodwork with required colour as approved by Engineer-in-Charge with preparing surface including scaffolding and hire charges of compressor machine including cost of filler and hardener material such as P. U. Sealing, P. U. Top coat (Matt/Glossy), Thinner, Spirit etc. and inclusive of all operation, material and labour complete as per direction of Engineer-in- Charge
33)	**Fiber cement tile false ceiling**	**:**	False ceiling with powder coated exposed G.I. grid suspension system (E-Grid T 2430 or equivalent load carrying capacity with mid span deflection not exceeding 1/360 span with hanger spacing of 1200mm c/c) consisting of Main Runner 3600 mm long, Cross Tee 1200 mm / 600 mm long and Wall Angle. The Wall Angle shall be fixed on PVC Dash Fasteners on the perimeter of the wall by steel screws with distance 300mm c/c. The Main Runners to be placed @ 1200 mm. The Cross Tee 1200mm will be inserted in the pre-cut slots of Main Runner at regular interval of 600 mm to form a modular grid of 1200mm X 600mm. Additional Cross Tees of 600 mm shall be placed perpendicular to the Cross Tee 1200 mm long to finally form a grid of 600 mm X 600 mm. Grid of module size 600 mm X 600 mm shall be supported by 6 mm dia G.I. wire from purlins / soffit. 6 mm thick High Pressure Steam Cured Non Asbestos Fibre Cement Standard Ceiling tile (Density > 1300 Kg/m3) of size 595 mm X 595 mm, conforming IS 14862 & Type B Category III of ISO 8336, tested as per AS-1530 part 3 & BS-476 Part 4,5,6,7 & 8, should be placed in the Grid module to form a False Ceiling. All complete as per the drawing & directions of Engineer-in-charge. (with 6mm thick Fibre Cement Standard Ceiling Board and E-Grid-
34)	**Magnesia False ceiling**	**:**	Concealed False ceiling Framework with G.I. Section (perimeter channels having one flange of 20 mm. and another flange of 30 mm. with thickness of 0.55 mm. and web of length 27 mm., along the perimeter of the ceiling, screws fixed to the wall with help of nylon sleeves or PVC dash fastners @ 610 mm c/c. then suspend G.I. intermidiate 'C' section with web 90 mm. and flanges of 15 mm. each from soffit @ 1200 mm c/c with ceiling angle of size 25 mm. X 10 mm. X 0.55 mm. fixed to soffit G.I. Cleat and Steel expansion fasteners. Ceiling section of 0.55 mm. thickness having web of 51.5 mm. and two flanges of 26 mm. each with lips of 10.55 mm., are then fixed on to the intermediate channel with the help of connecting clips in the direction perpendicular to the intermidiate channel @ 610 mm c/c) with fully threaded fiber cement screws @ 300 mm c/c. all complete as per the drawing and direction of Engineer-in-Charge. Section specification :- Perimeter Channel :- 30 mm X 20 mm X 27 mm, thickness 0.55 mm (min), Intermidiate Channel :- 15 mm X 90 mm, thickness 0.90 mm (min), Ceiling Section :- 51.5 mm X 26 mm X 10.55 mm, thickness 0.55 mm (min),

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
35)	**Acoustic false ceiling**	**:**	False ceiling with powder coated exposed G.I. grid suspension system (E-Grid U-1520 or equivalent load carrying capacity with mid span deflection not exceeding 1/360 span with hanger spacing of 1200mm c/c) consisting of Main Runner 3600 mm long, Cross Tee 1200 mm / 600 mm long and Wall Angle. The Wall Angle shall be fixed on PVC Dash Fasteners on the perimeter of the wall by steel screws with distance 300mm c/c. The Main Runners to be placed @ 1200 mm. The Cross Tee 1200mm will be inserted in the pre-cut slots of Main Runner at a regular interval of 600 mm to form a modular grid of 1200mm X 600mm. Additional Cross Tees of 600 mm shall be placed perpendicular to the Cross Tee 1200 mm long to finally form a grid of 600 mm X 600 mm. Grid of module size 600 mm X 600 mm shall be supported by 6 mm dia G.I. wire from purlins / soffit. Acoustic Board (NCR>0.90) of approved patern and size 595mm X 595mm should be placed in the Grid module to form a False Ceiling. All complete as per the drawing & directions of Engineer-in-charge.
36)	**Metal false ceiling**	**:**	False ceiling with powder coated exposed G.I. grid suspension system (E-Grid T 2430 or equivalent load carrying capacity with mid span deflection not exceeding 1/360 span with hanger spacing of 1200mm c/c) consisting of Main Runner 3600 mm long, Cross Tee 1200 mm / 600 mm long and Wall Angle. The Wall Angle shall be fixed on PVC Dash Fasteners on the perimeter of the wall by steel screws with distance 300mm c/c. The Main Runners to be placed @ 1200 mm. The Cross Tee 1200mm will be inserted in the pre-cut slots of Main Runner at regular interval of 600 mm to form a modular grid of 1200mm X 600mm. Additional Cross Tees of 600 mm shall be placed perpendicular to the Cross Tee 1200 mm long to finally form a grid of 600 mm X 600 mm. Grid of module size 600 mm X 600 mm shall be supported by 6 mm dia G.I. wire from purlins / soffit. 0.6mm thick powder coated metal tile of size 595 mm X 595 mm, should be placed in the Grid module to form a False Ceiling. All complete as per the drawing & directions of Engineer-in-charge. (with 6mm thick Fibre Cement Standard Ceiling Board and E-Grid-2430).
37)	**Polyester powder coated aluminium Sections for glazed sliding window Louvers, Glazed Partitions, Fixed glazing etc. as per drawing.**	**:**	Aluminium frames section made of Aluminium Alloy Extrusions conforming to IS: 732-1983 and IS: 1285- 1975; Polyester powder coated (minimum thickness of polyester powder coating 50 micron) for sliding & casement windows, Louvered window, partitions, formed of basic sections of ISI embossed / certified make and brand as per direction of Engineer - In- Charge as per approved drawing (with section thickness minimum 1.5 mm). Filling the gap in between aluminium frame & adjacent RCC/ Brick/ Stone work by providing weather silicon sealant over backer rod of approved quality as per architectural drawings and direction of Engineer-in-charge complete. Upto 5mm depth and 5 mm width.
38)	**Glass**	**:**	Coloured (any colour) / tinted / frosted toughened glass, miminum 5mm thick or as per design with U shaped & T Shaped EPDM gusket of approved make and brand as per direction of Engineer in charge.
39)	**MS Grill**	**:**	M.S.or W.I. Ornamental grill of approved design joints continuously welded with M.S, W.I. Flats and bars of windows, railing etc. fitted and fixed with necessary screws and lugs. Grill weighing above 10 Kg./sq.mtr and up to 16 Kg./sq. mtr.
40)	**SS functional hinge for casement window**	**:**	Supplying stainless steel functional hinge for casement window as per approved brand as directed by Engineer- in -charge. (Natural White) 300 mm long.

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
41)	**Collapsible gate**	**:**	Collapsible gate with 40mm x 40mm x 6mm Tee as top and bottom guide rail, 20mm x 10mm x 2mm vertical channels 100mm apart in fully stretched position 20mm x 5mm M.S. flats as collapsible bracings properly rivetted and washered including 38mm steel rollers including locking arrangements, fitted and fixed in position with lugs set in cement concrete
42)	**Steel rolling grill**	**:**	Fixing grilled rolling shutters manufactured out of 8 mm dia M.S. bar instead of laths as per design approved by Engineer-in- charge of approved make, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters with 1.25 mm thick top cover.
43)	**Steel rolling shutter for substation**	**:**	Fixing partly perforated rolling shutters of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters. 80x1.25 mm M.S. laths with 1.25 mm thick top cover.
44)	**Wall Guards and Corner Guards**	**:**	High Impact Vinyl 150 mm high Wall Guards with aluminium retainer, bumper, vinyl cover, end cap & suitable corner guard etc.
45)	**UPVC pipes (B Type) & fittings for sewerage system internal including roof water drainage system.**	**:**	UPVC pipes (B Type) & fittings conforming to IS-13592-1992 including fitting and fixing U.P.V.C. pipes for above ground work including cost of jointing materials etc. fitting and fixing all necessary specials, cutting pipes, cutting holes in walls or R.C. floor where necessary and mending good all damages excluding the cost of masonry or concrete work, if necessary, but including the cost and fitting and fixing holder bat clamps (any floor) complete as per direction of the Engineer-in-charge. Minimum dia of soil pipe is 110mm, waste pipe is 75mm & Rain water pipe is 160mm
46)	**UPVC pipes SDR41 SN4 & fittings for sewerage system external.**	**:**	UPVC pipes (B Type) & fittings conforming to IS-15328-2003 (reaffirmed 2008) including fitting and fixing as per approved drawing of U.P.V.C. pipes for underground work Minimum dia 250mm or as per design which ever is higher including cutting trenches upto design depth and refilling the same complete as per direction of the Engineer-in-charge.
47)	**CPVC pipes**	**:**	Fitting and fixing CPVC (Chlorinated Polyvinyl Chloride) pipes of approved make conforming to IS-15778: 2007 . with all necessary accessories, specials viz. socket, bend, tee, union, cross, elbo, nipple, longscrew, reducing socket, reducing tee, short piece etc. fitted with holder bats clamps at 1.00 m spacing, including cutting pipes, fitting, fixing etc. complete in all respect including cost of all necessary fittings as required,jointing materials in any position above ground. (Payment will be made on the centre line measurements of total pipe line including all specials. CPVC Pipes Class-I,SDR-11
48)	**UPVC pipes (Schedule 80)**	**:**	UPVC pipes (Schedule 80) & fittings conforming to ASTM D 1784, ASTM D-1785 shall be used for external water supply distribution.

SECTION 5.4C : ITEM WISE SPECIFICATION.			
Sl. No.	**Items**		**Detail Specification**
49)	**Mirror for single user toilet**	**:**	Fitting and fixing bevelled edged mirror 5.5 mm thick silver red as per I.S. 3438 / 1965 together with complete with 6 mm thick hard board ground fixed to wooden cleats with C.P. brass screws and washers complete. Size 600 mm X 450 mm
50)	**Mirror for common toilet**	**:**	Fixing mirror of superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shade with 6 mm thick hard board backing, rectangular shape size 1500mm x 450 mm or as per design requirement.
51)	**Wash Basin for single user toilets and staff quarters**	**:**	Fitting and fixing white vitreous china best quality approved make wash basin with C.I. brackets on 75 mm X 75 mm wooden blocks, C.P. waste fittings of 32 mm dia., one approved quality brass C.P. pillar cock of 15 mm dia., C.P. chain with rubber plug of 30 mm dia., approved quality P.V.C. waste pipe with C.P. nut 32 mm dia., 900 mm long approved quality P.V.C. connection pipe with heavy brass C.P. nut including mending good all damages and painting the brackets with two coats of approved paint. Size 630 mm X 450 mm.
52)	**Wash Basin for Common Toilets**	**:**	Fitting and fixing white vitreous china best quality approved make wash basin with C.I. brackets on 75 mm X 75 mm wooden blocks, C.P. waste fittings of 32 mm dia., one approved quality PTMT pillar cock of 15 mm dia., C.P. chain with rubber plug of 30 mm dia., approved quality P.V.C. waste pipe with C.P. nut 32 mm dia., 900 mm long approved quality P.V.C. connection pipe with heavy brass C.P. nut including mending good all damages and painting the brackets with two coats of approved paint. Size 550 mm X 400 mm.
53)	**Pedestal of wash basin (white) for Principal's Toilet & all HOD's Toilet**	**:**	Fitting and fixing pedestal of approved make for wash basin (white)
54)	**Stainless steel sink**	**:**	Fitting and fixing stainless steel sink complete with waste fittings and two coats of painting of C.I. brackets. 630 mm X 550 mm X 180 mm
55)	**Flat back urinal**	**:**	Fitting and fixing Flat back urinal (590 mm X 390 mm X 380 mm) (half stall urinal) in white vitreous chinaware of approved make in position with brass screws on 75 mm X 75 mm X 75 mm wooden blocks complete including urinal flush pipe fittings of approved brand.
56)	**Urinal Partition for common toilets**	**:**	Fitting and fixing 12mm high pressure compact bothside prelaminated panel for urinal partition wall of approved make of size 1000 mm X 600 mm with SS hardwere complete in all respect.
57)	**CP flushing valve**	**:**	Concealed type CP flush valve for flushing purpose minimum 32mm dia push type (Single/double flush) should be used in all toilet including commom toilets.

Section 5.5
Scope & Specification of Civil Works

Sec 5.5 Scope & Specification of Civil Works

1. Introduction to the project

West Bengal Medical Services Corporation Ltd (EMPLOYER), a Wholly Owned State Govt. Undertaking under Health & Family Welfare Department of Govt. of West Bengal is poised to execute construction of **4 New Medical colleges** on Turnkey Basis (Planning, Design & Execution) across the State of West Bengal in a time-bound manner. Though all the upcoming medical colleges are located inside the premises of existing / upcoming Hospital at city, district, sub-division & rural areas, these upcoming Hospitals will function on stand-alone basis both from points of administration and delivery of service to the users. But, in some of these ear-marked sites, the existing utility services viz, water line, sewerage line, electric line & substation, gas pipe line and other under and over ground structures may invite some hindrance. Intending bidder must carry out site-survey in detail and gather precise information to the extent possible and take into account all of them before quoting the Financial Bids for the individual packages. The Contractor must at the time of execution of the construction ensure seamless running of existing hospital and see the safety of all stakeholders of the running hospital according to standard industry practice of construction. Since the construction will take place inside the premises of running hospitals, any sort of pollution, be it sound, air or anything else related to clean environment have to be minimized to the extent possible by deploying modern mechanical plants &equipment. Assistance of latest mechanical equipment will not only minimize the eventual pollution but also warrant the overall project less labour intensive resulting in quick completion of the project, well within the time of completion and in a predictable way.

The project will be done on Turnkey Basis (Planning, Design & Execution) and the Contractor will be responsible for shortfall of any technical propriety and of upholding prevailing standard of Code of Practice according to NBC 2016 and all relevant latest-IS-Code as on 2018 on the way to accomplish the work according to the Employer's Requirements mentioned in Section – 5 of the Bidding Documents. Approval of Engineer of Employer(Employer’s Representative) at any stage of planning, design and construction of the project will not absolve the ingrained responsibility of the Contractor to execute the construction flawless and at par excellence and, if any aspect contrary to this owning up of responsibility is glaring, the Contractor will be held liable for such gross deviation.

The Project is scheduled to be completed within a period of 24 months from the date of notification of award.

2. SCOPE OF WORK

The project is broadly divided into 3(three) segments.

I. Construction of Medical college buildings comprising Administrative Building and various Departments.

II. Construction of hostel and residential quarters for Teaching staff, Non-Teaching staff, Nurse, RMO, Intern etc.

III. Out Patient Department.

3. GENERAL

Planning and Preparation of Concept plan, Structural design compatible with respective findings of Geotechnical Investigation & construction of Multi-Storied Frame-structured Buildings and allied works like Sanitary & Plumbing, Electrical installation, fire detection &fire fighting, Building Management System, CCTV, PA system, HVAC, Lift etc. on turnkey basis. The tentative ground coverage available for each floor of the upcoming medical college as per requirement specified, customization of

Architectural Plan in consultation with Engineer / Architect of the Employer will require depending on the shape and size of available land.

A. Survey Maps

Survey Maps for different locations of Four Medical Colleges are shown and the buildings to be constructed on the sites are also given in **Sec 5.2.**

B. Different Medical facilities (+ its approx. area)

The tentative allocation of different departments / facilities along with approx. required floor area in the proposed Medical College which is subject to addition and / or alteration in consultation with EMPLOYER at the time of preparation and finalization of Concept Plan is shown in **Sec 5.3**

C. Existing Services & Utilities

a) The existing services and utilities shall be diverted with proper liaison and approval of Employer. The services and utilities which cannot be diverted but require supporting, proper supporting shall be done by the Contractor at its own cost so that they are not damaged along their branches. Precautions to be taken while handling the services and utilities are mentioned as under.

b) Services and Utilities shall not be damaged at any cost. If due to some or the other reason mishap occurs, it should be rectified immediately by the Contractor at its own cost under intimation of EMPLOYER.

c) The Contractor shall take care and maintain at its own cost so that the ongoing activities are not disturbed in any manner whatsoever by the activities of the Contractor during the execution of the work. The above instructions are only indicative, other precautions which are specified from time to time by the EMPLOYER shall be followed by the Contractor at all times.

4. DETAILEDSCOPE OF WORK

The Scope of Work required for completion of the Project on a turnkey basis shall include the following:

A. CONCEPT PLANNING:

Preparation of the Concept Plan of upcoming medical colleges after incorporation of various facilities as per tentative floor plan given below subject to applicable laws and approval from EMPLOYER. It shall include:

I. Site surveys and soil investigations as per requirements.

II. Preparation of site layout plan for medical college.

III. Development of Building concept design/plans based on functional analysis and workflow analysis including preparation of space programming, design concept, concept for all services, interiors and exteriors, finishes etc.

IV. Obtaining approval of EMPLOYER for the concept plan and conceptual drawings

V. The Contractor may be asked to substantiate their quoted price by detailed estimate based on PWD SOR (WB) for scheduled items and based on market rate for non-scheduled items.

VI. Preparation and submission of drawings for statutory approvals and obtaining approvals / permits of the statutory / local / Government agencies

VII. Submission of concept plan document inclusive of site survey report, soil investigation report, cost estimates and approved drawings by all statutory authorities.

B. DETAILED DESIGN AND CONSTRUCTION

1. Detailed design engineering including architectural design, structural designs & drawings along with complete services of electrical, mechanical, bio-medical equipment – viz; DG set, UPS, Vertical Transportation System, Solar PV and Hot Water systems, water supply, sanitary & plumbing, fire detection, fire alarm &fire fighting, HVAC, networking (IT & Telephone), Public Address system, Common Antenna TV system, Video conference system, AV System, drainage, waste management system, sewage treatment plant, electrical sub-station, landscaping, parking etc. in accordance with detailed Plan & Design approved by EMPLOYER and in accordance with functional requirement of the medical colleges.
2. Obtaining structural design & drawing, concept architectural design duly approved by the academic institutions as recommended by the Employer.
3. Site clearance, relocation of existing utility services, including demolition of the existing services if required shall be completely under the scope of the Contractor.
4. Construction of foundation and substructure as per approved concept plan including erection of boundary wall and area development.
5. a. Internal Compound concrete road along with covered paved pathway to provide connectivity between Administrative block& Department block.

   b. Development of Campus for Residential Quarters, Hostels and other units comprising suitable landscaping, boundary wall, and internal concrete road connectivity with storm water drainage network connected with municipality drain, if any, and to the nearest natural outfall where municipality drain is not available.

   c. All approach concrete roads (upto nearest National Highway/State Highway/Major District Road) along with storm water drainage system and pathways inside premises of the medical college premises.
6. Assurance of quality aspect as per NBC 2016& all relevant IS-Code of latest edition.
7. Obtaining all the essential clearance /certificates/ NOCs from various local /statutory authorities and furnishing them to EMPLOYER as part of completion / occupancy readiness of the medical colleges and associated buildings.
8. Submission of the completion (i.e. 'as-built') drawings and other related documents in hard copy. A soft copy in Auto CAD or other similar software shall also be submitted.
9. Clearance of site of all wreckage and debris, before handing over of the facilities complete in all respect.
10. The Contractor shall have to execute the work in such manner so that appropriate service level of the buildings under construction is to be maintained during progress of the work and till the expiry of the Defects Liability Period for the Works, to the satisfaction of the Employer's Representative.

C.CONSTRUCTION OF SERVICE FACILITIES ALONG WITH ASSOCIATED INFRASTRUCTURE

Besides the Scope of Work referred at Sl. No. 'A' & 'B' above, the construction of buildings for Services along with associated infrastructure shall include the following along with other utilities required for smooth functioning of medical colleges complying all statutory regulations:

1. Water supply system including water treatment plant, underground storage tanks (2 days storage capacity of treated water and 1 day storage capacity of raw water of entire project), connection with existing water supply system. In addition to normal treated water, Reverse Osmosis (RO) treated water required for drinking purpose.
2. Construction of waste, sewer & storm water drainage system, recharge pits, sewage treatment plant etc. and connection of such service facilities with municipality drain, if any, and to the nearest natural outfall where municipality drain is not available.

3. All approach concrete roads (upto nearest National Highway/State Highway/Major District Road) along with storm water drainage system and internal concrete road inside premises of Medical College.
4. Landscaping and Horticulture at entrance and all around the premises of medical college as per approval of Employer.
5. Solar Photovoltaic plant
6. Fire fighting, fire detection and fire alarm system with required underground and overhead fire water tanks,

   fire fighting pumps, equipment, panels, ring mains, fire and smoke detectors, fire alarm panels, PA System etc. complete including construction of pump room.

N.B. Scope of Work cited above is indicative only. Agencies will submit progressively comprehensive and compatible service facilities design & report, subject to approval of EMPLOYER, to run the medical colleges and associated buildings smoothly.

5.Design Requirements for Building & Services

Introduction:

This specification defines the service and accommodation outputs that the EMPLOYER requires the Contractor to provide in respect of the new facilities for medical college. These are only indicative and the Contractor shall be responsible for the suitability and adequacy of the design and specifications to ensure that on completion the facilities become fully functional.

Project Objectives

The overall project objective is to develop the following:

- Planning & Setting up of new medical college along with all required associated services, infrastructure, to make it fully functional.

Required Outcome

- A design that will inspire and fulfill the requirement of all who use the facilities on day to day basis and which will make a positive statement to the society as a whole.
- Building design fabrics & materials, systems and services those are consistent with the latest architectural style and quality of similar facilities both of public and private sectors.
- Furniture and fittings that provide a safe, comfortable and welcoming environment and encourage and enable members across the society to use the facility.
- Use of materials consistent with the government's policies on environment, sustainability and urban design brief.
- The facilities shall have clear signage giving name and directional details enabling visitors, service users, staff and the emergency services, to easily locate the required destinations (internally and externally).

Designs

The Design Specification is intended to provide a clear understanding of the building design standards that the Employer wishes to achieve. While the Employer is keen to see innovation, it is equally conscious that basic standards of design including 3-D analysis and dynamic analysis of the structure be performed in letter and spirit.

The Contractor shall outline the means by which they will ensure design quality and the design objectives, which will influence their scheme. This shall include details of how the Employer's objectives are to be achieved.

General Standards

The new facilities shall be completed in conformity with high standards of construction and specification.

The facilities shall be technically and functionally suitable to meet the Employer's objectives:

i. The Architectural finishes shall be of such quality that will ensure better hygienic conditions.

ii. The design of buildings shall ensure control of noise due to walking, movement of trolleys and banging of doors etc.

iii. The architectural design should take in to account the requirements of physically challenged users.

iv. In general project will be constructed with AAC block with band beams and mullions (minimum thickness 250mm for outer wall & 150mm for internal wall). However wherever required, as directed by the Employer, the Contractor has to use 1st class clay brick. Strength, shape, size, properties etc. of AAC block should conform to the design requirements by way of sample testing. All the building materials, fittings and fixtures procured or to be used should be to the satisfaction of the Employer before being used for the Works intended to.

v. All sanitary/ water supply fixture and fittings shall be of approved make of EMPLOYER confirming to IS specifications.

vi. There should be separate inlets for hot and cold water in the buildings.

vii. The design should provide for underground & overhead water tanks of adequate capacity with necessary pumping arrangement for both portable and firefighting (where required) along with construction of pump room of required size & shape.

viii. The planning should include landscaping and horticulture to increase the comfort & hospitality conditions inside the buildings. The Contractor shall develop parking, approach roads and other service requirements meant for the medical colleges.

ix. a. Provision should be made for Internal Signage in all the buildings. In Medical College & hostels, it shall be provided in all the rooms with Directional Signage and Floor Signage. In residential quarters, it shall be provided for each unit &for respective floor.

b. External Signage near the Main Entrance of each building and directional signage to all the buildings placed at the junction of the road in the proposed area of development.

x. The room should be complete in all respect including communication networking, telephone connection, power points etc.

xi. Mechanical services shall be designed and installed with provisions to contain acceptable noise and the vibration generated by moving plant and equipment in the line of prevailing standard.

xii. All moving plant, machinery and apparatus are statically and dynamically balanced at manufacturer's work and mandatory certificate need to be procured to this effect from concerned authority.

xiii. Provision for development of parking / driveways as per standard practice laid down in the applicable municipal/ panchayat building rules.

xiv. Standard store room for collection of Bio-Medical waste.

xv. Design coordination between architecture, structure and all other building services. Disciplines should be modelled through suitable software for the entire project. The Employer / its authorized representatives shall have free access to review the same and get a feel of the complete horizontal and vertical spaces along with all services and fixtures in place before Good for Construction (GFC) drawings are released for physical execution. Soft copy of approved GFC Drawings will be submitted by

the Contractor in both AutoCad and PDF format before execution of the work. All changes in GFC drawings during execution of the project need to be incorporated duly at the time of submission of As-Built drawings.

Floor to Floor height of all Floors including stilt floor to be mentioned,

a) Academic building -4.20M
b) Hostels-3.30M,
c) Housing-3.30M, Stilt 3.30 M
d) Animal House-3.30M
e) Central workshop-3.30M
f) Maintenance Office-3.30M
g) Garbage Store-3.00 M
h) Sub-station & other service buildings-4.50M
i) OPD- 4.20 M

6. SPECIFICATIONS OF FINISHING ITEMS

Specification of finishing items both for internal & external civil works will conform to Sec 5.4of this document.

7. REQUIREMENTS OF VARIOUS SEGMENTS

7.1.1 Provision for the following shall be made.

i) The buildings shall be designed according to prevailing regulations & standards. However, the Contractor shall be responsible for the adequacy, suitability & sufficiency of the design.

ii) The Contractor shall provide all the required services of adequate capacity to meet the requirements of NBC-2016, NEC and other relevant IS-Code for smooth functioning of medical college.

iii) The project shall be designed according to best practices and constructed at par with the prevailing standards and equipped with latest equipment at the time of commissioning. Process of plan area utilization for different facilities at different floors as per Tentative Area programme in the Employer's Requirements is to be followed.

iv) Development of adequate parking area for Cars & Two Wheelers.

8.SAFETY AND SECURITY

i Security rooms should be provided in the following locations

a) Entry and exit gate of the premises.
b) Entry and exit gate of Academic building & Hostel blocks.

ii Arrangement for adequate exterior lighting in whole medical college campus.

iii Provisions for securing the personal belongings of staff, visitors, and students/residents should be taken care of.

9. FINISHES

a. Internal & External color palettes should be designed as per approval of Employer.

b. Finishes and colour palettes should respond to the geographic location of the project, regional responses to colour, and the cultural characteristics of the community served.

c. The following materials may be used for external finishes of Academic building under Medical College project:

i) Structural Glazing
ii) Glass mosaic tiles
iii) Exterior paint over plastered surface
iv) Exterior textured paint over plastered surface
v) ACP cladding
vi) Stone cladding
vii) Metal louvers
viii) Glass Fibre Reinforced Concrete (GFRC)
ix) Designer Balustrade
x) Exterior high pressure compact laminate

d. The following materials may be used for external finishes of Hostel buildings under Medical College project:

i) Glass mosaic tiles
ii) Exterior paint over plastered surface
iii) ACP cladding
iv) Metal louvers
v) GFRC
vi) Designer Balustrade
vii) Exterior high pressure compact laminate

e. The following materials may be used for external finishes of Quarters under Medical College project:

i) Exterior paint over plastered surface
ii) Metal louvers
iii) GFRC
iv) Designer Balustrade
v) Exterior high pressure compact laminate

f. The following materials may be used for external finishes of OPD buildings under Medical College project:

i) Structural Glazing
ii) Glass mosaic tiles
iii) Exterior paint over plastered surface
iv) Exterior textured paint over plastered surface
v) ACP cladding
vi) Stone cladding
vii) Metal louvers
viii) GFRC
ix) Designer Balustrade
x) Exterior high pressure compact laminate.

10. DOCUMENTS TO BE SUBMITTED WITH DESIGN

The Contractor shall submit with its design all the documents and the references used in the design. The Contractor shall also submit 6 (six) sets of copies of the following:

a. Concept plan document with site surveys, soil investigation report for the complete new proposed medical college.
b. Detailed structural design and drawings, architectural drawings, design & drawing of service component inter alia other allied items to be constructed.
c. Standards and specifications being followed in the design and for materials to be used in a consolidated statement of fact.
d. Different Laboratory& Field Tests to be carried out at site & referred laboratories.
e. Site safety plan
f. Quality plan in compliance with ISO: 9001 with latest edition & relevant particulars.
g. Design Basis Report showing data & relevant particulars.
h. Requirements for any foundation, structure, plants or services etc. which the Contractor feels shall be accessed in order to proceed with implementation of the projects.

The Contractor shall submit to the Employer all Design Data, together with the relevant Design Certificates issued. In the event that a re-submission of Design Basis report is required, such resubmission shall be made as soon as practicable after the receipt of the relevant statement of objections. All submissions of Design Basis report shall include 6 (six) copies.

11. QUALITY CONTROL

The Contractor must ensure that the Works conform to the quality standards up to the satisfaction of the Employer. The Contractor shall submit its quality enforcement plan for monitoring. The Works, Plants and Materials shall be subject to tests from time to time as per best practices in the industry. Wherever mentioned in the Contract, the tests must be carried out at the Contractor's expense. The materials, fitting & fixtures shall be procured from reputed make and vendors approved by the EMPLOYER. The Contractor must also supply samples of such material to the Employer for approval and they must carry out the laboratory & field tests as and when required by the Engineer of EMPLOYER and / or in conformity with relevant IS-Code.

12. STRUCTURAL SYSTEM

12.1 DESIGN PHILOSOPHY

- 3-D analysis and dynamic analysis of all the building structures will be carried out using latest versions of modern software packages such as S A F E , E T A B S , STAAD Pro / V8i select series and the results of the analysis shall be used for designing the various elements. All designs shall strictly conform to the standards specified in National Building Code 2016& other relevant IS-Code. At the time of earthquake analysis, wall panel filled in by brick wall weight to be considered. Use of mechanical coupler / device for joint of reinforcement will be allowed. Minimum Grade of steel reinforcement is Fe500D.Minimum grade of concrete is M30. Use of fly ash is prohibited for mix design concrete.
- The Employer reserves the right to conduct third party design validation by their 3rd party assessor and the Contractor shall provide all data in soft and hard copy and carry out all modifications that may be suggested by the party so appointed. An authorized representative of the Contractor will assist at the time of checking of structural design & drawings by 3rd party assessor for necessary clarification and for providing required data and statements to them.
- Contractor shall conduct site surveys and soil investigations on their own, and shall be responsible for accuracy and the adequacy of the Foundation design and design of super-structure as per IS code or international code where IS code is not available.

•Overhead tank& UGR of adequate capacity for the purpose of drinking water and for firefighting water as laid down in NBC-2016 and relevant IS code shall be designed.

12.2 MISCELLANEOUS STRUCTURES

Air-conditioning Plant, UG sump, Pump Room, Substation, RCC cable trench, DG Foundation with structural roof, etc. and other allied item of works as stated in Scope & Specification of Electrical works.

12.3 DESIGN METHODOLOGY

All R.C.C. structures shall be designed according to Limit State Method in conformity with all relevant IS –Code & NBC 2016.

12.4 WATER PROOFING WORKS

TERRACE FLOOR WATER PROOFING:

- Surface preparation including removing of existing dust, laitance, oil, grease and any other foreign material, complete& final cleaning of the surface, treating of construction joints, filling of honeycombs etc., including providing and applying polymer modified mortar at 1:4 ratio (cement: sand) admixed with SBR based compound at 3% by weight of cement to repair the covings, pot holes and any uneven surface on the RCC roof. All around on the roof, at the parapet wall junction, an angular fillet of 50 mm X 50 mm shall be made with the same mortar complete in all respects (excluding the cost of cement & sand).

- Providing and laying 20mm thick of two component instant setting spray applied multilayer insulative polyurethane foam waterproofing system, polymeric closed cell PU Foam with a core density of 55-60kg/cu.mt as per ASTM D1622 possessing an impermeable skin on top of each layer. The cured foam should be having closed cell apparent of 96%-98% by volume as per ASTM D-2856, and having fire resistance properties conforming to class B2 as per DIN4102, water absorption 0.009gms/cc as per ASTM C-272, as per the manufacturer's recommendations. Followed by a spray applied sealer coat of single component, cold applied, pure Polyurethane based, elastomeric, seamless coating of consumption of 1.5kg./sq.mt. up to 300 mm at parapet wall ; conforming solid content 90% as per ASTM C 836, elongation at break > 400% ASTM D-412, hardness 75 shore A, as per ASTM D2240(15"), root resistance properties as per EN 13948, Euroclass F for fire resistance property and subsequently protected with a geo-textile(non-woven polyester) of 150-200gsm thick. The entire system for supply of material and installation of system needs to be carried out by in-house application arm of the manufacturer with manufacturer's warranty for a period of ten(10)years, under strict supervision of the manufacturer.

- Providing and laying of 75mm average & 50 mm minimum thick M25 grade screed concrete (or suitable thickness for necessary slope). Green stage saw cutting on the screed will be done in panels (3mx3m) with grooves 6mm width X 8 mm depth & finally the groove will be sealed with suitable elastomeric sealant.

WATERPROOFING TO INTERNAL WET AREAS, BATHROOMS AND KITCHENS ETC:

- Cleaning and making necessary surface preparation by high pressure water jet to remove any dust and laitance etc., chasing open the construction joints and sealing the same to form a U shaped groove of approx. 20 mm width and 20 mm depth, using polymer modified cementitous mortar carrying out injection grouting at the construction joints, honeycombs, etc., by injecting cement slurry grout admixed with plasticizing and expandable grout additive @ min 225gm/bag of cement, to full saturation

wherever necessary. Thereafter, providing and applying one coat of water based epoxy primer, followed by high performance waterborne, modified, single component, synthetic rubber based, liquid applied waterproofing elastomeric membrane having over 300% elongation capacity applied in two coats to a total DFT of 700 microns, with a consumption of approx. 1.2 to 1.3 litre per sqm on the floor & walls upto 1.00 mtr height (Shower area upto full height), ponding with water for 3 days etc. complete.

- Providing and applying Epoxy based bonding coat @ approx. 0.15 to 0.20 Kg per Sq.Mt., sprinkled with quartz sand over the surface still, while sticky, so as to form a key for installation of plaster / screed.

- Providing and applying polymer modified high strength cementitious mortar with a compressive strength of min 30 Mpa, to be applied as a protective layer for the floor and walls in a thickness of 5-6 mm thick by trowel application all as per manufacturer's recommendation etc., complete.

- Sunken filling with Sand or suitable material

- Providing and laying 50 mm thick M20 grade P.C.C. layer screed including Polypropylene fibers @ 0.9 Kg. per Cu.Mt., including LW+, or equivalent, integral waterproofing admixture @ 100 ml per bag of cement, well compacted to a float finish, curing etc. complete.

- Providing and applying two component, flexible and highly elastic acrylic polymer modified, micro-fiber reinforced, cementitious coating having a tensile strength of min 1 Mpa and elongation of min 250%, to be applied in two coats with a total consumption of 2 Kg per Sq.Mt., on the top of the screed above the sunken filling layers, all as per manufacturer's recommendation including embedding fiberglass or polyester reinforcing mesh between the two coats of the coating and taking the coating on the verticals for an overlap of minimum 100 mm all around the periphery etc., and thereafter providing and applying polymer modified cementitious bond coat, comprising of URP polymer mixed with cement in the ratio of (1:1) parts by weight applied by brush and thereafter immediately sprinkling quartz sand over the bond coat to create the protection layer as well as to provide a rough key for the subsequent floor finishing etc. complete.

- Sealing around down take pipes: Providing and laying Micro concrete, or, equivalent non shrink, free flow, high strength cementitious grout material to seal the annular gap around pipe periphery and core cut in the slab including providing and applying self adhesive SBS Tape, which is a two way adhesive tape to be stuck around the pipe periphery within the cutouts section of the slab and prior to laying the Micro concrete, all as per manufacturer's recommendation, followed by providing and applying single component, air cured PU Sealant, or, equivalent around the pipe periphery joints at the top level etc., complete.

- Along with manufacturer's warranty for a period of ten (10)years.

WATERPROOFING TREATMENT TO INTERNAL SURFACES OF UG TANKS AND OH TANKS:

- Cleaning the surface of the internal concrete surface of the floor as well as walls thoroughly by wire brushing and washing with high pressure water jet, to remove any loose laitance as well as contaminates, thereafter inspecting the concrete surface to identify any honeycombs, crack, voids or defects in the concrete such as cracks, construction joints etc., and sealing all such locations with solvent free epoxy mortar, using epoxy resin and hardener as per manufacturers recommendation. Thereafter providing and applying one coat of solvent free epoxy/PU primer followed by 2 coats of two component, 100% solids, and aromatic Pure Polyurethane elastic coating possessing non-toxic, potable water contact capability properties of total 1.5 mm thick. The membrane possess tensile strength of 8Mpa, Shore A Hardness >90, Elongation property >100%, Concrete Adherence of >1.5Mpa at 23 deg.C. with Euro Class F as fire reaction properties.

- Along with manufacturer's warranty for a period of ten (10)years.

13. PUBLIC HEALTH ENGINEERING

13.1 SCOPE OF WORK

- CP Sanitary fittings & Fixtures as shall be approved by the Employer.
- PTMT (Poly Tetra Methylene Terephthalate) Sanitary fittings (Only for domestic water supply at common toilets) as shall be approved by the Employer.
- Internal Domestic Water Supply Systems including drinking water system
- Internal hot water
- Internal Sanitary & Roof Drainage Systems
- External Water Supply, Sewerage & Storm water Drainage Systems
- Water Treatment Plant
- Sewage Treatment Plant
- Rain water harvesting systems

13.2 WATER SUPPLY SYSTEM

i. External water supply is to be designed based on total water requirement for the individual building and internal water supply on Effective Fixture Unit basis. All water supply lines are to designed based on Indian Standards and Manuals.

ii. Design Standards
- CPHEEO: 1999 – Manual on water supply and treatment latest edition
- CPHEEO: 1993 – Manual on sewage and sewage treatment latest edition
- SP 35: 1987 – Handbook on water supply and Drainage latest edition
- NBC 2016
- UPC – India: 2011
- Relevant Indian Standards

iii) Quantification of daily water is to be determined and Tube well of adequate capacity and numbers (200/250 mm internal dia heavy duty pipe with fibre glass strainer) would have to be sunk to meet up the requirement of the entire demand of the medical college building, OPD building and its different residential quarters.

Capacity of water treatment plant shall be designed based on the requirement of potable water for Academic Block, OPD Block and all residential & hostel accommodation.

Requisite water for washing of compound, road, hospital premises, gardening, arboriculture etc. can be taken from treated water through STP and the residual treated water from STP shall be disposed off to adjacent drainage network connected with municipality drain, if any, and to the nearest natural outfall where municipality drain is not available.

iv) Submersible pump will be used for pumping raw water from bore well to UGT and open well submersible pumps for pumping water from UGT to OHT of the buildings. Submersible pump capacity shall be arrived assuming raw water sump shall be filled in 3 hours and open well submersible pump capacity is to be arrived assuming OHT shall be filled in 2 hours. Borewell and open well submersible pump shall be integrated with level sensors and same shall be controlled through automatic ON/OFF controller.

v) The Water Treatment Plant (WTP) need to be in place to treat the raw water from the bore well. The location of WTP shall be designed to place in the pump room.

vi) Domestic water supply distribution from OHT shall be formed, as a loop / branch network by gravity.

vii) UPVC pipes (Schedule 80) & fittings conforming to ASTM D-1784, ASTM D-1785 for cold water supply in terrace and vertical. For internal distribution of cold water supply and hot water supply CPVC (Class -1, SDR11) pipes shall be used. Water from the bore wells shall be pumped to the UGT from bore well by submersible pumps. The raw water in UGT shall be suitably treated before pumping it up in OHT of building.

viii) UPVC pipes (Schedule 80) & fittings conforming to ASTM D 1784, ASTM D-1785 shall be used for external water supply distribution. Sanitary fixtures and CP-fittings shall be of standard and approved make and shall be according to best industry practice. PMPT domestic water supply fittings only for common toilets except staff quarters and single user toilet.

NOTE: Sanitary fixtures and CP-fittings shall be of standard and approved make and shall be as per best industry practices. PTMT-fittings (only for domestic water supply at common toilets) shall be of standard and approved make for common toilets only except staff quarters building.

13.3 SEWERAGE SYSTEM

i. Diameter of vertical stacks for soil pipes and waste pipes will be determined according to demand of fixture units. Sewer lines are to be designed for running partially full with a maximum depth of sewage equal to half depth of the sewer diameter. All necessary appurtenances like gully trap, manholes etc. will be provided for the efficient functioning of the sewerage system.

ii. Soil and wastewater from the water closets and toilets will be collected separately. Soil pipes will be connected to manholes and waste pipes to gully trap and then to manholes.

iii. UPVC pipes (B Type) & fittings conforming to IS-13592 & 13593 shall be used for internal sewerage pipes. Minimum diameter of rain water pipe is 160mm, soil pipe is 110 mm and waste pipe is 75 mm.

iv. UPVC pipes SDR41 SN4 & fittings conforming to IS-15328-2003 (reaffirmed 2008) for sewerage system external with minimum diameter 250mm or as per design whichever is higher.

v. All building manholes will be interconnected for carrying sewage finally to the Sewage Treatment Plant (STP).The process of STP operation will be Moving Bed Bio-reactor. The outlet water quality of treated water from STP shall be suitable to be used for Flushing purposes as prescribed in CPHEEO Manual (on Sewerage and sewage treatment systems of latest edition) only at Academic building flushing purpose with provision of normal supply arrangement also. Provision of Soak pit in absence of open sewer line adjacent to proposed site and ground water recharging if possible will also be made for absorption of treated water. The Contractor will design the system as deemed fit with the approval of the Employer.

vi. Rain water harvesting i.e. collection of rainwater runoff from the rooftops is to be properly designed. Roof water from the buildings shall be taken through rain water pipes and connected to recharge pit. The excess from the recharge pits shall be connected to drainage network connected with municipality drain, if any, and to the nearest natural outfall where municipality drain is not available.

vii. Suitable arrangement of watering landscape and arboriculture will be made. In absence of necessity for irrigation, soak-pit of adequate capacity will take care of treated water.

viii. Solid waste generated in the medical colleges shall be collected separately, according to the category of wastes and sent to disposal facility. The garbage room shall be in place to store different categories of waste.

13.4 Site office for EMPLOYER

The Contractor will arrange site office of semi-permanent type along with providing 3nos. Personal Computers, Internet connection, LAN, intercom,A3 &A4laser printer with scanner etc. for Employer's personnel at each site which shall be furnished with Officer's tables, Officer's chairs, visitor's chair, almirahs and shall be duly air-conditioned, to the satisfaction of the Employer. At each Site office provision for 4 rooms of approximate area @ 120 sq. ft. each is to be made including separate toilet facility for men & women.

14. LIST OF APPROVED MAKES / VENDORS

The Contractor has to take prior approval from the Employer's Representative for selection of any particular Make/Brand or any particular category/subcategory of such Make/Brand for any item of work mentioned in the list. If any Make/Brand or any category/ sub-category thereof is not available in the market, Employer's Representative can add or substitute Make/Brand or any particular category/sub-category of such Make/Brand apart from that in the list at any stage during progress of work but only upon due application in this respect from the end of the Contractor corroborated by necessary documents. The decision in this regard taken by the Employer will be final and binding.

Sl. No.	Materials	Manufacturers / Agencies
1	Batch Mix Concrete (BMC) / Ready Mix Concrete (RMC)	The Contractor to install its own computerized batching plant of suitable capacity and arrange for Transit Mixers, pumps etc. as per approval of the Employer's Representative Or The RMC shall be procured from the source as approved by the Employer's Representative from Nuvoco /ACC/Ambuja/Ultra Tech
2	Portland Slag Cement / Portland Puzzolona Cement/ Ordinary Portland Cement	ACC / Ambuja / Nuvoco / Ultra Tech
3	Reinforcement/ Structural Steel (Each LOT shall accompany manufacturer's Test Certificate)	SAIL, TISCO, RINL
4	Admixture	Fosroc, Sika, BASF, Chryso
5	Interior decorator for Auditorium & Lecture Halls	Manashi, Godrej Interio, K.G. Enterprise, Satelite Electronics, Elite Interior, Living Creation
6	White Cement	Ultra Tech Birla White/ Grasim/JP Cement

Sl. No.	Materials	Manufacturers / Agencies
7	Sand	Sand conforming to IS : 383 of latest edition
8	AAC Block	Icon, Biltec, UAL, Featherlite, JOYOUS
9	Vitrified Tiles, Ceramic Tiles	Kajaria, NITCO, RAK Ceramics, Somany
10	Vitrified Tiles, Ceramic Tiles	Kajaria, NITCO, RAK Ceramics, Somany
11	Stone Polymer Composite (SPC) tiles flooring	Welspun, Wonderfloor, Armstrong
12	Carpets	Miliken, Heritage, Shaw, Welspun
13	Tiles Adhesive, Tiles Grout, AAC Block Adhesive, Glass Mosaic Adhesive, Stone Fixing Adhesive, Silicon Sealant	MYK LATICRETE, Kerakoll, Fosroc, Ardex, Ultratech
14	Pre-laminated Flush doors, Plywood	Green-Ply, Century-Ply, Archid-Ply, Merino
15	Metal Fire doors	Ahura Mazda, Sakti Hormone, Navair, Metaflex
16	Aluminium Door & Window Fittings	Ebco, Hefele, Dorma, LGF Sysmac
17	Door fittings & fixtures	Hettich, Dorma, Hefele, Godrej, Ozone
18	Hydraulic floor Spring	Hettich, Dorma, Godrej
19	Metal Door frame	Tata Steel pravesh, JSW steel door, Sakti Hormone, Ahura Mazda
20	Metal Door Shutter	Tata Steel pravesh, JSW steel door, Sakti Hormone, Ahura Mazda
21	Aluminium Extruded Sections with power coating	Indalco / Hindalco/ Jindal
22	Aluminum Composite Panel	Eurobond, Aludecor, Alstrong, Alucobond
23	Putty	Birla White, Berger, Dulux Acknozabel, Asian Paints, Gyproc
24	Paints	Dulux Acknozabel, Berger, Asian Paints, Nerolac
25	Glass	Modiguard, Saint Gobain, Asahi Glass Co. Ltd.
26	Water proofing Works	Fosroc, Sika, Pidilite, BASF
27	Paver blocks	Dona Tiles, Buildmat, Salasar tiles,
28	Hydraulic Door Closers (Heavy Type)	Hettich, Dorma, Hefele, Godrej

Sl. No.	Materials	Manufacturers / Agencies
29	Cement Based Paint	Acknozabel, Berger, Snowcem, Seacem
30	False Ceiling Structure	Armstrong, Hunter Douglas, AMF, Gyproc, Anutone
31	False Ceiling Board / Tile (a) Metal False Ceiling (b) Magnesia False Ceiling (c) Acoustic False ceiling (NCR>0.9) (d) Fiber cement tile False Ceiling	a. Armstrong, Hunter Douglas, AMF, Gyproc, Anutone b. Anutone, Winwin, Besta c. Armstrong, Anutone, AMF d. Vnest Visaka, Everest,Bison Panel
32	Wall Paneling (a) Acoustic (b) Normal	(a) Anutone, AMF, Armstrong (b) Bison Panel, Green-Ply, Century-Ply, Archid-Ply, Merino
33	SS Hand rail for stair and other places.	Godrej, Ozone, Iona, Oral
34	Metal Fascia Louvers	Hunter Douglas, Armstrong
35	Glass Mosaic	Italia, Glass Stone Mosaic, Ramas Mosaic House, Paladio
36	Furniture	Godrej Interio, Featherlite, Wipro, Midmark (formerly Janak), Stellar, Methodex
37	Urinal Partition (12mm High pressure Laminated Panel)	Royale Touch Qbiss, Merino, Green Ply,
38	RCC Pipes	Aurbinada Spun Pipe Industries, EAST INDIA, Calcutta spun pipes, Eastern Spuncrete Pipes
39	Granite	Black Marcello, Tan Brown, Cat's Eye, Asian Top, River White, Imperial Gold, Golden Juparana, Madurai Gold, Crystal Yellow, China White, Tiger Skin, Tometo Red, Shiva Pink, Larvin Pink, Magnet Pink, Pista Green, New Imperial Red,
40	Cast Iron Pressure Pipes & Fittings	Electrosteel/ISSCO
41	Cast Iron Pipe and Fittings (Soil Pipes)	Electro Steel / IISCO / BIC
42	GI Pipes (ISI marked)	Jindal / Tata / SAIL (Heavy Duty)
43	GI Fittings (ISI marked)	'R' Brand KS/UNIK (Heavy Duty)
44	Brass ball Valves & Fittings	Zoloto/Sant/Uniflow/R Brand
45	Cast Iron Butterfly Valves & Fittings	Premier/ Zoloto/Sant/Intervalve/Deepak

Sl. No.	Materials	Manufacturers / Agencies
46	CI Sluice Valves, Check valves	IVC (Calcutta) Kirloskar/Zoloto/Sant/Deepak
47	Premium quality CP Brass Sanitary and water supply Fittings including health faucet.	Jaquor/ Essco/Cera/Marc/Parryware/Hindware
48	Vitreous China Sanitary ware	Jaquor/ Essco/Cera/Marc/Parryware/Hindware
49	WC Seats & Covers	Jaquor/ Essco/Cera/Marc/Parryware/Hindware
50	Curtain/Wall/Structural Glazing	Specialist Agency to be employed with Prior Approval of Employer's Representative
51	Plywood Products, Parcticle Boards & Veneers	Greenply /Century / Archid-Ply / Merino
52	Plastic Laminates	Formica, Sunmica, Greenlam, Bakelite HYLAM
53	Powder Coatings	Berger/ Acknozable
54	Polyethylene Water storage Tank	Sintex / Rotex / Duro plast / Patton
55	Tile Joint Filler	Kajaria, Jhonson
56	Resin Bonded Glass Wool	Crown Fibre Glass/Rock lloyd
57	M.S. Pipe	Jindal / TATA
58	UPVC, CPVC Pipes/Fittings	Supreme/Finolex/Astral/Prince
59	Silicon Sealant	Silicone, SIKA, Pidilite
60	Anchor Fastener	Hilti, Bosch
61	Formwork Release Agent	Fosroc, MBT, MC Baucheme CICO, ADO Conmat
62	CP Waste, Spreaders for Urinals	Jaquar/ Essco/Cera/Marc/Parryware/Hindware
63	Manual Push cock operating urinals	Jaquar/ Essco/Cera/Marc/Parryware/Hindware
64	SFRC Manhole Covers	KK/SK Precast Concrete/ Daya Concrete
65	Mirror	Modiguard /Saint Gobain/ Asahi Glass Co. Ltd.
66	Flushing Valve	Jaquor/ Essco/Cera/Marc/Parryware/Hindware
67	Floor EWC/IPWC/AIWC/OPWC & Wall Mounted EWC	Jaquor/ Essco/Cera/Marc/Parryware/Hindware
68	R.O. System	As per discretion of Employer's Representative

Sl. No.	Materials	Manufacturers / Agencies
69	Geyser	Venus / Voltas / Bajaj/Havels/ Jaquar
70	Hand Drier	Venus / Voltas / Bajaj
71	Stainless Steel sink	Parryware/HINDWARE/CERA/Tata/Jaquar
72	PTMT and water supply Fittings	Prayag.

15. QUALITY ASSURANCE PLAN AND TESTING OF MATERIALS

Quality Assurance :

Quality Assurance Plan is to be maintained by the Contractor to ensure a progressively improved and uniform quality of the finished work. The plan shall indicate all the required tests to be done during the construction stage, all the relevant applicable codes, specifications and standards, as well as the acceptable criteria for each of the relevant items of work, materials. The Contractor is to submit a 'Methods Statement' for Quality Assurance for the elaborate construction procedures, the specification of the materials involved, their testing and acceptance criteria, equipment to be used, precautions to be taken for all activities, for approval of the Employer. All these have to be checked/tested periodically at the required intervals by the Contractor in presence of the authorized persons of the Employer and the reports shall have to be signed by the authorized representatives of the contractor and authenticated by authorized representative of the Employer. The Contractor is to arrange for an Independent Quality Assurance set up providing adequate covered space, Qualified expert technicians, equipment & consumables at site assuring maintenance of Quality. For Quality Assurance certain tests are to be conducted at approved laboratories and certain tests are to be performed at site. The Contractor is to maintain a field testing laboratory equipped with at least the following equipment and instruments :

A. For Building Works

1. Balances

   i) 7 kg to 10 kg capacity, semi-self indicating type-accuracy 10 gm.

   ii) 500 gm capacity, semi-self indicating type-accuracy 1 gm.

   iii) Pan balance-5 kg capacity –accuracy 10 gms.

2. Ovens-electrically operated, thermostatically controlled upto 110^0C - 1^0C.

3. Sieves : as per IS 460-1962.

   i) IS sieves – 450 mm internal dia, of sizes 100 mm, 80 mm, 63 mm, 50 mm, 40 mm, 25 mm, 20 mm, 12.5 mm, 10 mm, 6.3 mm, 4.75 mm, complete with lid and pan.

   ii) IS sieves – 200 mm internal dia (brass frame) consisting of 2.36 mm, 1.18 mm, 600 microns, 425 microns, 300 microns, 212 microns, 150 microns, 90 microns, 75 microns, with lid and pan.

4. Sieve shaker capacity of 200 mm and 300 mm dia sieves, manually operated with timing switch assembly.

5. Equipment for slump test – Slump cone, steel plate, tamping rod, steel scale, scoop.

6. Dial gauges, 25 mm travel – 0.01 mm/division least count – 2 nos.

7. 100 tones compression testing machine, electrical-cum manually operated.

8. Graduated measuring cylinders 200 ml capacity – 3 nos.

9. Enamel trays (for efflorescence test for bricks)

   i) 300 mm x 250 mm x 40 mm – 2 nos.

   ii) Circular plates of 250 mm dia – 4 nos.

B. For Road Works

1. Balances

   i) 7 kg to 10 kg capacity, semi-self indicating type-accuracy 10 gm.

   ii) 500 gm capacity, semi-self indicating type-accuracy 1 gm.

   iii) Chemical balance, 100 gm capacity – accuracy – 0.1 gm.

   iv) Pan balance – 5 kg capacity – 10 gm accuracy.

   v) Platform scale – 300 kg capacity.

2. Oven electrically operated, thermostatically controlled.

   i) Upto 200^0 C for determination of loss on heating of bitumen.

3. Sieves as per IS 460-1962.

   i) IS sieves – 450 mm of internal dia of sizes 100 mm, 80 mm, 63 mm, 50 mm, 40 mm, 25 mm, 20 mm, 12.5 mm, 10 mm, 6.3 mm, 4.75 mm, complete with lid and pan.

   ii) IS sieves – 200 mm internal dia (brass frame) consisting of 2.36 mm, 1.18 mm, 600 microns, 425 microns, 300 microns, 212 microns, 150 microns, 90 microns, 75 microns, with lid and pan.

4. Sieves shaker capable for shaking 200 mm and 300 mm dia sieves, electrically operated with timer.

5. Dial guage

   i) 25 mm travel – 0.01 mm/division.

6. Load frame – 5 tones capacity, electrically operated with speed control.

7. Aggregate impact test apparatus as per IS 2386-Part IV-1963.

8. Compaction apparatus (Proctor) as per IS 2720-Part VII-1974.

9. Modified ASHO compaction apparatus as per IS 2720-Part III-1974.

10. Sand pouring cylinder with control funnel and tube complete as per IS 2720-Part XXVIII-1974.

11. Sampling tins with rods 100 mm dia x 50 mm ht, ½ kg capacity, and miscellaneous items like moisture tines etc.

12. Constant temperature bath for accommodating bitumen test specimen, electrically operated and thermostatically controlled.

13. Penetrometer with automatic time controller and with adjustable weight accessories and needles as per IS 1203-1958.

14. Oxhlet extraction apparatus complete with extraction thimbles etc.

15. Laboratory mixer, about 0.02 cu-meter capacity, electrically operated with heating jacket.

16. Hubbard filed stability test apparatus complete.

17. Marshall compaction apparatus as per ASTIM 1559-62T, and complete with electrically operated leading unit, compaction pedestal bearing head assembly, diamicrometer, and bracket for flow measurement, load transfer bar, specimen mould (4 inch. Dia) with base plate, columns, mold (4 inch dia) with base plate, collars, specimen extracted. Compaction hammer, 4.53 kg (10lb)/457 mm (18 inch) fall.

18. Distant reading thermometers.

19. Graduated cylinder 1000 ml. capacity.

20. Enamel tray.

21. Electric operated oven for determining Moisture Content of soil and aggregates.

Laboratory Equipment for testing of building materials at site (Indicative only)

All necessary equipment for conducting necessary tests shall be provided at the site laboratory by the Contractor at its own cost. The following minimum laboratory equipment shall be set up at site office laboratory:

Sl. No.	Equipment	Quantity
1	Cube testing machine	1 No.
2	Slump Cone	2 Nos.
3	Tensile Briquette testing machine	2 Nos.

Sl. No.	Equipment	Quantity
4	Vicats apparatus with Desk Pot	2 Nos.
5	Megger & earth resistance tester	4 Nos.
6	Pumps and pressure gauges for hydraulic testing of pipes	2 Nos.
7	Weighing scale platform type 100 kg capacity	2 Nos.
8	Weighing scale platform type 10 kg capacity	2 Nos.
9	Weighing scale platform type 5 kg capacity	2 Nos.
10	Graduated glass cylinder	As per requirement
11	Sets of sieves for coarse aggregate [40,20,10,4.75 mm]	2 Nos.
12	Sets of sieves for fine aggregate [4.75; 2.36, 18; 600; 300 & 150 micron	2 Nos.
13	Core cutter for soil compaction with accessories including cylindrical moulds	2 Nos.
14	Cube moulds size 150mm x 150mm x 150mm	90 Nos.
15	Modified proctor testing apparatus	1 Set
16	Hot Air Oven Tem. Range 500C to 3000C	2 Nos.
17	Electronic balance 600g x 0.01g. 10kg and 50kg	3 Nos.
18	Digital thermometer up to 1500 C	2 Nos.
19	Poker Thermometer (Concrete Road) 00C to 500 & 1500C	2 Nos.
20	Measuring Jars 100ml, 200ml, 500ml	2 Nos. set of each size.
21	Gauging trowels 100mm & 200mm with wooden handle	4 Nos.
22	Spatula 100mm & 200mm with long blade wooden handle	2 Nos. set of each size.
23	Digital Vernire callipers 12” and 6” sizes	2 Nos. each
24	Digital PH motor least count 01mm	1 No.
25	Digital Micrometer least count .01mm	1 No.
26	Digital paint thickness meter for steel 500 micron range	2 Nos.
27	GI tray 600 x 450 x 50mm, 450x300x40mm, 300xc250x40mm	2 Nos.
28	Electric Morter mixer 0.25 Cum capacity	2 No.
29	Rebound hammer test Digital rebound hammer	1 No.
30	Digital Screw gauge 0.1mm – 10mm, least count 0.05	2 Nos.
31	Water testing Kit	2 Nos.
32	Aggregate impact value testing machine with blow counter	1 Set
33	Crushing value apparatus	1 Set
34	Thickness gauge for measuring flakiness index	1 Set

Sl. No.	Equipment	Quantity
35	Elongation gauge	1 Set
36	Pycnometer	2 Nos.
37	Motorized Sieve shaker	2 Nos.
38	Moisture Meter	2 Nos.
39.	Moisture meter (for Timber)	1 Nos.
40.	Rapid mousture meter (soil)	2 Nos.
41.	Field CBR testing equipment	1 No.
42.	AAC block cutting machine	1 No.
43.	Digital Powder coating thickness gauge/measuring instrument	2 Nos.
44.	Plastic Bags for taking samples in different size	Sufficient nos.
45.	Ball pin hammer, 100 gms	1 nos.
46.	Magnifying glass	2 nos.
47.	Dynamic Penetrometer	2 nos
48.	Rebound hammer for NDT of concrete.	1 no
49.	Screw drivers set of different size.	2 sets
50.	Earth resistance tests (for electrical work)	1 no
51.	Wire gauge	1 no
52.	Foot rule	2 nos
53.	Sprit level	5 nos
54.	Electro logging test equipment	1 set
55.	Auto level	5 nos
56.	Total Station	1 no
57.	A good quality plumb bob	5 nos
58.	Any other as required from time to time for the interest of the work.	

Any other equipment for laboratory tests at site will be the way it is outlined in relevant IS-Code and / or as directed by the Employer. Quality control engineer shall monitor collection of samples and conducting regular testing at site maintaining propriety and the very best standard followed in industry of construction. Tests which are inconvenient to be conducted at site can be done in referred Laboratory as and when required.

All relevant IS Codes, special publications as per latest amendment/edition, Latest edition of WB PWD SOR, WB PW(Road)D SOR and CPWD SOR shall be made available at site by the Contractor at its own cost.

TESTING OF MATERIALS

SL. NO.	ITEM	IS CODE REFERENCE	NATURE OF TEST	
1	Cement –	IS-4031	i)	Fineness.
	a) OPC – IS-269		ii)	Soundness.
	b) PSC – IS-455		iii)	Setting Time (Initial & Final).
			iv)	Compressive Strength.
			v)	Consistency of Standard Cement paste.
2	Fine Aggregate (Sand)	IS-383 IS-2386	i)	Organic Impurities.
			ii)	Silt content, silt factor.
			iii)	Fineness Modules and Sieve Analysis.
			iv)	Bulking of Sand, unit weight.
3	Coarse Aggregate	IS-383 IS-2386	i)	Aggregate crushing value.
			ii)	Particle size distribution.
			iii)	Water absorption & specific gravity.
			iv)	Organic Impurities.
			v)	Percentage of soft & deleterious material.
			vi)	Sieve analysis.
			vii)	Crushing value.
			viii)	Flakiness index.
4	MS & Medium Tensile Steel Bars IS-432	IS-432 IS-1599	i)	Ultimate tensile stress.
			ii)	Yield stress.
			iii)	Elongation.
5	High strength deformed Bars IS-1786	IS-1786 IS-1608	i)	Ultimate tensile stress.
			ii)	Yield stress.
			iii)	Elongation.
6	Burn Clay Building Brick	IS-1077 IS-3495	i)	Compressive strength.
			ii)	Water absorption.
			iii)	Efflorescence.
7	Ceramic Glazed Tiles	IS-13630 IS-13755 IS-1443 IS-13753	i)	Water absorption.
			ii)	Crazing test.
			iii)	Impact strength test.
			iv)	Flexural strength.
			v)	Surface flatness.
8	Vitrified Tiles	IS-13756 IS-1443	i)	Water absorption.
			ii)	Crazing test.
			iii)	Impact strength test.
			iv)	Flexural strength.
			v)	Surface flatness.

SL. NO.	ITEM	IS CODE REFERENCE	NATURE OF TEST
9	Timber	IS-4021 IS-12896	Moisture content and specific gravity.
10	Wooden Panel Door Shutter	IS-1003	Moisture content.
11	Wooden Flush Door Shutter	IS-2202 IS-1659 IS-4020	As mentioned in Code.
12	Synthetic Enamel Paint	IS-2932 IS-1477 Part-I&II IS-2338 Part-I&II IS-2395 Part-I&II	As mentioned in Code.
13	Plastic Emulsion Paint	IS-5411	As mentioned in Code.
14	Exterior Acrylic Emulsion	IS-15489	As mentioned in Code.
15	Anodic Coating of Aluminium and its Alloys	IS-1868	As mentioned in Code.
16	Bitumen	Specification for road & building works. IRC publication latest edition.	Penetration, ductility, viscosity, specific gravity, flash & fire point, solubility, water content, softening point.
17	Factory made Commercial flush Door.	IS 2202 (Part-I) IS 848	Striping value.
18	CI Rain Water pipes	IS 1729 IS 3989	
19	Anti Termite preconstruction work	IS 6313 (Part-2)	
20	Structural Steel works	IS 226 IS 991 IS 1977 IS 2062	
21	Electrodes	IS 814 IS 815	
22	Bolts & Nuts	IS 1442 IS 1367 IS 1608	
23	Washers	IS 226 IS 961	
24	GI Pipes & fittings.	IS 1239 IS 1977	
25	HCI soil pipe	IS 3989 IS 1029	

SL. NO.	ITEM	IS CODE REFERENCE	NATURE OF TEST
26	Vitreous china Sanitary wares P, S trap.	IS 771 IS 2556 (Part-II & VII)	
27	Vitreous china LavatoryBasin	IS 775	
28	SW pipe	IS 651	
29	Glazing	IS 2835	

Codes to be followed as noted in the specification of the items, otherwise the following IS codes of latest edition will be adhered for building works. If any code is not included in the following list, IS codes relevant to the specific items will be abided. In absence of IS code, the Contractor will abide by international code.

BUILDING CONSTRUCTION PRACTICE		
Sl. No	***Specification for***	***Indian Standard No***
1	*Design of structural Timber (Fourth revision)*	*883 : 1994*
2	*Structural use of un-reinforced masonry (Third Revision)*	*1905 : 1987*
3	*Brick Work (First revision)*	*2212 : 1991*
4	*Construction of floor roof with joists and filler blocks: Part-I with hollow concrete filler block*	*6061 (Part 1) :1971*
5	*Construction of floor & roof with joists & filler block: Part 2 with hollow clay blocks joints and hollow clay filler block*	*6061 (Part 2) :1981*
6	*Construction of floor and roof with joists & filler blocks: Part 3 precast hollow clay block joints and hollow clay filler block*	*6061 (Part 3): 1981*
7	*Construction of floor roof with joists & filler blocks: Part 4 with hollow clay block slab panels*	*6061 (Part 4): 1981*
8	*Anti-termite measures in buildings part I constructional measures (First Revision)*	*6313 (Part 1): 1981*
9	*Anti-termite measures in buildings : Part 2 pre constructional chemical treatment measures (First Revision) (Amendment No.5)*	*6313 (Part 2) :1981*
10	*Antitermite measures in buildings Part 3 Existing buildings (First Revision) (Amendment No. 4)*	*6313 (Part 3): 1981*
11	*Installation of Joints in concrete pavements (First revision)*	*6509 : 1985*
12	*Construction of reinforced brick and R.B.C floor and roofs*	*10440 :1983*
13	*Setting out of buildings*	*11134 :1984*
14	*No fines cast in situ cement concrete*	*12727 :1989*
15	*Sand for masonary mortars (first revision)*	*2116 :1980*
16	*Polysulphide base joints sealants : Part 1 General requirements*	*11433 (Part 1) : 1985*
17	*Polysulphide base joints sealants : Part 2 General requirements Methods of test*	*11433 (Part 2) : 1986*
18	*Polysulphide based sealants: Part 1. General requirement*	*12118 (Part 1) : 1987*
19	*Polysulphide based sealants : Part 2 methods of test*	*12118 (Part 2) : 1987*

BUILDING LIMES AND LIME PRODUCT		
Sl. No	***Specification for***	***Indian Standard No***
20	*Field slaking of building lime & preparation of putty (2nd revision)*	*1653 : 1992*
21	*Preparation of use of lime puzzolona mixture concrete in Building & Roads (1st revision)*	*5817 : 1992*
22	*Method of field testing of building lime (1st revision)*	*1624 : 1986*
CEMENT & CONCRETE		
23	*Plain & reinforced concrete (Fourth revision)*	*456 : 2000*
24	*Prestressed Concrete (first revision) (Amendment No 1)*	*1343 : 1980*
25	*Concrete structures for the storage of liquids: Part I general requirements (Amendment No 1)*	*3370 (Part 1) : 1965*
26	*Concrete structures for the storage of liquids: Part 2 Reinforced concrete structures (Amendment No-2)*	*3370 (Part 2) : 1967*
27	*Concrete structure for the storage of liquids: Part 3 Prestressed concrete structures (Amendment No I)*	*3370 (Part 3) : 1967*
28	*Concrete structures for the storage of liquids Part 4: Design table (Amendment No. 2)*	*3370 (Part 4) : 1967*
29	*Use of immersion vibrators for consolidating concrete (first revision)*	*3558 : 1983*
30	*Extreme Weather concreting: Recommended practice for hot weather concreting. (Amendment No. 1)*	*7861 (Part 1) 1975*
31	*Extreme Weather concreting: Recommended practice for hot weather concreting. (Amendment No. 1)*	*7861 (Part 2): 1981*
32	*Methods of non-destructive testing of concrete : Part 1 Ultrasonic pulse velocity*	*13311 (Part 1) : 1992*
33	*Methods of non-destructive testing of concrete: Part 2: Rebound hammer*	*13311 (Part 2) : 1992*
34	*Methods of Sampling & analysis of concrete*	*1199 : 1959*
35	*Recommended guidelines for concrete mix design*	*10262 : 1982*
36	*Concrete slump test apparatus*	*7320 : 1974*
37	*Ready mixed concrete (2nd revision)*	*4926 : 2003.*
38	*Artificial lightweight aggregates for concrete masonary units*	*9142 : 1979*

CEMENT MATRIX PRODUCT		
Sl. No	***Specification for***	***Indian Standard No***
39	*Construction of lightweight concrete block masonry*	*6042 : 1969*
40	*Concrete masonry units Part I Hollow and Solid concrete blocks (Second Revision) (Amendment No 1)*	*2185 :(Part 1) : 1979*
41	*Concrete masonry units Part 2 Hollow and Solid lightweight concrete blocks (first revision)*	*2185 : (Part 2) : 1983*
42	*Reinforced concrete fence posts (First Revision)*	*4996 : 1984*
43	*Precast concrete coping blocks (First Revision)*	*5751 : 1984*
44	*Precast concrete kerbs (first revision)*	*5758 : 1984*
45	*Precast reinforced concrete door & window frames (first revision)*	*6523 : 1983*
46	*Precast reinforced concrete plant guards*	*9375 :1979*
47	*Precast concrete septic tanks*	*9872 :1981*
48	*Precast concrete blocks for lintels and sills (Amendment No-I)*	*9893 :1981*
49	*Precast concrete manhole covers and frames: Part 1 Covers (Amendment No 3)*	*12592 (Part 1) : 1988*
50	*Precast concrete manhole covers and frames : Part 2 frames*	*12592 (Part 2) : 1991*

CLAY PRODUCTS FOR BUILDING		
Sl. No	***Specification for***	***Indian Standard No***
51	*Common burnt clay building bricks (Fifth Revision)*	*1077 : 1992*
52	*Heavy duty burnt clay building bricks (Third Revision)*	*2180 : 1988*
53	*Burnt clay flat terracing tiles : Part 1 Machine made (Second Rev.)*	*2690 (Part 1) : 1993*
54	*Burnt clay flat terracing tiles : Part 2 Hand Made (Second Rev.)*	*2691 (Part II) : 1992*
55	*Revision) Burnt clay facing bricks (Second Revision)*	*2691 : 1988*
56	*Burnt clay paving bricks (Second Revision*	*3583 : 1988*

CONCRETE REINFORCEMENT		
Sl. No	***Specification for***	***Indian Standard No***
57	*Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement Part 1 Mild Steel and medium tensile Steel bars (Third Revision)*	*432 (Part I) : 1982*
58	*Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement Part 2 Hard Drawn Steel wire (Third Revision)*	*432 (Part II) : 1982*
59	*High strength deformed steel bars and wires for concrete reinforcement (Third Revision) Amendment No.1*	*1786 : 1985*

CONSTRUCTION MANAGEMENT		
Sl. No	***Specification for***	***Indian Standard No***
60	*Unified nomenclature of workmen for civil engineering*	*10302 : 1982*

DOOR, WINDOWS AND SHUTTERS		
Sl. No	***Specification for***	***Indian Standard No***
61	*Aluminium doors, windows and ventilators.*	*1948 : 1961*
62	*Aluminium windows for industrial building (Amendment No.1)*	*1949 : 1961*
63	*Wooden flush doors shutters (Cellular and hollow core type) : Part 2Particle board and hard board face panels (Third revision)*	*2191 : (Part 2) : 1983*
64	*Wooden flush doors shutters (Solid core type) Part-1 Ply wood face panels (Sixth Revision)*	*2202 (Part 1) : 1999*
65	*Wooden flush doors shutters (Solid core type) Part-2 particle board face panels and hard board (Third Revision)*	*2202 (Part 2) : 1983*
66	*Steel doors frames (Second Revision) (Amendment No.2)*	*4351 : 2003*
67	*Wooden side sliding doors*	*4962 : 1968*
68	*Collapsible gate*	*10521 : 1983*

EARTHQUAKE ENGINEERING		
Sl. No.	***Specification for***	***Indian Standard No.***
69	*Earthquake resistant design & construction of buildings (Second Revision) (Amendment No. 1)*	*4326 : 1993*
70	*Criteria for earthquake resistant design of structures (Fourth Revision) (Amendment No. 1)*	*1893 : 2002*
71(a)	*Improving earthquake resistant low strength masonry buildings – Guidelines (Amendment No. 1)*	*13828 : 1993*
71(b)	*Ductile detailing of reinforced concrete structure subjected to seismic forces*	*13920 : 1993*

FIRE FIGHTING		
Sl. No	***Specification for***	***Indian Standard No***
72	*Selection, installation and maintenance of automatic fire detection and alarm system (Second Revision)*	*2189 : 1988*
73	*Selection, installation and maintenance of portable first aid fire extinguishers (Third Revision)*	*2190 : 1992*
74	*Installation and maintenance of internal fire hydrants and hose reels on premises (First Revision)*	*3844 : 1989*
75	*Selection, Operation and maintenance of special fire fighting appliances: Part:1 combined foam and crash tender*	*5896 (Part 1) : 1970*

FIRE SAFETY		
Sl. No	***Specification for***	***Indian Standard No***
76	*Fire Safety of building (General) : General Principles of fire grading & classification (First Revision)*	*1641 : 1988*
77	*Fire Safety of buildings (General) : Details of construction (First Revision)*	*1642 : 1989*
78	*Fire safety of buildings (General) : Exposure hazard construction (First Revision)*	*1643 : 1988*

FLOORING, WALL FINISHING & ROOFING		
Sl. No	***Specification for***	***Indian Standard No***
79	*Chequered Cement concrete tiles specification*	*13801 : 1993*
80	*Magnesium oxychloride composition floors (Second Revision)*	*658 : 1982*
81	*Laying Bitumen mastic flooring (Second Revision)*	*1196 : 1978*
82	*Laying of rubber floors (First Revision)*	*1197 : 1970*
83	*Laying, fixing and maintenance of linoleum floor (First Revision)*	*1198 : 1982*
84	*Application of cement and cement lime plaster finishes (First Revision)*	*1661 : 1972*
85	*Laying in situ terrazzo floor finish (First Revision)*	*2114 : 1984*
86	*Application of lime plaster finish (First Revision)*	*2394 :1984*
87	*External rendered finishes*	*2402 :1963*
88	*Laying in-situ cement concrete flooring (First Revision)*	*2571 :1970*
89	*Use of silicate type chemical resistant mortars (First Revision)*	*4441 1980*
90	*White washing and colour washing*	*6278 1971*
91	*Laying of bitumen mastic flooring for industries handling LPG and other light hydrocarbon products*	*13074 : 1991*
92	*Bitumen mastic for flooring (Second Revision)*	*1195 : 1978*
93	*Cement concrete flooring Tiles(First Revision)*	*1237:1980*
94	*Sand for plaster(Second Revision)*	*1542:1992*

FUNCTIONAL RQUIREMENT IN BUILDINGS		
SL. No.	***Specification for***	***Indian Standard No***
95	*Sound Insulation of non-industrial buildings(Amendment No. 1)*	*1950:1962*
96	*Acoustical design of auditoriums and conference halls (Amendment No. 1)*	*2526:1963*
97	*Industrial ventilation of residential buildings(First revision)*	*3103:1975*
98	*Noise reduction in industrial buildings*	*3483:1965*
99	*Acoustics in buildings*	*9736:1981*
100	*Sound Insulation of building and of building elements: part 1 Airborne sound insulation in buildings and of building elements*	*11050(Part1):1984*
101	*Sound Insulation of building and of building elements: part 2 impact sound insulation in buildings and of building elements*	*11050(Part2):1984*
102	*Rating of Sound Insulation of building and of building elements: part 3 Airborne sound insulation of facade elements and facades*	*11050(Part3):1984*
103	*Buildings and facilities for the physically handicapped(first revision)*	*4963:1987*
104	*Orientation of buildings:Part1 Non-industrial buildings*	*7662(Part 1):1974*

HILL AREA DEVELOPMENT ENGINEERING		
105	*Retaining wall for hill area : Part 1 Selection type of wall*	*14458 (Part 1) : 1998*
106	*Retaining wall for hill area : Part 2 Design of retaining / breast walls*	*14458 (Part 2) : 1997*
107	*Retaining wall for hill area : Part 3 construction of dry stone walls*	*14458 (Part 3) : 1998*
108	*Land slide controls*	*14680 : 1999*

HOUSING		
Sl.No	***Specification for***	***Indian Standard No***
109	*Design and construction of floors and roofs with precast reinforced planks and RC joists*	*13994:1994*
110	*Design and construction of floors and roofs with prefabricated brick panel*	*14142:1994*
111	*Construction of floor and roof with RC channel units*	*14215:1994*
112	*precast reinforced concrete planks and joists for flooring and roofing*	*13990:1994*
113	*prefabricated brick panel and partially precast concrete joists for flooring and roofing*	*14143:1994*
114	*precast reinforced concrete channel unit for construction of floors and roofs*	*14201:1994*
115	*Precast L-panel units for roofing*	*14241:1994*

METHODS OF MEASUREMENT OF WORKS OF CIVIL ENGINEERING		
Sl.No	***Specification for***	***Indian Standard No***
116	*Measurements of building and civil engineering works: Part 1; Earthwork(fourth revision)*	*1200(part1):1992*
117	*Measurements of building and civil engineering works: Part 2 concrete(third revision)*	*1200(part2):1974*
118	*Measurements of building and civil engineering works: Part 3 brickwork(third revision)*	*1200(part3):1976*
119	*Measurements of building and civil engineering works: Part 4 Stone masonry(third revision)*	*1200(part4):1976*
120	*Measurements of building and civil engineering works: Part 5 form work(third revision) (Amendment no-1)*	*1200(part5):1982*
121	*Measurements of building and civil engineering works: Part 6 Refractory work(second revision)*	*1200(part6):1974*
122	*Measurements of building and civil engineering works: Part 7 Hardware(Second revision) (Amendment no-2)*	*1200(part7):1972*
123	*Measurements of building and civil engineering works: Part 8 Steel Work & Iron Work(fourth revision)*	*1200(part8):1993*
124	*Measurements of building and civil engineering works: Part 9 Roof covering(including cladding)(Second revision) (Amendment no-1)*	*1200(part9):1973*
125	*Measurements of building and civil engineering works: Part 10 Ceiling & Lining(Second revision) (Amendment no-2)*	*1200(part10):1973*
126	*Measurements of building and civil engineering works: Part 11Paving,floor finishes, dado & skirting(Third revision) (Amendment no-1)*	*1200(part11):1977*
127	*Measurements of building and civil engineering works: Part 12 Plastering & Pointing (Third revision)*	*1200(part12):1976*
128	*Measurements of building and civil engineering works: Part 13 white washing, colour Washing, distempering & painting of building surfaces(fifth revision)*	*1200(part13):1994*

129	*Measurements of building and civil engineering works: Part 14 Glazing (Third revision)*	*1200(part14):1984*
130	*Measurements of building and civil engineering works: Part 15 painting, polishing, varnishing etc. (fourth revision)*	*1200(part15):1987*
131	*Measurements of building and civil engineering works: Part 16 laying of water & sewer lines including appurtenant items (third revision)*	*1200(part16):1979*
132	*Measurements of building and civil engineering works: Part 18demolition & dismantling(third revision)*	*1200(part18):1974*
133	*Measurements of building and civil engineering works: Part 19 Water supply, plumbing & drains (third revision)*	*1200(part19):1981*
134	*Measurements of building and civil engineering works: Part 21 Wood work & joinery (second revision) (Amendment no-1)*	*1200(part 21):1973*
135	*Measurements of building and civil engineering works: Part 22 materials*	*1200(part22):1982*
136	*Measurements of building and civil engineering works: Part 23 pilling(fourth revision)*	*1200(part23):1988*
137	*Measurements of building and civil engineering works: Part 24 Well foundation (third revision)*	*1200(part24):1983*
138	*Measurements of building and civil engineering works: Part 27 Earth work done by mechanical appliances*	*1200(part27):1992*
139	*Measurements of building and civil engineering works: Part 28 Sound insulation works*	*1200(part28):1992*
140	*Measurements of plinth, carpet & rentable area of buildings (first revision) (Amendment no-3)*	*3861:1975*

PAINTING, VARNISHING AND ALLIED FINISHES		
Sl No	***Specification for***	***Indian Standard No***
141	*Painting of ferrous metals in buildings: Part 1 Pretreatment(first revision)*	*1477(part1):1971*
142	*Painting of ferrous metals in buildings: Part 2 Painting (first revision)*	*1477(part2):1971*
143	*Finishing of wood & wood based materials: Part 1 operations and workmanship*	*2338(part1):1967*
144	*Finishing of wood & wood based materials: Part 2 Schedules*	*2338(part2):1967*
145	*Painting concrete, masonry and plastered surfaces :Part 1 operations and workmanship (first revision)*	*2395(part 1):1994*
146	*Painting concrete, masonry and plastered surfaces :Part 2 Schedules (first revision)*	*2395(part 2):1994*

PUBLIC HEALTH ENGINEERING		
Sl No	***Specification for***	***Indian Standard No***
147	*Basic requirement for water supply drainage and sanitation (Fourth revision)*	*1172:1993*
148	*Building drainage (Second revision)*	*1742:1983*
149	*Selection, installation and maintenance of sanitary appliances (Second revision)*	*2064:1983*
150	*Water supply in building(Second revision)*	*2065:1983*
151	*Installation of septic tanks: Part 1 design, criteria and construction (Second revision)*	*2470(part 1):1985*
152	*Installation of septic tanks: Part 2 secondary treatment and disposal of septic tank effluent (Second revision)*	*2470(part 2):1985*
153	*Laying of cast iron pipes (Second revision)*	*3114:1994*
154	*Ancillary structures in sewerage system: Part 1 Manholes (First revision)*	*4111(Part 1):1986*
155	*Ancillary structures in sewerage system: Part 2 flushing tanks (First revision)*	*4111(Part 2):1986*
156	*Laying of glazed stoneware pipes (First revision)*	*4127:1983*
157	*Sanitary pipe works above ground for buildings (First revision)*	*5329:1983*
158	*Plumbing in multistoried buildings: Part 1Water supply*	*12183(part 1):1987*
159	*Drainage of building's basement*	*12251:1987*

SAFETY IN CONSTRUCTION		
Sl No	***Specification for***	***Indian Standard No***
160	*Steel tubular scaffolding:Part2 Safety regulations for scaffolding*	*4014(part 2):1967*
161	*Preventive measures against hazards at work places: Part 1 falling material hazards prevention*	*13416(part 1):1992*
162	*Preventive measures against hazards at work places: Part 2 fall prevention*	*13416(part 2):1992*
163	*Preventive measures against hazards at work places: Part3 disposal of debris*	*13416(part 3):1994*
164	*Preventive measures against hazards at work places: Part4 timber structures*	*13416(part 4):1994*
165	*Preventive measures against hazards at work places: Part5 timber structures*	*13416(part 5):1994*

STONES		
Sl. No	**Specification for**	**Indian Standard No**
166	Marble (blocks, slabs and titles)	1130:1969
167	Sandstone (slabs and titles)(First revision)	3622:1977
STRUCTURAL SAFETY		
Sl. No	**Specification for**	**Indian Standard No**
168	Design loads (other than earthquake) for buildings and structures Part 1 Dead Load-unit weights of building	875(part 1):1987
169	Design loads (other than earthquake) for buildings and structures Part 2 Imposed Load (Second revision)	875(part 2):1987
STRUCTURAL SECTIONS		
Sl. No	**Specification for**	**Indian Standard No**
170	Aluminium bulb angles Marine application (first revision)	6449:1987
171	Aluminium channels (first revision)	3921:1985
172	Aluminium equal leg angles (first revision)	3908:1986
173	Aluminium I-beam(first revision)	5384:1985
174	Aluminium T-bars for Marine application(first revision)	6475:1987
175	Aluminium T sections (first revision)	6445:1985
176	Aluminium unequal leg angles (first revision)	3909:1986
177	Light Gauge structural steel sections (revised)	811:1987
TIMBER AND TIMBER STORES		
Sl. No	**Specification for**	**Indian Standard No**
178	Door and Window shutters and frames	12896:1990
179	Furniture and cabinets	13662:1993
180	Bamboos for structural purposes	9096:1979
WATER PROOFING AND DAMP PROOFING		
Sl. No	**Specification for**	**Indian Standard No**
181	Lime concrete for a water proofed roof finish (second revision)	3036:1992
182	Application of bituminous mastic for water proofing of roofs	4365:1967
183	Water proofing of underground water reservoirs and swimming pools (first revision)	6494:1988
184	Damp-proofing using bituminous mastic	7198:1974
185	Bituminous mastic for use in water proofing of roofs (first revision)	3037:1986
186	Silicon based water repellents	12027:1987

LIST OF INDIAN STANDARDS
RELATED TO ELECTRICAL INSTALLATION WORK

STANDARDS		*TITLE*
Codes of Practice/Guide :		
1.	*IS: 732-1989*	*Code of practice for electrical wiring installations.*
2.	*IS: 5578-1985*	*Guide for marking of insulated conductor.*
3.	*IS: 13234*	*Guide for short-circuit calculations.*
4.	*IS: 3646 (Part-1)-1992*	*Code of practice for interior illumination: General requirements and recommendations for welding interiors.*
5.	*IS: 3646 (Part-2)-1966*	*Code of practice for interior illumination: Schedule for values of illumination and glare index.*
6.	*IS: 3646 (Part-3)-1968*	*Code of practice for interior illumination: Calculation of coefficients of utilization by the BZ method.*
7.	*IS: 10118 (Part-1)-1982*	*Code of practice for selection, installation and maintenance of switchgear and control gear: General.*
8.	*IS: 10118 (Part-2)-1982*	*Code of practice for selection, installation and maintenance of switchgear and control gear: Selection.*
9.	*IS: 10118 (Part-3)-1982*	*Code of practice for selection, installation and maintenance of switchgear and control gear: Installation.*
10.	*IS: 10118 (Part-4)-1982*	*Code of practice for selection, installation and maintenance of switchgear and control gear: Maintenance.*
11.	*IS: 4146-1983*	*Application guide for voltage transformers.*
12.	*IS: 4201-1983*	*Application guide for current transformers.*
13.	*IS: 5547-1983*	*Application guide for capacitor voltage transformers.*
14.	*IS: 2309-1989*	*Code of practice for the protection and allied structures against lightning.*
15.	*IS: 3043-1987*	*Code of practice for earthing.*
16.	*IS: 5216 (Part-2)-1982*	*Guide for safety procedures and practices in electrical work: General.*
17.	*IS: 5216 (Part-2)-1982*	*Recommendation on safety procedure and practices in electrical works – life saving techniques.*
18.	*IS: 3696 (Part-2)-1966*	*Safety code for scaffolds and leaders: Ladders.*

Electrical Fans :		
1.	*IS: 374-1979*	*Electrical ceiling type fans and regulators.*
2.	*IS: 11037-1984*	*Electronic type fan regulators.*
Low voltage switchgear and control gear :		
1.	*IS: 10027-2000*	*Composite units of air-break switches and rewireable type fuses for voltages not exceeding 650V AC.*
2.	*IS: 4064 (Part-1)-1978*	*Air break switches, air break disconnectors, air-break switch disconnectors and fuse-combination units for voltages not exceeding 1000V AC or 1200V DC : General requirements.*
3.	*IS: 8828-1996*	*Electrical accessories-circuit breakers for over current protection for household and similar installation.*
4.	*IS: 13032-1991*	*AC Miniature circuit breaker boards for voltages upto and including 1000 volts AC.*
5.	*IS: 8623 (Part-2)-1993*	*Particular requirements for bus bar trunking system.*
Power Cable:		
1.	*IS: 1554 (Part-I)*	*XLPE insulated PVC sheathed armoured Aluminium/ Copper cable of 3½ & 4 core.*
2.	*IS: 1554 (Part-II)*	*XLPE insulated PVC sheathed armoured Aluminium/ Copper cable of 3 core.*
Electric wiring accessories :		
1.	*IS: 9537 (Part-1)-1980*	*Conduits for electrical installations General requirements.*
2.	*IS: 9537 (Part-5)-2000*	*Flexible (pliable) non-metallic conduits for electrical installations.*
Electrical lamps and their auxiliaries :		
1.	*IS: 2418(Part-1)-1977*	*Tubular fluorescent lamps for general lighting service: Requirements and tests.*
2.	*IS: 9900 (Part-1)-1981*	*High-pressure mercury vapor lamps: Requirements and tests.*
3.	*IS: 9974 (Part-1)-1981*	*High-pressure sodium vapor lamps: General requirements and tests.*
4.	*IS: 3323-1980*	*Bi-pin lamp holders for tubular fluorescent lamps.*

5.	*IS: 3324-1982*	*Holders for starters for tubular fluorescent lamps.*
6.	*IS: 1534 (Part-1)-1977*	*Ballast for fluorescent lamps: For switch start circuits.*
7.	*IS: 1569-1976*	*Capacitors for use in tubular fluorescent high pressure mercury and low-pressure sodium vapor discharge lamp circuits.*
8.	*IS: 6616-1982*	*Ballasts for high-pressure mercury vapor lamps.*
Light fittings and luminaries :		
1.	*IS: 1913 (Part-1)-1978*	*General and safety requirements for luminaries: Tubular fluorescent lamps.*
2.	*IS: 10322 (Part-1)-1982*	*Luminaries: General requirements.*
3.	*IS: 10322 (Part5/Sec.2) -1985*	*Luminaries: Particular requirements : Recessed luminaries.*
4.	*IS: 10322 (Part5/Sec.3) -1987*	*Luminaries: Particular requirements: Luminaries for road and street lighting.*
5.	*IS: 10322 (Part5/Sec.5) -1987*	*Luminaries : Particular requirements: Floodlight.*
6.	*IS: 2206 (Part-1)-1984*	*Flameproof electric lighting fittings: Well glass and bulkhead types.*
7.	*IS: 3528-1966*	*Waterproof electric lighting fittings.*
Electrical appliances :		
1.	*IS: 2268-1194*	*Electric call bells and buzzers for indoor use.*
Electrical instruments:		
1.	*IS: 722 (Part-7/Sec.-1)-1987*	*AC electricity meters: Volt-ampere hour meter for full power factor range : General requirements.*
2.	*IS: 722 (Part-8)-1972*	*AC electricity meters: Single-phase 2 wire whole current watt hour meter (Class 1.0).*
3.	*IS: 722 (Part-9)-1972*	*AC electricity meters: Three phase whole current and transformer operated Watt hour meters, and single phase two wire transformer operated watt hour meters (Class 1.0).*
4.	*IS: 8850-1977*	*Maximum demand indicators.*

Instrument transformers:		
1.	*IS: 2705 (Part-1)-1992*	*Current transformers: General Requirements.*
2.	*IS: 2705 (Part-2)-1992*	*Current transformers: Measuring current transformers.*
Fuse :		
1.	*IS: 9224 (Part-1)-1979*	*Low voltage fuses: General Requirements.*
Electrical Installation Code of Practices :		
1.	*IS: 3043/1987*	*Earthing.*
2.	*IS: 732/1989*	*Electrical wiring installation (system voltage not exceeding 650 volts).*
Switch Gear and Control Gear :		
1.	*IS: 1248*	*Electrical Measuring Instruments and their Accessories.*
DG Set :		
1.	*BS:5514, ISO:3046*	*Engine*
2.	*IS: 4722, B S 2613*	*Alternator*
3.	*IS: 4273 and 8623*	*AMF Control Panel*
4.	*IS: 1248/1958*	*Measurement Instrument*
5.	*IS: 5*	*Paint Code*

INDIAN STANDARD FOR BUILDING WORKS

For specifications as well as quality control all relevant IS Codes as mentioned in WB PWD current Schedule of Rates will also be applicable wherever necessary in addition to that already stated in the GCC.

Section 5.6 Scope and Specification of Electrical Works

PART A: CODES AND STANDARDS

PART B: ELECTRICAL INSTALLATIONS (BOTH INTERNAL & EXTERNAL)

PART C: MAKE LIST

PART A: CODES AND STANDARD TO ALL SERVICES.

The electrical system of this medical college building and other service areas is proposed to be designed on the basis of National Building Code 2016 (NBC 2016) for such a project giving due consideration to aspects of safety, liability and no interruption in the functions of essential services in the medical college.
Following are the major guidelines followed while designing the electrification and other facility works:

S.L.No.	STANDARDS (Codes of Practice / Guide)	TITLES
1	IS : 732 – 1989 Revision - 3	Code of practice forElectrical Installation wiring
2	IS : 8061 – 1976	Code of practice for design, installation and maintenance of service lines up including 650 Volts.
3	IS : 4347 – 1967	Code of practice for hospital lighting.
4	IS : 10118 (Part – 2) – 1982	Code of practice for selection, installation and maintenance of switchgear and control gear.
5	IS : 10118 (Part 1,2 & 3) – 1985	Code of practice for selection, installation and maintenance of Transformers.
6	IS : 3043 – 1987	Code of practice for Earthing.
7	IS : 694 -1990 (Third Revision)	PVC insulated wires for working voltages up to and including 1100 V.
8	IS : 9537(Part – 2) - 1981 (Amendment - 2)	Conduits for Electrical installations: Rigid steel conduit.
9	IS : 1554 - 1988	PVC insulated heavy-duty cables.
10	IS : 7098 - 1985	High voltage XLPE cable
11	Indian Electricity Rules	

The design engineering manufacturing and the installation shall be in accordance with established codes, sound engineering, practices, and specifications and shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities' e.g. Electrical inspector, pollution control boards, WBSEDCL /CESC as applicable before commissioning of electrical/DGs.

- Indian Electricity Act.
- Indian Electricity Rules.
- Factory Act.
- Pollution Control Act.
- National Building Code 2016 (NBC 2016).

IS-732: Code of practice for electrical wiring installation system voltage not exceeding 650V.
IS-3043: Earthing.

IS-2309: Code of practice for the protection of buildings and allied structure against Lightning
IS-7689: Guide for control of undesirable static electricity.
IS-3716: Insulation co-ordination application guide.
IS-8130: Conductors for insulated electrical cables and flexible cords.
IS-5831: PVC insulation and sheath of electric cables.
IS-3975: Mild steel wire, strips & tapes for armouring cable.
IS-3961: Current rating of cables
IS-694: PVC insulated (heavy duty) electric cables for working. Voltage up to and including 1100 volts.
IS-424- 1475 (F-3): Power cable flexibility test.
IEC-439/IS-7098: Specification for cross linked polyethylene insulated PVC sheathed cable for working voltage up to 1.1 KV.
IS-1554: PVC insulated cables up to 1100 volts.
IS-10810: Test procedures for cables.
IS-6121:Cable glands.
IS-10418: Cable drums.
IEC-754(1): FRLS PVC insulated cable.
ASTM-D-2863: Standard method for measuring minimum oxygen concentration to support candle like combustion of plastic (oxygen index).
ASTM-D-2843: Standard test method for measuring the density of smoke from burning or decomposition.
ASTM E-662/IEC 754(A): Standard test method for specific optical density of smoke generated by solid materials.
IEEE-383: Standard for type test class-IE, electric cables, field splicers and connections for power generation station.
IS 13947/IEC 947: Air circuit breaker/moulded case circuit breaker.
IS-8623: Specification for factory built assemblies of switch gear and control gear for voltage upto and including 1000vac/1200vdc
IS 1018: Switchgear and control gear selection/installation and maintenance
IS-1248: Direct acting indicating analogue electrical measuring instruments and testing accessories.
IS-13779: Digital measuring instruments and testing accessories.
IS-3156: Voltage transformer
IS-2705: Current transformer for metering and protection with classification burden and insulation.
IS -2147: Degree of protection provided by enclosures for low voltage.
PART 1,11,111 Switchgear and control gear
IS-3427: Metal enclosed switchgear and control gear
BS-162: Safety clearance
IS-3202: Code of practice for climate proofing of electrical equipment.
IS-375: Marking and arrangement for switchgear, bus bars, main connections and auxiliary wiring.
IS-722: Ac electric meters
IS-3231: Electrical relays for power system protection.
IEC-255: Electrical Relays
IS-5082: Electrolytic copper/aluminum bus bars
IS-2834: Capacitors
IS-2713: Steel tubular pole
IS-335: Specification for insulating oil
IS-3837: Specifications for accessories for rigid steel conduit for electrical wiring.
IS-2026&335: Distribution transformer
(PART I, II, III)GI/STEEL /PVC conduit pipe for electrical wiring.

IS-2274 : Code of practice for electrical wiring installation system voltages exceeding 650 volts.
IS-6665 : Code of practice for industrial lighting
IS-3646 : Interior insulation part 1&2
IS-1944 : Code of practice for lighting of public through fares.
IS-7752: Guide for improvement of power factor consumers installation.
IS-13346: General requirement for electrical for explosive gas atmosphere.
IS-13408 : Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres
IS-12360: Voltage and frequency for ac transmission & distribution system.
IS-5572: Classification of hazardous area for electrical installations.
IS-5571: Guide for selection of electrical equipment for hazardous area.
IS-4201: Application guide for Current Transformer
IS-4146: Application guide for Voltage Transformer
IS-10028: Code of practice for installation and maintenance of transformer
IS-8478: Application guide for on load tap changer
IS-10561: Application guide for power transformer
IS-1646: Code of practice for fire safety of buildings electrical installation
IS-3034: Code of practice for fire safety of industrial building-electrical generating and distribution station
IP-30: National electrical code (NEC) BIS publication.
IS-4722: Rotating electrical machines.
IS-4889: Method of determination of efficiency of rotating electrical machines.
IS-325: Three phase induction motors.
IS-4729: Measurement and evaluation of vibration of rotating electrical machines.
IS-900: Installation and maintenance of induction motors.
IS-4029: Air break switches.
IS-2208-9224: HRC cartridge fuses.
IS-2959: Contactors.
IS-9537: Rigid steel conduit.
IS-1030-1982: Specification for carbon steel castings for general engineering purpose.
IS-1601/ BS-649: Performance& testing of Internal Combustion (IC) engines for general purpose. AIEE-606(1959): Recommended specification for speed governing of I.C. engine generator units.
BS-5514/IS-3046 8528(Part-2): Reciprocating IC engine driven A.C. generators.
Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.
In case of any deviation /conflict of this specification with the codes & standards, the following order of precedence shall govern.

a) Specification, particular specification if any, and drawings.
b) Indian regulations/codes and standards.

PART B: ELECTRICAL SYSTEM (both internal & external).

a. Preparation of necessary Single line diagram(SLD), Power Distribution etc. of all electrical installation for each floor as well as electrical conduit layout drawing of each room, corridor, Varandah, toilet etc. and as per requirement of the entire Medical college campus.

b. Submit Detailed Project Report including preliminary drawings to the WBMSC in respect of internal & external electrification considering all electrical requirements of all electrical loads such as luminaries, fans, ACMV, Generator etc. with distribution panels, distribution boxes showing their actual positions in drawings for incorporating suggested changes, additions and alterations and secure approval of the WBMSC.

c. All staff quarter should be provided with individual metering (single phase) and the whole metering arrangement will be arranged at the suitable position of the ground floor of staff quarter building.

I. Power Source from WBSEDCL / CESC & H.T overhead line:

The bidders shall investigate the existing electrical service/distribution system so that the location of electrical service building while preparing the site plan will be indicated nearest to the WBSEDCL's distribution network to receive power with minimum hindrance**.** Supply and laying of HT cable/overhead line from tapping point of state electricity board to proposed substation shall be in scope of WBMSCL, which includes Charge of feeder cable (supply & laying) between Point of Power Source upto RMU location in substation, liaise with state electricity authority and associated civil work.

II. Load Calculation including loads of Medical equipment for preparation of Substation Design:

a. Calculating electrical loads of all items such as luminaries ,fans ,compound lights, lifts, HVAC, water supply system etc. and medical equipments if required and detailed design of substation incl. Transformer H.T & L.T gear, L.T panel Earthing etc. and details drawing showing actual position of different items earth pits etc. in the drawings. Load calculations of medical college are incorporated in this concept design of Substation according to the approved area of medical college.

b. **ELECTRICAL LOAD: Proposed Electrical Load is Estimated for Medical College, Auditorium, Hostels and Staff Quarters are as under:**

TABLE 1: Calculation of Transformer loads:

Medical college campus in West Bengal						
Sl. No.	**Facility / Location**	**Area (m^2)**	**LOAD In for Light, Fan, 6 amps Plug & Power plug etc KW/Sqm**	**CONNECTED LOAD IN KW**	**MD factor**	**MD IN KW**

1	**ADMIN & DEPARTMENT**	26736	0.04	1069	0.6	642
2	**ANIMAL HOUSE**	130	0.06	8	0.6	5
3	**CENTRAL WORKSHOP**	130	0.04	5	0.5	3
4	**GYMNASIUM**	90	0.03	3	0.7	2
5	**HOSTELS**	13856	0.01	139	0.6	84
6	**QUARTERS**	11954	0.01	120	0.6	72
7	**SERVICE BUILDINGS**	700	0.01	7	0.85	6
8	**Misllaneous Loads (Fire Pumps, Lift, STP Pump, Domestic Water Pump, External Lighting,.etc..)**			150	1	150
9	**Auditorium Load (Including AC)**	1728		200	0.9	180
10	**A/C Load**	5600		560	0.85	480
	Total					**1624**
Considering Diversity Factor at 80%						**1299**
Total				Say		1300
Maximum Load Demand in KVA (0.8 Power Factor)						1625
Add. 20% Future Load						325
TOTAL						**1950**
Transformer Loading 85%						**2294 KVA**

Two nos. 1250 KVA Transformer will be provided for considering above mentioned Load demand

TABLE 2: <u>Calculation of DG loads:</u>

Sl. No.	**Load Description**	**Emergency Load (KW)**
1	ADMIN & DEPARTMENT	**300**
2	HOSTELS	**50**
3	Misllaneous Loads (Fire Pumps, Lift, STP Pump, Domestic Water Pump, PHE, External Lighting, etc.)	**110**
4	Auditorium	**180**
5	A/C Load (50% load)	**240**
	Total in KW	**880**
	Applying 0.8 power factor Load in KVA	**1100**
	Loading on DG set at 90% or Keeping	**1222**

	10% as spare capacity in KVA	
	Total Say	**1230 KVA**

Two nos. D.G set will be provided for considering above mentioned Load demand.

III. ELECTRICAL SCHEMES:

A. POWER DISTRIBUTION SCHEME:

The normal power supply to the medical college premises shall be available from WBSEDCL at 11 KV and fault level is 350 MVA. Suitable capacity of HT cable shall be used to connect to. Transformers as per established loads to step down the voltage level at 433 V. The Supply Authority's power supply cable shall enter to the substation building through adequate size where necessary with long radius bend and inspection chambers of suitable size at regular interval as per requirement.

The following equipments shall be accommodated in the substation building:

1) Supplier's Metering Panel.
2) 11 KV Distribution board.
3) Two nos. 11/0.433 KV Dry type Transformer of required capacity
4) Two nos. DG as per required capacity in KVA; DG set with auxiliaries for supply of emergency power in case of main power failure.
5) Battery and charger for DG sets and HT panel protection circuit.
6) APFC Panel.
7) Main L.T. Panel.

The Transformers shall be protected on the HT side of the consumer, by 11 KV Circuit Breakers i.e. VCB (Vacuum Circuit Breaker) with necessary metering and protection.

B. LOW VOLTAGE DISTRIBUTION SYSTEM:

LT power from the secondary sides of the transformers shall be brought through suitable size of LT cables to the Main panel in L.T. Room and from this room to the electrical room at the ground floor of main hospital building. The power supply cable shall enter to the building through RCC/GI heavy duty pipe with long radius bend and inspection chamber of suitable size at regular interval, as per requirements in the electrical room to accommodate Sub LT panel & distribution boards.

The Main L.T. panel shall have Air Circuit Breaker (ACB) as Incomers and bus couplers with 50KA short circuit rating and adequately rated Aluminum bus bars of 50 KA short circuit withstand capacity. All outgoings shall be protected with MCCBs of 25 KA to 50 KA short circuit rating as per requirement instead of conventional switch fuse unit for better operation and maintenance.

Power Distribution Scheme

Entire system is conceived as per the latest standards, guidelines of local Electrical Authority and relevant Electricity rules.

The Circuit Breakers in Main LT Panel shall be electromechanically interlocked to achieve the conditions mentioned above.

From Main LT panel outgoing feeders, suitable size XLPE cables shall be used to feed power to different distribution boards to cater the various type of electrical loads ie. Bio-medical equipment's, indoor lighting & power points, Lifts, A.C, fire fighting pumps, Water Pumps, external lighting etc.

DISTRIBUTION BOARDS:

All lighting and power distribution boards shall be phase segregated double door type, consisting Miniature circuit breakers (MCBs) of 10 KA rating and Earth leakage Circuit breakers (ELCBs) of 30 mA and MCCB of 25KA to 50 KA sensitivity and SPD for medical equipment & ELV network components.

All Distribution Boards shall be three phase incoming and single-phase outgoing type. Main incomer shall have a TPN MCB or MCCB and one double pole ELCB to each of the three outgoing phase bus bars. This prevents the other two phases get tripped OFF in case one phase has the earth fault.

Lighting and small power installation:
The lighting and small power installation shall be done with multi strand FRLS, PVC insulated copper conductor wires laid in concealed in slab/wall in heavy gauge PVC Conduit / M.S. ERW (Medium Protection and Heavy mechanical stress) black conduits of 20 mm. to 40 mm.dia. as per requirement to be laid in open area and above false ceiling Wiring shall be done with following size of flexible multi - strand Copper conductors.

1) **Main Lighting Circuit between DB & Switch board** - 2 x 2.5 sq.mm. + 1 x1.5 sq.mm.(E)
2) **6 Amp. Independent point** - 2 x 2.5 sq.mm. + 1 x1.5 sq.mm.(E)
3) **6 Amp. Socket on Sw./ board** - 2 x 2.5 sq.mm. + 1 x1.5 sq.mm.(E)
4) **6/16 Amp. Power socket (1st point)** - 2 x 4 sq.mm. + 1 x 4sq.mm.(E)
5) **6/16 Amp. Power socket (2nd point)** - 2 x 2.5 sq.mm. + 1 x 2.5 sq.mm.(E)
6) **32 A. TPN outlet** - 4 core 10 sq.mm. XLPE, 1.1KV, Al Armoured Cable.
7) **40 A.TPN outlet** - 4 core 16 sq.mm. XLPE, 1.1KV, Al Armoured Cable.
8) **63 A.TPN outlet** - 4 core 25 sq.mm. XLPE, 1.1KV, Al Armoured Cable.

The light sub-circuits shall be designed within the permissible limit of 800 watts or 10 points per circuit. The design basis of circuits shall be limited to a voltage drop of 5% max.
Load balancing shall be carried out in three-phase circuit only. The overall load balancing including single phase & three phase circuits in main panel shall be considered as per the connected load. The colour band of PVC copper wire both in single phase and three phase distribution should be maintained in all the installation for phase balancing.

POWER FACTOR IMPROVEMENT USING CAPACITORS:
Generally the Supply Authority supplies power at a power factor of 0.8 and the p.f. drops even more at the consumer end depending upon the nature of the load. Therefore the Supply Authority insists that the load power factor do not fall below a level of 0.95 at the consumer end. To keep the Power Factor constant at and above the permitted level, suitable number of capacitor banks of different KVAR rating has to be connected to the load side of the main LT panel through **SCR based Thyristor Switch** with zero crossing change over facility. Suitable capacity of (APFCR) automatic Power Factor correction Relay and other auxiliaries will be built in to achieve the automation in this respect.

SWITCHES AND SOCKETS:
All switches and sockets shall be Modular type to facilitate compatibility of the modern trends. Industrial socket will also be provided where required. Proposed minimum nos. of Electrical small power socket requirements for Medical College, Auditorium, Hostels and Staff Quarters. The nos. of switches and sockets may be changed as per employers' requirement.

TABLE 1: <u>Power Socket Schedule:</u>

TABLE - POWER SOCKET SCHEDULE

Sl. No.	Facility	RAW POWER SOCKET				UPS POWER SOCKET		
		6/16 A	6A	20A	32A	6/16 A	6A	20A
1A	**ADMINISTRATIVE BLOCK**							
	Principal office	1	3	2		4	4	
	Staff room	2	2				10	
	College Council room	2	2			2	4	
	Officer Superintendent room	1	2	1			2	
	Office	2	2				50	
	Record room		1				2	
	Common room - Boys & Girls	2	4				0	
	Cafeteria	6	2					
	Examination Hall	2	2			2	6	
	Central Library	50					20	
	Lecture Theatres (Big)	4	2			3	6	
	Lecture Theatres (Small)	4	2			3	6	
	Auditorium	15				20	6	
	Common Laboratories (Bigger)	20	4				4	
	Common Laboratories (Smaller)	10	10				4	
	Central Research Laboratory	10	10			8	4	
	Central Photographic Section	2					2	
	Medical Education Unit	1	1			1	2	
1B	**DEPARTMENT BLOCK**							
A	**ANANTOMY**							
	Demonstration room	2	2			2	1	
	Dissection Hall	4	2	1			2	
	Museum	10	2					
	Embalming room	2	1	1		1		
	Storage Tanks							
	Cold Storage room	2		2				

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
	Histology Lab	20	4				2	
	Preparation room	2	1					
	Research Lab	1	2			1	1	
	Museum - Preparation rooms	2	2				2	
	Department Library	2	2				2	
B	**PHYSIOLOGY INCLUDING BIOPHYSICS**							
	Demonstration room	2	1			2	1	
	Amphibian Lab	5	1				2	
	Preparation room	2	1					
	Mammalian lab	5	1				2	
	Preparation room	1	1				1	
	Human Lab - Haematology	2	2			1	1	
	Preparation room	2	1					
	Clinical Physiology Lab	2	2				2	
	Department Library	2					2	
	Research Lab	1					1	
C	**BIOCHEMISTRY**							
	Demonstration room	2	2			2	1	
	Practical Class room	20	4				2	
	Ante room	2	2					
	Department Library	2	2				2	
	Research Lab	1	2			1	1	
	Service Lab	8	2			8		
D	**PATHOLOGY**							
	Demonstration room	2	2			2	1	

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
	Museum	15	4					
	Practical Labs	20	4				2	
	Preparation room	2	1					
	Service Laboratory	6				2	4	
	Balance room	1						
	Store room	1						
	Special room for High Centrifuge	1					2	
	Wash	1						
	Autopsy Block	1	1					
	Department Library	2	2				2	
	Research Lab	1	2			1	1	
E	**MICROBIOLOGY**							
	Service Laboratories	6	4			2	4	
	Museum	1	4					
	Demonstration room	2	2			2	1	
	Practical Lab	20	4				2	
	Preparation room	2						
	Media Preparation & Storage	2	1				2	
	Autoclaving	2	1	1				
	Washing & Drying	2	1					
	Department Library	2	2				2	
	Research Lab	1	2			1	1	
F	**PHARMACOLOGY**							
	Demonstration room	2	2			2	1	
	Museum	4	4					
	Practical Labs	20	4				2	
	Preparation room	2	1					

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
	Department Library	2	2				2	
	Research Lab	1	2			1	1	
G	**FORENSIC MEDICINE INCLUDING TOXICOLOGY**							
	Demonstration room	2	2			2	1	
	Museum	4	4					
	Practical Lab	20	4				2	
	Department Library	2	2				2	
	Research Lab	2	1			1	1	
H	**COMMUNITY MEDICINE**							
	Museum	4	4					
	Demonstration room	2	2			2	1	
	Practical Lab	4	4			2		
	Department Library	2	2				2	
	Research Lab	2	1			1	1	
	Staff Accommodation							
	Professor & Head	3	2	1			2	
	Asso. Prof/ Reader	3	2	1			2	
	Asst. Prof/ Lecturer	3	2	1			2	
	Statistician cum Lecturer	2	2	1			2	
	Epidemiologist cum Lecturer	2	2	1			2	
	Tutor/ Demonstrator	2	2	1			2	
	Dept Office/ Clerical Room	2	1				2	
	Non Teaching staff room	1	1				2	

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
2	**ANIMAL HOUSE**							
	Lobby	1						
	Change/ Lockers		1					
	Toilet	1		1				
	Laboratory/ Sterile Store	2						
	Staff room/ Doctors room	2	2				2	
	Operation Theatre	2	1	1			2	
	Animal rooms	1						
	Feed Room	1						
3	**CENTRAL WORKSHOP**							
	Lobby	1						
	Bio-Medical Engineers room	1	2	1			2	
	Instruments repair area/ Workshop area	4	2	2			2	
4	**GYMNASIUM (OPTIONAL)**							
	Lobby	1						
	Change/ Lockers		1					
	Toilet	2						
	Carrom/ Chess room	1	1					
	Gym room (Tread Mill, Cycling, Work area)	2	4					
5	**AUTOPSY BLOCK**							
	Lobby/ Reception	1	1					
	Office / Staff room/ Doctors room	2	1				2	
	Demonstration room	2	1					
	Autopsy room	6	4	6				
	Cold room	2		2				

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
	Store	1						
	Toilet	1						
6	**HOSTEL**							
	Hostels (Boys & Girls) Room							
	Interns Girls & Boys Hostel Room							
	Residents Doctors Hostel Room							
i	Lobby	3						
ii	Student room (3 students Per Room)		4					
iii	Visitor room/ Care taker room	1	2					
iv	Study room (With Computer & Internet)	2	2				10	
v	Common Toilet (WB/ WC/ Bath)	1		1				
vi	Dining room	2						
vii	Recreation room	2	2					
viii	Service room	2		1				
ix	Varandah		1					
7	**QUARTERS**							
	Superintendent / Principal Housing							
i	Lobby		1					
ii	Living room/ Family room	2	2	1				
iii	Kitchen	2	3					
iv	Bed room -1		4	1				
v	Bed room -2		3	1				
vi	Bed room -3		3	1				
vii	Toilets (WB/WC/Bath) (Common/ Attached)	1	1	1				
viii	Varandah		1					

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
	Guest House							
i	Dinning Room	2	2	2				
ii	Guest Room (each)		4	1				
iii	Kitchen	2	3					
iv	Toilets (WB/WC/Bath) (Common/ Attached)	1	1	1				
v	Varandah		1					
	Doctors Quarters							
i	Lobby		1					
ii	Living room/ Family room	2		1				
iii	Kitchen	2	3					
iv	Bed room -1		4	1				
v	Bed room -2		3	1				
vi	Bed room -3		3	1				
vii	Toilets (Common/ Attached)	1	1	1				
viii	Varandah		1					
	Paramedics/Admin. Staff Quarters							
i	Lobby		1					
ii	Living room/ Family room	1	1	1				
iii	Kitchen	2	3					
iv	Bed room -1		3	1				
v	Bed room -2		2	1				
vii	Toilets (WB/WC/Bath) (Common/ Attached)	1	1	1				
viii	Varandah		1					
	Nurse Quarters							

TABLE - POWER SOCKET SCHEDULE								
Sl. No.	**Facility**	**RAW POWER SOCKET**				**UPS POWER SOCKET**		
		6/16 A	**6A**	**20A**	**32A**	**6/16 A**	**6A**	**20A**
i	Lobby	1						
ii	Living room	1	3					
iii	Kitchen	2	3					
iv	Bed room -1		3	1				
v	Toilets (WB/WC/Bath) (Common)	1	1	1				
vi	Varandah		1					
8	**SERVICE BUILDINGS**							
i	Electrical Sub station, Transformer Yard,	6	2	2				
ii	UG Sump & Pump Room,	2	1	1				
iii	HVAC Plant room	1	1	1				
iv								

III. DETAILED ELECTRICAL AND MECHANICAL ENGINEERING SERVICES:

1.0 GENERAL

To provide a complete electrical system for the distribution of electric power from the point of supply (WBSEDCL), D.G.s to the utilization equipment, and described in these specifications. It will be the bidder's responsibility to work out the exact quantities with drawings as per area program & from work site, which trade provides said equipments, materials, tools and labour.

2.0 SCOPE

The bidder shall supply, install and commission along with requisite spare, maintenance tools and tackles the following equipments and system in the Building. The scope also covers the detailed engineering and calculations of the various equipments/system mentioned hereunder and the same shall be approved by the Owner /Architect prior to execution of the job.

1. 11 KV H.T. Switchgears.
2. Specification of Distribution Transformers
3. Specification of L.T panels and switchgears.
4. Specification for Lighting Protection system.
5. Specification for Capacitor Bank and Capacitor Control Panels.
6. A) Specification of HT cable (XLPE) (11KV)
6. B) Specification of LT cables and Wire
7. Specification for Internal Electrical Works.
8. Specification for wiring.

9. Specification for D.G Set.
10. Specification for Fire Detection System and Fire Fighting System
11. Specification for AV/ PA System
12. Surveillance Closed Circuit Television (CCTV) System.
13. Specification for LAN Networking System & Telephone System.
14. Specification of Air Conditioning and Mechanical Ventilation System.
15. Specification of Signage.
16. Specification of Lift.
17. Specification of Pump Motor for Water Supply & Sewerage.
18. Specification of Solar System
19. A) Scope of Backup power source B) Scope of UPS System. C) Specification of U.P.S System
20. Building Management System (BMS)
21. Specification of Earthing
22. Specification for External & Internal Lighting
23. Specification of Street Light
24. Specification of Visual Display system
25. Illumination
26. Specification of Digital Classroom
27. Special Condition.

This specification defines the basic guidelines to develop a suitable electrical system as necessary for the Medical College, associated hostels and residential quarters. All data required in this regard shall be taken into consideration to develop a detailed engineering of the system.

Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.

All work to be performed and supplies shall be affected as a part of contract requires specific approval/review of Owner or his authorized representative. Major activities requiring approval/review shall include but not be limited to the following:

The engineering activities shall comprise the submission for approval of the following:

- Basic engineering documents e.g. overall single line diagram, area classification drawing, overall cable layout, Area illumination (External lighting) System shall be proposed with Automatic Timer based Power control supplied from normal power supply from main panel, testing, type test report, guaranteed particulars of all equipments and maintenance manuals.
- Quality Assurance Plan (QAP).
- Standard Operating Procedure (SOP).
- Field testing and commissioning procedures.
- Control and protection schemes.
- Load sharing and annunciation scheme, Preparation of power supply distribution drawing.

Bidder shall be responsible for:

- Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, lighting layouts, ACMV Layouts, cabling layouts, earthing and lightning protection layouts, including equipment installation and cable termination details etc. prior to start of work.
- Preparation of bill of materials for cabling, lighting, earthing and miscellaneous items etc.
- Cable schedule.
- Lighting/power panel schedule.
- Interconnection/ Co-ordination Drawing.

- Protection co-ordination schemes in drawings/tabular format for complete power system.
- Shop inspection and testing procedures.
- Field testing and commissioning procedures.
- Preparation of As Built drawings for all services.
- Any other work/activity which is not listed above however is necessary for completeness of overall Electro-mechanical System.

2.0 SITE CONDITIONS

i)	Design ambient50 Deg.C. maximum 2 Deg. C. minimum
ii)	Relative Humidity 85% maximum
iii)	Site environment Normal

2.1 DESIGN CRITERIA

a) Electrical Details of Incoming Supply		
i)	Supply Voltage	11 KV
ii)	Neutral Earthing	Solid Earthing
iii)	Voltage Regulation	± 10%
iv)	Frequency Regulations	± 3%
v)	Combined	± 10%
b) L.T. Power Distribution System		
i)	Voltage	415 V / 240 V
ii)	Frequency	50 Hz
iii)	Neutral Earthing	Grounded
iv)	Short Circuit Fault Withstand Capacity	10 KA - 65 KA (1 Sec)
c) Source of Power Supply		
a)	Voltage	415 V / 240 V
b)	Source	Mains/D.G. Set/Solar Power
d) Control Supply for Electrical System The various supply voltage to be used in the control panels for main equipments are:		
i)	Spring Charge Motor	230 Volt A/C
ii)	Closing/Trip Coil	24 V DC / 230V AC
iii)	Alarm/Indication/Relay	24 V DC/ 230 V AC
iv)	Heaters	230 V AC

A	POWER SUPPLY LOAD CONTROL/DISTRIBUTION PANEL.	433 V TPN / 240 V 1 phase A.C.
e) Painting		
i)	PAINTING OF PANEL.	Powder coating of approved shade.
f) CABLE DETAILS		
A	INTERNAL WIRING.	Copper conductor PVC insulated 1.1 KV grade as called for
B	POWER CABLES (L.T.).	XLPE insulated Al. Armoured Cable
C	11 KV	Aluminium conductor XLPE insulated armoured cable.
D	GROUNDING CONDUCTOR.	Copper/G.I. strip as called for.
E	LIGHTNING CONDUCTOR.	Conventional type as per NBC 2016.
g) ACCURACY CLASS OF METER		
i)	Revenue Meters	Class-0.5 or as per WBSEDCL approved.
ii)	AmmeterVoltmeter and Other Instrument.	Class – I Digital Analogue

1. 11 KV H.T. SWITCHGEARS

This specification covers the 'General Requirements' for the design, manufacture, supply performance, inspection, testing and commissioning including supply of indoor type high voltage switch boards upto 11 KV including necessary termination, cabling, bus work required for satisfactory operation .
Specific requirements shall be in accordance with single line diagram/specification/data sheet. In case of conflicting requirement between the Technical Data and General Specification the former shall prevail. The technical parameters of switchgear equipments, transformers etc. shall be submitted by the Contractor for approval by the employer.
This specification shall cover 11 KV and Single Panel as well as 3 Panel Board.

1.1 STANDARDS:
All equipment, material and components shall comply with the requirements of the latest editions of Indian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.
The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.

Some of the relevant Indian and British Standards are listed below:

IEC 62271-100 – Type tested assembly
IEC 62271-200 – Type test for metal enclosure

IEC 60932 : Climate aging test
IEC 60068-3-3 : Seismic Test

IS 13947 - A.C. Circuit Breakers (Relevant Parts/SCC)
IS 13941 - High voltage Circuit Breaker (Relevant Parts/SCC)
IS13118 - Gas insulated Switchgear
IS 3427 - Metal enclosed Switchgear & Control Gear
BS 162 - Safety Clearances
IS 2705 - Current Transformers (Parts 1 to 4)
IS 3156 - Voltage Transformers (Parts 1 to 4)
IS 3202 - Code of Practice for climate proofing of electrical equipment
IS 375 - Marking & Arrangement for Switchgear Bus Bars, main connections and auxiliary wiring.
IS 722 - A.C. Electric Meters
IS 1248 - Direct acting Electrical Indicating Instruments
IS 3231 - Electrical Relays for Power System Protection
IS 2544 - Epoxy Cast Resin Insulators
IS 5082 - Electrolytic Copper and Aluminum
IS 5792 - High Voltage HRC fuses
IEC 60694 - High Voltage Switchgear
IEC 60947 - High voltage Circuit Breaker
IEC 60056 - Gas insulated Switchgear
IEC 60298 - Metal Enclosed High Voltage Switchgear

1.2 DETAIL OF DESIGN

a. CONSTRUCTION

The switch boards shall be cubicle type, suitable for indoor/outdoor installation, floor mounting and free standing. The design shall be totally enclosed, dust - tight, dam proof and vermin proof offering degree of protection not less than IP-42 for Indoor Application & IP-54 for Outdoor application.

Separate segregated compartments shall be provided for circuit breakers, bus bars, cable box, voltage transformers, wire ways, relays, and instrument and control devices. Switchgear cubicles/ modules shall be provided with hinged doors in front with facility for padlocking door handles.

Vent openings shall be covered with grills so arranged that hot gases cannot be discharged through them in a manner that can injure the operating personnel. These vent openings shall be vermin proof.

All the High Voltage compartments i.e. Circuit Breaker, Bus Bar, and Cable Compartments shall be separated from each other by metallic partitions in line with IEC-600298. These compartments must have pressure relief flaps for exit of gas due to internal arc to ensure operators safety. All the HV design must ensure conformity to IEC-600298 and must be Type tested for Internal Arc Test. The supplier shall submit Type Test report from CPRI or other independent agency to prove the above.

All panels shall be of same height, width and depth. Panels shall be bolted together to form a continuous flush front switch board, suitable for front of board operation.

The switchgear cubicles shall be rigid and robust in design and construction, fabricated out of CRCA sheet steel. Cubicles shall be made from rigid welded structural frames made of structural steel sections or of pressed/formed sheet steel of not less than 2mm thickness. The frames shall be enclosed by sheet steel of at least 2mm thickness, smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary. Height of the operating handle, push button etc. shall be restricted between 300 mm to 2000 mm from the finish floor level. Fixing screws and nuts shall be used. Selftapping screws shall not be used in the construction.

All doors, panels, removable covers shall be provided with non deteriorating (neoprene) gaskets all around the perimeter.
All doors shall be removable and supported by concealed type hinges. The hinges shall be strong and braced to ensure freedom from sagging, bending and general distortion of panel or hinged part.
Floor mounted cubicles with minimum 75 mm high channel and 5 mm thick channel base frame. Approx 200 mm-blank space between the floor of the switchboard and bottom most units shall be provided. The total height of the cubicle shall not exceed 2400mm.

b. Each site requires 1 (one) 11KV substation.

c. BUSBARS & BUSBAR CHAMBER

Three phase bus bars shall be of high conductivity electrolytic copper as stated in Bid Document. The bus bars shall be air insulated and housed in a separate compartment, which segregated from all other compartments, in case of Vacuum Circuit Breaker. Current density of **Cu. Bus-Bar** shall not exceed 1.5 Amps / mm^2
Bus bars & bus bar connections shall be of uniform cross section shall be suitable for carrying rated current continuously and short circuit current for specified duration without overheating. The bus bars connections shall be adequately supported on insulators to withstand dynamic stresses due to short circuit current specified. Normal operating temperature for bus bars shall be 85 Deg. C. Short circuit rating of the bus bars shall be 35 KA for 1 sec.

All bus bar joints and bus tap joints shall be silver or tin plated. Joints shall be bolted type and shall be insulated. Spring/Lock washers shall be provided to ensure good contact the joints.
Direct access to accidental contact with bus bars and primary connections shall be avoided by providing shrouds. All apertures and slots shall be protected by barriers to prevent accidental shorting of bus bars. To provide a tight seal between cubicles, bushings or insulating panels shall be provided for bus bars crossing from one cubicle into another.
All insulating materials used shall be non-hygroscopic and shall be treated for preventing fungus growth. Surface of insulators shall be highly glazed and treated with silicone compounds to minimize accumulation of dust, condensation and tracking.

d.CIRCUIT BREAKERS

The circuit breakers shall be Triple Pole double break type and the Insulation and Arc interruption medium shall be Vacuum. The Breaker shall be enclosed in a sealed Vacuum Tank. The circuit breakers shall be of horizontal draw out construction with horizontal/vertical isolation. The circuit breaker including its operating mechanism shall be mounted on a wheeled carriage moving on guides, designed to align correctly and allow easy movement on the circuit breaker. There shall be three discrete positions viz. Service, Test and Isolated. Locking facility in all three positions shall be available. Position indicator shall be provided on the panel to indicate the position of the circuit breaker. Test position shall offer testing of circuit breaker operation/interlocks without energizing the power circuit. Circuit breakers shall have stored energy spring mechanism charged by manually operated handle as well as electrically operated mechanism. The closing mechanism of the circuit breakers shall be Motor operated, spring charged with a provision for manual charging.
The operating mechanism shall be mechanically and electrically trip free and non-pumping. Anti pumping feature may be built in or separate anti-pumping relay may be provided. In case spring charged mechanism, spring charged indication shall be provided.

Local manual trip device shall be provided on the operating mechanism. The trip device shall be suitable for front operation and positive mechanical 'ON-OFF' indication shall be provided.
Main contacts of circuit breaker shall have ample area and adequate contact pressure to carry the rated and short time current without excessive temperature rise. The contacts shall be adjustable for wear and easily replaceable. Main contacts shall open before and close after the arcing contacts when these are provided. Arcing contacts shall be easily accessible for inspection and replacement in case of VCB. Each breaker shall normally be provided with auxiliary contacts of 6 NO+6NC directly operated from breaker operating mechanism. These contacts shall be in addition to these used in circuit breaker internal wiring. These contacts shall be rated for 10 Amps at 240V AC and 20 Amp (inductive breaking) at 220V D.C. If more breaker auxiliary contacts are required latching relay shall be used to multiply the contacts.
Shunt trip coil as called for shall be provided for tripping the circuit breaker. The trip coil/s shall operate satisfactorily between 50% - 110% of rated control voltage. Wattage of trip coils will be sufficiently high to prevent it from picking up or holding on with specified number of trip circuit supervisory indicating lamps wired in series.
It shall be possible to trip the breaker, in case of failure of control supply
Circuit breaker type duty and rating shall be submitted in Data Sheet by the Contractor. Circuit breakers of similar rating shall be interchangeable.

e.CURRENT TRANSFORMERS

Current transformers shall be of ratio, burden (shall be worked out by panel supplier), class/accuracy. Current transformers shall conform to latest edition to relevant standards.
Current transformers shall be epoxy resin cast with bar Primary or ring type.
CT core laminations shall be of high grade silicon steel. The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit.
The current transformer shall preferably be capable of being left open circuited on the secondary side with primary carrying rated full load current, without overheating or damage. Short time current rating and rated withstand time shall be same as corresponding C.B.
Secondary terminals of CT shall be brought out to a terminal block which will be easily accessible for testing and external connections. Facility shall be provided for short circuiting and earthing of CT secondary leads through a removable and accessible link with provision for attaching test link. Rating plate details and terminal markings shall be according to the latest edition of relevant Indian Standard specification.
Current transformers (core) shall be used for metering and protection. Each CT shall be provided with rating plate indicating: Name and Make, Serial number, Transformer Ratio, Rated burden, Rated voltage and Accuracy class.

f.POTENTIAL TRANSFORMERS

Potential Transformers shall conform to latest edition of "IS-3156 (Part I, II & III) as applicable relevant standards.
Potential transformers shall be dry, cast epoxy resin type. The PTs shall be of single phase construction.
The PT shall be capable of operating continuously at 110% of the rated voltage without any damage. When star - star connection is required in non-effectively or ungrounded system, the PTs shall be suitable for continuous operation with a persistent phase to ground fault.

Maximum temperature rise of the transformer at rated burden and with rated primary voltage and frequency shall not exceed 40 Deg.C above an ambient of 45 Deg.C.

The PT's shall be fixed at rear bottom / top of the panel as called for. An interlock or automatic shutters shall be provided to prevent access to live HV parts when PT is withdrawn.
HRC Fuses shall be provided both primary & secondary side. It shall be possible to replace PT fuses easily without having to de-energize the main bus bars. Prospective interrupting current rating of the fuses shall be same as the system fault level.
Voltage transformer ratio, output and class shall be specified and shall be stated in data sheet by the Vendor/Contractor. Nameplate as per relevant standards shall be provided on the PT.

g.PROTECTIVE RELAYS

Relays type and numbers shall be in accordance with the protective scheme required.
Relays shall be digital microprocessor based or analogue type. It shall be enclosed in rectangular shaped cases, suitable for flush mounting only, dust tight covers projecting from the front cover panel. The case shall be dust tight, damp proof and tropicalised. The relays shall be either self powered or a 24V DC Power-pack of suitable capacity with charging device shall be provided within the HT panel.
Relays shall be accessible for setting from the front. Access to setting devices shall be possible only after removal of front cover.
Protective relays shall be drawing out type. Where it is not possible to provide protective relays of the draw out pattern, fixed type relays with facilities for plugging in a portable test plug shall be provided. Necessary test plugs shall be furnished along with the relays.
Relays shall be provided with positive action self reset type with indicator. The indicator/s shall be visible from the front.
Relays conform to relevant standards in all respects. Relays shall be provided with minimum two pairs of self or hand reset type contacts as specified. Auxiliary relays shall have the number of NO and NC contacts as required and shall be in data sheet by the Vendor / Contractor.

h.SAFETY/PROTECTION INTERLOCKS/FEATURES

Following interlocks and features shall be incorporated for equipment protection and personnel safety under mal-operation. No deviations on these interlocks and safety features are allowed. These interlocks and safety features shall be fail-safe, positive and fool-proof.

a) It shall not be possible to plug-in or isolate a closed circuit breaker. An attempt to do so shall trip the breaker. (In case of breakers with vertical isolation, this will apply to raising and lowering). There shall be a positive locking facility to prevent closing of circuit unless it is in Service or Test position.
b) Closing and opening operations shall be possible only in discrete, well defined Test and Service positions and not in any position midway. An extension adapter cable with plugs and sockets shall be preferably be provided so that the closing and opening operation of the circuit breaker can be done in fully withdrawn position outside the cable.
c) Slow operation of circuit breakers shall be possible only in the circuit breaker in Test or Isolated position.
d) Isolating switches if provided shall be interlocked with respective circuit breakers to prevent them making or breaking the current.
e) 1 no. bus earthing truck shall be supplied with each panel to earth the outgoing cable of the VCB.
f) Automatic safety shutters for all openings which will lead to access to the live parts of the switchgear upon withdrawal or any operation the switchgear components/parts shall be provided, preferably with a padlocking facility.

g) Spring of motor operated spring charged mechanism shall not discharge until they are fully charged and charging means are fully disconnected.

h) Where key interlocking is employed, tripping of a closed circuit breaker shall not occur if any attempt is made to remove the trapped key from the mechanism.

i) Annunciation window shall be provided for winding temperature trip / alarm as required.

j) Any other interlocks which manufacturer may deem to be required for safety and specifically specified separately required for the system shall be included.

k) All terminals, connections which may be live and exposed for accidental contact shall be adequately shrouded.

l) Components within cubicles shall be properly labeled to facilitate testing.

i. EARTHING

The switch board shall be provided at the bottom throughout its entire length with an earth bus of copper of adequate size to carry the fault current for the duration same as short time rating of the circuit breaker. Earth bus shall have two earthing connection facility at its both ends of earthing conductor.

All non-current carrying metal parts, frames and equipment mounted in the switchboard shall be bonded to earth bus.

Earthing of moving carriage of draw out equipment shall be achieved by scraping earthing device. The earthing device shall maintain positive earth continuity in all Service Test and Isolated positions. It shall be possible to connect each circuit or set of three phase bus bars to earth either through earthing trucks or through the circuit breakers.

One earthing trolley suitable for earthing of cables or bus bars and common for all circuit breakers of the same type/rating shall be provided.

j. INSTRUMENT & METERS

Electrical indicating instruments shall be digital type with zero adjustment, probe from outside the cover.

Multi function meter of CL 1.0 accuracy with RS 485 port shall be provided.

Instruments/meters shall be suitable for flush mounting on the panel with flanges protecting outside the panel.

All meters shall be industrial grade with accuracy of class 1.0 unless specifically indicated.

k. CONTROL WIRING

All wiring for control, protection, alarm, indicating circuits and remote tripping mechanism on all equipment shall be carried out with at least 650V grade, PVC insulated, stranded, copper, 2.5 Sq.mm conductors.

All wiring shall be run on the sides of the panels and shall be neatly bunched and cleated without affecting access to equipment mounted in the panel. Where wiring enters or passes through compartments containing HT apparatus then they shall be in earthed metallic conduits or ducts.

All wiring shall be taken to terminal blocks without joints or tees in their run.

All wiring shall be colour coded as follows:

Instrument Transformer AC circuit - Red, Yellow & Blue determined by the Phase with which the wire is associated.

AC Phase Wire	-	White
AC Neutral	-	Black
DC Circuits	-	Grey

Earth connections - Green

Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted to each wire. Ferrules shall fit tightly on the wires, without falling off when wire is removed. Ferrules shall be of white colour with black lettering. Each wire shall be identified by letter to denote its function followed by a number to denote its identity at both ends.

All wiring for external connections shall be brought out to individual terminals on a readily accessible terminal block.

All unused auxiliary contacts of the circuit breaker and relays shall be wired upto terminal block.

l. FITTINGS AND ACCESSORIES

Indicating Lamps:

Neon type indicating lamps or LED indicators shall be provided everywhere except where low voltage filament type with series resistor called for.

Lamp covers shall be provided with interchangeable colored lenses of Perspex or equivalent unbreakable material. The lenses shall not discolor in course of time due to heat of the lamp.

Bulbs and lenses shall be interchangeable and replaceable from the front. Following colors shall be used for the function indicated:

Red	-	Circuit Breaker 'ON'
Green	-	Circuit Breaker 'OFF'
White	-	Continuous trip supply supervision
Amber	-	Auto trip
Blue	-	Spring charged
R.Y.B	-	Potential indication
Green	-	Earth

Push Buttons:

All push buttons shall be push to actuate the contact type.

Start & Stop push buttons shall be colored green and red respectively. Reset push buttons shall be yellow in color and test push buttons shall be blue in color. All other push buttons shall be black in color. Emergency stop push buttons shall be lockable in the operated position, i.e. push to operate and key to release type. Push buttons for emergency stop shall be recessed/shrouded type to avoid accidental operation.

Control & Selector Switches:

Control and Selector switches shall be of rotary type, having enclosed contacts accessible only after removal of cover.

All control and selector switches for circuit breakers and instruments shall be mounted on the front of the panel. Control switches for space heater/s and control supplies shall be mounted inside the panel. Circuit Breaker control switches shall be provided with pistol grip handles. Selector switches shall be provided with round, knurled handles. All handles shall be black in colour. Properly designated escutcheon plates clearly marked to show the operating positions shall be provided on all switches.

All other instruments and selector switches shall have stay put contacts.

Circuit breaker control switches shall normally have three positions close - Normal - Trip with spring return to normal position. Switch operating mechanism shall prevent the switch from being operated twice successively in the same direction. Circuit breaker control switch shall have one NO-NC contact along with other contacts as required.

Contacts of all control and selector switches shall be rated for 10 Amps at 240V AC or 20 Amps at 220V dc (inductive break). Switch for space heater supply and control voltage supply shall normally be two pole rated for 25A A.C.

Control Terminal Blocks:

Box - clamp type, 1100V grade line up terminals of minimum 2.5 Sq.mm size shall be provided.

Connection to terminals shall be from front.

Not more than one wire on each side shall be connected on any terminal. Where duplication of terminals block/s is necessary, suitable solid bonding links shall be incorporated. Terminal blocks at different voltage shall be segregated into groups and distinctly labeled. Current transformer secondary leads shall be brought to terminal blocks having facility for short circuiting and grounding the secondary. Terminals shall be numbered for identification and grouped according to function. Engraved back on white PVC labels shall be provided on the terminal blocks describing the function of the circuit.

Separate terminal stems shall be provided for internal and external wiring.

Control terminal blocks shall be so located that control cables are fully segregated from power cables. Suitable insulated or earthed metal race ways shall be provided for control wiring. Separate undrilled removable gland plate shall be provided for the control cables at the bottom of each panel. Minimum 10% of total number spare terminals shall be provided for future use.

Name Plates and Labels

One Name plate giving designation of the HV switchboard shall be affixed prominently on top of the switch board. Details of designation will be specified.

Labels giving following details shall be affixed on each feeder panel:

i) Feeder Name.
ii) Equipment reference no. & Description
iii) Rating (KVA/Amp.)

All components whether mounted inside or on the door shall be permanently and clearly labeled with reference number/letter or their function. Rating of fuse shall be part of fuse designation. Paper labels, stickers or labels fixed with adhesives are not acceptable. All labels shall be properly fixed by screws with provision to prevent distortion due to expansion.

All labels shall be non-corroding, preferably laminated plastic or rear engraved perspex with white letters on black background.

Labels for feeder panel designation fixed on front side shall be fitted with chrome paste, self tapping, and counter sunk head screws. These labels shall be of identical size to permit interchange.

Space Heaters:

Adequately rated anti-condensation space heaters shall be provided in each cubicle.

Space heater/s shall be trip type, rated with operation voltage of 240V, 50 Hz. AC supply.

Each space heater shall be complete with a 2P MCB, 10KA and a control thermostat.

The space heater shall be rated for maintaining the panel inside temperature 10 Deg.C above outside ambient temperature.

Cubicle Lighting:

Each cubicle shall be provided with interior lighting by means of CFL light fixture. An ON/OFF switch/door switch shall be provided. The lighting fixture shall be suitable for operation from a 240V single phase, 50 Hz. A.C. supplies.

Auxiliary Supply:

Auxiliary supply for control, indication, space heater etc. shall be made available at one point on the switch board. Vendor shall provide suitable auxiliary supply in the switch board.

Fuses:

All fuses in control, indication and metering circuit shall be HRC link type of approved make. Mounting of fuse fitting shall ensure adequate dissipation of heat generated and shall facilitate inspection and easy replacement of fuse.

Cable Termination:

The switch board panel shall be provided with separate compartment for cable termination complete with suitable cable end termination for XLPE insulated cables suitable for bottom entry. Cable and sealing box shall preferably be mounted inside the panel. Cable compartment doors shall be self–locking type, interlocked and shall have Arc withstand capability due to short circuit. The compartment shall be provided with cable testing facility in case of gas insulated medium. For XLPE cables adequate space and clearances shall be made for heat/cold shrinkable termination e.g. Raychem or cold flowing stress grading joints.

Two earthing terminals shall be provided in each panel in cable box/cabling chamber for earthing armour/screen.

Where more than one core is terminated on each phase, links suitably designed and properly supported shall be provided to avoid unnecessary bending of cable cores without decreasing the length of insulated cable tail. Electrical clearances which would normally be required when using one core per phase shall be maintained.

Where core balance type current transformers are provided on switchgear feeder circuit cable/s for earth fault protection sufficient space, clearance and support, mounting arrangement shall be provided for the CT.

Painting:

All steel work shall be pretreated in tanks and finally powder coated of approved shade of the levels not less than 100 microns.

1.3 TESTING & INSPECTION

Four copies of all test certificates and certificates shall be furnished. After completion of all work at the manufacturers works the switchboards shall be inspected and tested in presence of employer. However, stage inspection may be carried out from time to time to check progress of work and workmanship. The following tests shall be carried out:

i) All routine tests specified in relevant Indian/British Standards shall be carried out on all circuit breakers.

ii) Test for protective relay operation by secondary injection method. iii) Operation of all meters.

iv) Secondary wiring continuity test

v) Insulation test with 5000 Volts megger, before and after high voltage test.

vi) HV test on components on which such test is permissible (23 KV for one minute)

vii) Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.

viii) Measurement of power required for closing/trip coil of the breaker.

ix) Pick up and drop out voltages for shunt trip and closing coils. x) CT Polarity & ratio test.

xi) Power frequency voltage withstand test.

Vendor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from Sub-

Vendor for the components procured from them are to be submitted before dispatch of switch boards.

1.4 DRAWINGS AND INFORMATION

The Vendor shall furnish following drawings/documents in accordance with enclosed requirements:

i) General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cut-outs/trenches for external cables

ii) Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.

iii) Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc.

iv) Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.

v) Relay wiring diagrams.

vi) Equipment List. vii) Bus bar sizing calculations.

Vendor shall furnish required number of copies of above drawings for Purchaser's review, fabrication of switch boards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.

The information furnished shall include the following:

i) Technical literature giving complete information of the equipment.

ii) Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.

iii) A comprehensive spare parts catalogue.

1.5 TOOLS

One complete set of all special or non-standard tools required for installation, operation and maintenance of the switchboard shall be provided. The manufacturer shall provide a list of such tools individually priced with his quotation.

1.6 QUALITY ASSURANCE

Quality Assurance shall follow the requirements of employer as applicable.

Quality Assurance involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Purchaser's requirements.

2. SPECIFICATION OF DISTRIBUTION TRANSFORMER

2.1 SCOPE:

This Specification covers the design, engineering, manufacture, testing at manufacturer's works before dispatch, packing, forwarding and delivery, supervision of erection, testing at site and commissioning of two nos. indoor dry type of distribution transformer complete with ON- Load Tap Changing Circuit (OLTC) suitable for trouble - free operation.

The equipment shall be of type-tested design as per standards for the ratings required. If the type test reports are not available for the required ratings, the test has to be conducted and relevant documents shall be submitted.

2.2 SUBMISSIONS

- All technical submissions shall be approved by the Design Consultant on behalf of M/s West Bengal Medical Services Corporation Ltd. (WBMSC).
- Following details to be submitted along with signed copy of technical specifications and datasheet compliance.
  a. Equipment's drawing submission including manufacturer's data, shop drawing showing the coordinated installation & mounting details, control wiring diagram and interface wiring diagram between equipment and marshalling box.
  b. Recommended safety earthing schematics as per West Bengal CEIG norms shall be submitted.
  c. List of sub items with rating, range, makes and its country of origin.
  d. Data sheet and all technical details for all the equipments used and shall be approved by the concerned authority.
  e. Builder's works requirement such as equipment foundation requirements, exact clearance requirements and rating of interfacing devices (NCT etc).

2.3 CODES & STANDARDS

The equipment covered by this specification shall, unless otherwise stated to be designed, constructed and tested in accordance with latest revisions of relevant IS Standards / IEC publications.
IS 191: 2007: Copper Specification
IS 335:1993 (reaffirmed 2005): Insulating oil
IS 613: 2000 (Reaffirmed 2006): Copper Rods and Bars for Electrical Purposes
IS 2026 (Part-I) 1977 (Reaffirmed 2001), IS 2026 (Part-II) 1977 (Reaffirmed 2001), IS 2026 (Part-III) 1981 (Reaffirmed 2001), IS 2026 (Part-IV) 1977 (Reaffirmed 2001), IS 2026 (Part-V) 1994 (Reaffirmed 2004): Power transformers
IS 1271: 1985 (reaffirmed 2001): Thermal evaluation and classification of electrical insulation.
IS 6600:1972 (reaffirmed 2001) - Guide for loading of oil immersed transformer
IS 8130: 1984 (reaffirmed 2001) - Conductors for insulated electric cables and flexible cords
IS/IEC - Moulded epoxy bushings for transformers
IS 10028 Part 1: 1985 (reaffirmed 2001), Part 2: 1981 (reaffirmed 2001) &
Part 3: 1981 (reaffirmed 2003): Code of practice for selection, installation and maintenance of Transformers
IS 2099: 1986 (reaffirmed 2003): Bushing for alternating voltages above 1000 V
IS 4257 Part- 1: 1981 (reaffirmed 2004) &Part 2: 1986 (reaffirmed 2004) - Porcelain bushings for transformers
IS 3639: 1966 (reaffirmed 2001) - Power transformer fittings and accessories
IS 2705 (Part-I to IV): 1992 (reaffirmed 2002) - Current transformers
IS 8468:1977(reaffirmed 2006) -On load tap changer
IS 8478: 1977 (reaffirmed 2001) & ECBC - 2008- Application guide for tap-changers

2.4 SITE CONDITION

2.4.1 The transformer shall be suitable for installation and satisfactory operation for indoor service at service building.
2.4.2 These transformers shall be designed to operate under following site conditions.
Site Location

a) Atmosphere: All weather condition environment.
b) Altitude: 1000 mtrs. above MSL Maximum
c) Design Ambient temperature: 50°C
d) Relative Humidity: 85-100%

e) Geographic Location: XXXX Deg. N.
f) Seismic Zone: 0.3 g.

2.5 QUALITY ASSURANCE

All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection / tests to be carried out by the Vendor for equipment as whole as well as major components /material / sub-items / bought out items as part of QAP shall be furnished. This is, however, not intended to form a comprehensive programme, as it is the Vendor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field testing shall be drawn up by the Vendor and will be submitted to Employer for approval. Schedule of finalization of such quality plans will be finalized before award of contract. Monthly progress reports on Manufacturing Quality Plan (MQP)/ Field Quality Plan (FQP) submission/ approval shall be furnished.

2.6 GENERAL DESIGN FEATURES

a) Transformer shall be of the latest design only. The type of cooling shall be Air cooled and forced air cooling type, cast rasin, dry type and the corresponding ratings for the transformer shall be as indicated in the specific requirements.
b) The transformer shall be suitable for operation at full rated power on all tapings without exceeding the applicable temperature rise.
c) It shall be possible to operate the transformer satisfactorily, up to overloads of 110% of the rated value on confirmation. There shall be no limitations imposed by bushings, tap changers, auxiliary equipment to meet this requirement. The manufacturer shall confirm that the transformer shall cater to the starting kVA requirement of motors up to 110% of the rated capacity with the period of starting as 20 secs. There shall be a minimum of 6 such starts in one hour.
d) The transformers shall be designed to be capable of with-standing, without injury, the thermal and mechanical effects of short-circuits between phases or between phase and earth at the terminals of any winding with full voltage applied across the other winding for periods given in relevant standards. There shall be no limitations imposed by any part/component of the transformer/on load tap changer to meet the short circuit level Specified. The successful bidder shall justify their design with necessary supporting calculation. The maximum short circuit current shall be determined by computing the through fault current using the formula:
Short circuit current = (Rated Current x 100)/% Impedance.
e) The Transformer shall be designed to suppress harmonic content, especially the third, fifth and seventh harmonics with specified limits, so as to eliminate distortion in the waveform and consequent additional insulation stress, noise on communication system and undesirable circulating currents between the neutrals at different transformer stations.
f) The transformer shall be designed for minimum no-load and load losses within the economic limit i.e. less than or equal to 0.98% of transformer rating and shall be able to have minimum loss at the rated load condition during different period of the day.
g) All electrical connections and contacts shall be of ample cross sections for carrying the rated current without excessive heating.

h) The transformer shall be capable of continuous operation at full load rating under the following conditions.
- Voltage variation = ± 10%
- Frequency variation = ± 3%
- Combined voltage and frequency variation (Absolute sum) = 10%

2.7 CONSTRUCTION

a) The transformer shall be designed and constructed to withstand capability of minimum 35KA for 3 Sec without damage to the thermal and dynamic effects of external short circuits between phases or between phase and ground.
b) The transformer shall be, ONAN cooled suitable for indoor installations. Transformer shall be housed in, freestanding enclosures of welded sheet steel frames with expanded metal screens of suitably size or louvers backed by wire mesh. Transformer and the enclosure shall be suitably reinforced to prevent distortion during handling. Base channels shall be provided with skids and pulling eyes to facilitate the movement of the transformer in all directions.
c) The core-clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly.
d) The core assembly of the transformer enclosure shall be electrically connected to the transformer tank for effective core earthing. Also copper flexible for earth continuity purpose shall connect different parts of transformers.
e) Transformer with all accessories shall be of free standing type.
f) Transformer/accessories shall be designed in such a way that no supporting/post structure shall be required other than rails.
g) The transformer shall have suitable ON load tap changing on the HV windings.
h) The lifting lugs and rollers shall be provided. A winding temperature scanner shall be provided and is actuated by means of resistance temperature detectors embedded in LV windings of all three phases.
i) It should have alarm and trip contacts at a specified temperature. The scanner shall be suitable for IP-55 protection.
j) The transformer shall be provided with protection class of IP-33 protection class enclosure suitable for indoor applications. The thickness of the enclosure shall be as per the latest standard.

2.8 HV & LV WINDINGS

LV & HV Winding will be made of Copper Strip / Foil and capable of withstanding Short Circuit Current Situations as per IS. The core shall be built up with high grade, non aging, low loss, high permeability, grain oriented, cold rolled silicon steel Iaminations especially suitable for core material. Grade of core should be M4 or better. The specified evidence of procurement of core has to be provided. The coils shall be manufactured from electrolytic copper conductor & fully insulated for rated voltage. Coils shall be resin molded for both LV & HV with empoxy resin, Class H, naturally cooled (AN) alongwith Forced Cooling Fan (AF). Insulating materials shall be of proven design & should be selected in such a way that the transformer will be capable of supplying 110% continuous load, Coils shall be so insulated that impulse & power frequency voltage stresses are minimum. Coil asembly shall be suitably supported betwwn adjacent sections by insulating spacers and barriers. All leads from the windings to the terminal board & extended Busbars shall be rigidly supported to prevent injury from vibration or short circuit stresses. The core and coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement of transformer or under short circuit stresses.

2.9 ON-LOAD TAP CHANGER (OLTC)

- High-speed on-load tap changing gear with number of steps as specified in the Specific requirement & MSLD shall be provided.
- The OLTC gear shall have diverter resistance and the current diverting contacts shall be housed in a separate oil chamber segregated from the main tank of the transformer.
- The contacts shall be accessible for inspection and their tips shall be replaceable.
- The tap changer shall be suitable for connection to tapping brought from HV winding covering the range as specified. Tap changer cubicle shall be located at a convenient operating level. The tap changer shall be supplied with the following components in the driving mechanism cubicle.
  a. High torque electric motor suitable for operation on 415 volts three phase, 50 Hz AC supply
  b. Motor drive and energy accumulator
  c. Motor isolating device with over load and single phasing protection
  d. Contactors for forward and reverse operation of motor
  e. 'Raise/Lower' limits switches.
  f. Retainer switch.
  g. Local/Remote control selector switch.
  h. Raise/lower control for remote operation.
  i. Out of step relay.
  j. Auxiliary transformer.
  k. Anti-condensation heater with switch.
  l. Interlock between manual and electrical operation.
  m. Mains isolating switch.
  n. A set of fuses.
  o. Insulated terminal board (with connectors for transformer tap leads).
  p. Mechanical (local) tap position indicator.
  q. Handle for manual operation.
  r. Tap changer operation counter.
  s. Mechanical stops to prevent over cranking of the mechanism beyond extreme tap Positions. However the tap switch shall in no case get stranded at these extreme positions which may cause over voltages &consequently damage the connected equipment.
  t. Rating plate.
  u. Driving mechanism chamber locking arrangement.
  v. Undrilled gland plate for cable entry.
  w. Terminal strips.
  x. Lubrication chart.
  y. Potentiometer for remote tap position indicator

- An Indoor Floor or Wall Mounted CRCA sheet steel Remote Tap changer Control Cubicle (RTCC) with rear access door with wiring and with the following components shall be provided.
  a. Remote tap position indicating meter (digital meter)
  b. 'Tap change in progress' signal lamp
  c. Auto/Manual selector switch
  d. 'Raise/Lower' push buttons for remote operation
  e. AVR(Automatic Voltage Regulator)
  f. Cubicle illuminating lamp with door switch with fuse.
  g. Terminal strips

h. Supply 'ON' signal lamp
i. Undrilled gland plate for cable entry in the bottom side
j. A.C. fail lamp (thru D.C. supply)

2.10 MARSHALLING BOX

- A marshalling box made with sheet steel of 2mm thick, (CRCA) conforming to IP42 degree of protection shall be located near the transformer. The marshalling box shall contain all accessories that are required for the transformer except those that are mounted on the transformer itself. The wiring of all devices shall be brought to stud type terminal block. 15% spare terminals shall be provided. Control wiring shall be done by 2.5sq.mm. PVC insulated FRLS Stranded copper wires. Labels shall be provided for ease of identification. Capillaries for WTI shall be taken in GI flexible and the same shall be terminated on the marshalling box/thermometer pockets with weatherproof glands.
- **Following items, apart from regular marshalling box instruments shall be equipped:**
  a. Triple pole line isolating switch
  b. HRC fuses / MCCB
  c. Strip heaters, thermostat controlled with switch
  d. Cubicle lamp with door switch
  e. Control circuit MCB
  f. Adjustable wire wound rheostat for winding temperature Indicator
  g. Mushroom type 'RED' emergency stop Push button with acrylic Shroud.
  h. One set of winding temperature indicator shall be fitted locally in the marshalling box of the transformer so as to be readable at a standing height from the ground level. Each winding temperature indicator shall be provided with necessary contacts for alarm on a high set point and for trip on a higher set point. The contacts shall have adequate rating, if used directly in the control circuit, otherwise auxiliary relay shall be provided for the purpose.
- **The following accessories shall be provided.**
  a. Temperature sensing relay with one contact for alarm and one for trip.

2.11 TERMINATION ARRANGEMENT:

- The HV terminal arrangement shall be as per specific requirements.
- The HV terminals shall be brought out to a weather-proof self-supporting detachable (disconnecting chamber type with disconnecting links) cable end box.
- HV cable box shall be air insulated phase-segregated type. The phase segregation barriers shall be minimum 3mm FRP sheet.
- The phase sequence in the LV bus duct flange for transformer as per the customer requirement (purchaser’s choice) and the same shall be decided during the detailed engineering stage.
- The cable box shall be complete with gland plate / bushings, cable armour clamps etc. The arrangement shall be such as to permit removal of transformer without dismantling bus duct or cable installation.

2.12 NEUTRAL BUSHINGS AND NCT'S

- Neutral bushing, wherever applicable shall be identical to the phase bushing in all respects i.e. voltage, current rating etc.
- LV Neutral terminal for the purposes of earthing shall be brought down totally insulated by means of epoxy insulator supports, up to the skid level. The rating of the earth bushing shall be similar to the phase bushing.
- Neutral CT (NCT) shall be as specified in the specific requirement sheet. It shall be mounted in the exclusive neutral to earth circuit only. NCT shall not sense any unbalance current, which will flow through the neutral.
- Further NCT's shall be located in a separate enclosure with both sides of the primary (neutral) as well as secondary connections shall be accessible for primary injection testing. Suitable bolting type connections shall be provided on either side of NCT primary to facilitate external connections. The degree of protection for the NCT housing shall be as per requirements.
- The material for LV neutral & LV earth bushing shall be minimum Porcelain only. Epoxy bushings will not be accepted.

2.13 CLEARANCES

- The electrical clearances shall be maintained as per IS standards. The design of the transformer/the height of the bushing/location of the conservator shall be chosen/carried out considering the electrical clearances stipulated.
- There shall not be any structure/piping etc., which may clash with the vertical uptake of the LV bus duct. LV bus duct, in no case shall be deviated from vertical direction.

2.14 LOSSES

- The Transformer Losses shall be separately quoted in the Schedule of particulars and Guarantees at the time of installation.
- The Transformer Losses & Regulation shall be guaranteed as per ECBC-2009 guidelines.

2.15 NOISE

- The audible sound level measured at one foot (30cm) from the external surface of the transformer shall be as per IS.

2.16 RATING PLATES

- The transformer shall be provided with rating plate as per clause 15 of IS 2026 (Part-I) 1977 (Reaffirmed 2001) in visible position showing the appropriate items as given below:-
    a. Type of transformer
    b. Manufacturing Standard
    c. No. & year of manufacture
    d. Manufacturer's name & Trade mark, if any.
    e. Manufacturer's serial number
    f. Year of manufacture
    g. Purchase order information
    h. No. of phases
    i. Rated power
    j. Rated frequency
    k. Rated primary and secondary voltages and tapping voltages
    l. Rated current

m. Impedance voltage at rated current (in % or PU)
n. Type of cooling
o. Efficiency at full load
p. winding notation
q. Design Ambient Temperature
r. Degree of enclosure protection of transformer enclosure
s. Connection diagram
t. Insulation level
u. Total weight & dimensions
v. Temperature class of insulation & permissible temp.rise
w. Noise level

2.17 PAINTING

- All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents as required to produce a smooth surface free of scale, grease and rust.
- The external surface, after cleaning, shall be given a cost of high quality red oxide or yellow quoted primer, followed by filler coats. The transformer shall be finished with two coats of synthetic enamel paint.
- The transformer shall be finished as per IS requirement for indoor applications pebble grey Shade RAL 7032

2.18 CABLE BOX

- HV cable box should be suitable for terminating of 11kV XLPE insulated armoured aluminum cable. Bottom plate should be detachable. Cable Box as per IP-33. Suitable non hygroscopic bushings are required for supporting the cable connection.
- Distribution transformer shall have LV termination flange suitable for LV Busduct / cable. LV termination box shall be suitable for bus bars as per Master SLD.
- Terminals should be marked as per IS 11171 with latest modification and CBIP modification.

2.19 INTERFACE

- All necessary hardware / potential free contacts shall be provided in the RTCC panels & Marshalling box (as applicable).
- The transformers shall be interfaced for availing the following status signals.
    a. Winding & Oil Temperature Alarm
    b. Winding & Oil Temperature Trip status

2.20 INSPECTION AND TESTING.

A. GENERAL

- The representative of Employer Design consultant or Site electrical engineer may carry out inspection and testing of equipments at manufacturer's works.
- No. equipment shall be delivered without prior written confirmation from Employer Design consultant or Site electrical engineer
- All expenses relating to test shall be borne by the vendor.
- The Vendor shall provide all necessary instruments and labour for testing. He shall make adequate records of test procedures and readings and shall repeat any tests requested by the Owner.
- Test certificate duly signed by an authorized person shall be submitted for scrutiny.

- If it is proved that the installation or part thereof is not satisfactorily carried out then the vendor shall be liable for the rectification and retesting of the same as called for by the Design consultant.
- All tests shall be carried out in the presence of representative of site Electrical engineer/ Design Consultant / Employers site representative..
- The Vendor besides above test shall carry out test for performance at different load including full load at PF of 0.8, 0.9, and 1.0.
- The Transformers shall be tested in the presence of Owner's representative at Supplier's works in accordance with latest prevailing standards and codes.
- The successful passing of any such tests will not however prejudice the right of Purchaser to reject the Transformers and its accessories, if they do not comply with specifications when erected or perform complete satisfactory operation as intended.
- The Vendor shall provide the test certificate for the bought out items used, if any in the assembly of Transformers.

B. PRE-COMMISSIONING CHECKS

All standards checks including the ones elaborated in the specifications to ensure that the installation of the Transformers and associated systems has been carried out satisfactorily shall be done on completion of installation.

C. PERFORMANCE TESTING AND TYPE TESTS

The transformers shall be tested at manufacturer's works in the presence of purchaser's authorized representative (s) as per latest edition of IS 11171 with latest modification and/ or equivalent International standard.

D. PERFORMANCE TESTS

Upon completion of work the performance test shall demonstrate the following among other things:

- Equipment installed complies with specification in all respects and is of the correct rating for the duty and site conditions.
- All items operate efficiently and quietly to meet the specified requirements.
- All circuits are correctly protected and protective devices are properly Co-ordinated.
- All non- current carrying metal parts are properly and safely grounded in accordance with the specifications and appropriate codes of practice.
- Manufacturing / Assembly defects.

E. TYPE TEST'S CERTIFICATE SUBMISSION

Transformer vendor shall submit following type tests reports/certificate as per Govt. /NABL (National Accreditation Board for Laboratories) approved.

The following shall constitute the type tests:

a. Lightning impulse test & temperature rise test.

F. ROUTINE TESTS

The following shall constitute routine tests:

b. Measurement of winding resistance.
c. Measurement of voltage ratio and check of voltage vector relationship.
d. Measurement of impedance voltage (principal tapping), short circuit impedance and load loss.
e. Measurement of no load losses and current.
f. Separate source voltage withstand test.
g. Induced over voltages withstand test.3

The purchaser reserves the right to having other reasonable tests carried out at his own expense either before dispatch or at site to ensure that the transformer complies with the requirement of the specification.

G. COMMISSIONING TESTS

The following tests shall be carried out prior to commissioning at site.

a. Insulation resistance of the winding between phases and phase and earth on the H.V. side.
b. Winding resistance of all the windings on all tap positions.
c. Voltage ratio test shall be carried out by applying low voltage on HV side and measuring the voltage between phases and phase and neutral on the L.V. side for every tap setting.
d. If necessary the transformer shall be heated by applying low voltage on the H.T. side and shorting the L.V. side. This shall be done for a period of 48 hours or till all the moisture has been removed from the transformer.
e. On commissioning of the transformer the following readings shall be taken
   - L.V. side voltages at all tap settings
   - Temperature rise under no load condition
f. Transformer oil breakdown voltage & other physical & chemical properties test.

H. TEST CERTIFICATES

- Copies of all documents of routine test certificates of the equipments carried out at the manufacturer premises shall be furnished to the user department along with the supply of equipments.
- Transformer configurations offered shall be CPRI /Independent accredited agency tested.
- Copies of the type test certificates of the type testing for the identical equipment of similar rating shall be submitted at time of obtaining Vendor approval.

I. DRAWINGS AND MANUALS

- Operation, maintenance and erection manual (seven copies) shall be furnished by the manufacturer at least one month prior to the dispatch and shall contain all the drawing and information required for erection, operation and maintenance of transformers.
- Description, literature and data (seven copies) on transformer, windings, bushings etc. shall also be supplied by the manufacturer along with the instruction manual.

J. INSTALLATION

- The transformer shall be installed as per the manufacturers' instruction manual and shall conform to CEIG requirements.
- The transformer foundations shall be cast as required. If any lifting is required, the same shall be done by all the lifting lugs to avoid any imbalance.
- The transformer wheels shall be locked by suitable locking arrangement to avoid accidental movement after testing and commissioning.
- The transformer cable end boxes shall be sealed to prevent entry of moisture.
- The transformer neutral and body earthing shall be as per the requirements of IS:3043-1966 and the Local Inspecting Authorities
- Cable termination has to be from bottom

SPECIFIC REQUIREMENT SHEET FOR DRY TYPE CAST RESIN DISTRIBUTION TRANSFORMERS:

Application Standard: IS 11171-1985 with latest modification (if any) & CBIP Specification.

Type: Indoor type, core type Cast Resin (CRT), 3-Phase Copper wound, Air cooled & Forced Air cooled dry type.

Voltage ratio: 11KV / 433 Volt

Tappings range & steps: OLTC, tapping range +10% to -10%, in 17 steps of 1.25%. Tap position configuration diagram shall be provided.

Cooling: AN + AF
Forced cooling by 6 nos. Centrifugal blower fan of minimum air delivery 518 cum/hr. at the bottom of the winding with necessary duct and structure should be provided.
Painting: As per IS (Powder coating, min thickness 80 Micron)

Vector Group: Dyn 11.

Class of insulation: Class H

Behaviour Class: Environment/ Climatic/ Fire: E2 / C2 / F1

Temp. rise: 90 degree C over ambient of 50 degree C

Core & Coils:

LV & HV Winding will be made of Copper Strip / Foil and capable of withstanding Short Circuit Current Situations as per IS. The core shall be built up with high grade, non aging, low loss, high permeability, grain oriented, cold rolled silicon steel Iaminations especially suitable for core material. Grade of core should be M4 or better. The specified evidence of procurement of core has to be provided. The coils shall be manufactured from electrolytic copper conductor & fully insulated for rated voltage. Coils shall be resin molded for both LV & HV with empoxy resin, Class H, naturally cooled (AN) alongwith Forced Cooling Fan (AF). Insulating materials shall be of proven design & should be selected in such a way that the transformer will be capable of supplying 110% continuous load, Coils shall be so insulated that impulse & power frequency voltage stresses are minimum. Coil asembly shall be suitably supported between adjacent sections by insulating spacers and barriers. All leads from the windings to the terminal board & extended Busbars shall be rigidly supported to prevent injury from vibration or short circuit stresses. The core and Busbars shall be rigidly supported to prevent injury from vibration or short circuit stresses. The core and coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement of transformer or under short circuit stresses.

Transformer losses: Transformer Losses & Regulation shall be guaranted as per ECBC (2009) Guideline.

Minimum Efficiency at unity power factor: "98.79% & above at full load 98.97% & above at 75% load 99.07% & above at 50% load.

Impedance: 6% (Allowable tolerance as per IS) (Efficiency, regulation, NLL, LL & %Z test certificate along with all calculations should be submitted during delivery of material at site) (A computer generated drawing mentioning all inside & outside dimensions, along with weight of core & winding, name plate to be approved before starting construction)

Testing: Routine tests as per relevant latest IS has to be conducted at manufacturer's works. The manufacturer should have in-house testing facilities & should arrange for type tests i.e. impulse test & temp. rise test, if asked for. List of Tests to be conducted at Manufacturer's Work: Routine Test according temp. rise test, if asked for. List of Tests to be conducted at Manufacturer's Work: Routine Test according to IS 11171 & IS 2026. Heat Run Test, Magnetizing Current Test, and Double Voltage Double Frequency Test to be conducted & report to be submitted as per standard procedure.

(Noise Level when measured at 1 Meter Distance: As per NEMA TR 1 db)

Test specification: As per latest IS specification routine test to be performed in presence of EIC and lightning impulse voltage withstand test & short circuit test certificate to be produced for similar design or of above rating transformer before delivery of material at site.

Terminal Arrangement: Should have Cable End Box (both LV & HV side) Terminal arrangement will be done with suitable size of support insulators & busbars.

Enclosure: Sheet steel with protection class IP-33; painting should be epoxy / as per latest standard with paint shade 631 of IS 5.

Basic Insulation Level for HV: 60 KVpk (Separate source power frequency voltage withstand / Rated insulation level: 20 KV rms (HV) / 3 KV rms (LV))

Temperature Scanner: Transformer will be provided with 3 RTDs for sensing winding tempertures along with temperature scanners for display of winding temperature and with alarm / trip contacts. with temperature scanners for display of winding temperature and with alarm / trip contacts.

Overall Dimensions (L X B X H): 2400 x 2800 x 2400 mm (approx.) / As per type tested design.

Fittings & Accessories: Should be provided withAs per standard along with Rating & Diagram plate, Base Channel, Earthing Terminal, digital temperature scanner with two set points alarm & trip with RTD type 3 PT-100 Sensors, lifting lug 2 nos, bidirectional roller etc.

3. SPECIFICATION FOR L.T. PANELS & SWITCHGEARS

Medium voltage switch boards/distribution boards, the combination of both these and components shall conform to the equipments of the latest revision including amendments of the following codes and standards.

3.1 Codes & Standards:

The design, manufacture and performance of equipment shall comply with all the currently applicable statues, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (B.S.), International Dutro Technical Commission (IEC) Publication, NEMA, IDE & DEMA standard as amended upto date.

a) IS:13947- Air circuit breaker/moulded case circuit breaker. 1993/IEC 60947-1989
b) IS:3156 Voltage transformers.
c) IS:2705 Part-I, II Current transformers for metering and protection with classification burden and insulation.& III 1964
d) IS:9224 Low voltage fuse and protection.

e) IS:3231 Specification for electrical relays for power system protection.
f) IS:8623 Specification for factory built assemblies of switchgear and control gear for voltage upto and including 1000-V AC/1200 V-DC.
g) IS:4237 General requirements for switch gear and control gear for voltage not exceeding gear.
h) IS:2147 Degree of protection provided by enclosures for low voltage switch gear and control gear.
i) IS:1018 Switchgear and control gear selection/installation and maintenance.
j) IS:1248 Direct acting electrical indicating instruments.
k) IS:375 Arrangement for switchgear, bus bars, main connections, auxiliary wiring and marking.
l) IS:2959 AC contactors for voltage not exceeding 1000V.
m) IS:5578 Guide for marking of insulated conductors.
n) IS:11050 Guide for forming system of marking and identification of conductors & apparatus terminal.
o) IS:1248 Direct acting indicating analogue electrical measuring instruments and Testing accessories.
p) IS:600 Code of practice for phosphating of iron & steel.

The board shall be metal enclosed single front, indoor, floor mounted, free standing type or wall mounting type. The panel shall be designed for a degree of protection of IP-55. However bus bar chamber shall have IP: 42 degree of protection incase bus bar rating exceed 1600 Amps. Keeping in view the operating height of the top switch 1750mm from finish floor. 400mm clear space shall be left throughout the panel at bottom. The cold rolled sheet steel will be of 2mm thick. The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 3mm thickness and 50mm height.

All cutouts and covers shall be provided with synthetic rubber gaskets (preferably neoprene).

The panel shall be divided into distinct vertical sections each comprising of:

i) Complete enclosed bus bar compartment for running horizontal and vertical bus bars.
ii) Complete enclosed switchgear compartment one for each circuit for housing air circuit breaker, MCCB/MPCB with starters etc.
iii) Compartment for power and control cables of at least 300mm width covering entire height provided.
iv) The front of each compartment shall be provided with hinged single leaf door with locking facilities. Panel shall be provided with suitable lifting facilities. Isolators and MCCB/ACBs and accessories shall be of fixed / draw out type.

Each feeder shall have compartmentalized or non-compartmentalized for MCB feeders only. Ri-tall type with separate construction cable entry shall be from top/bottom (3mm thick gland plate with suitable numbers & sizes of knockout holes (as called for in schematic/ fabrication drawings) shall be provided. The panel shall be provided with three phase buses & neutral bus bars of high conductivity electrolytic copper/Aluminium sections throughout the length of the panel & shall be adequately supported and braced to withstand the stressed due to the short circuit current of 35 KA rms. for 1 sec. Maximum temperature rise of bus bars and bus bar connection while carrying rated current shall not exceed 40 Deg.C over an ambient temperature of 50 Deg.C. The Current density of Bus Bar shall be 1.0 Amp/mm^2 for Aluminium and 1.5 Sq.mm/mm^2 for copper.

The minimum clearance in air between phases and between phases and earth for the entire run of the bus bar connections shall be 32mm minimum. Bus bars support insulators shall be made of nonhydroscopic non-combustible track resistant and high strength SMC or polyester fiberglass moulded material.

All bus bars shall be colour coded as per IS: 375.
Copper /G.I./Aluminum earth bus of suitable size shall be provided at the bottom of the panel throughout the length. Similarly suitable size of strip in each vertical section for earthing the individual equipment/accessories shall be provided and connected to main horizontal bus.
Sheet steel hinged lockable doors shall be interlocked with MCCB to prevent opening of the panel when MCCB is on position. Safety interlock with operating handle shall be provided.
Contactors shall be electromagnetic type with interrupted duty as per IS: 2959. The main contacts shall be of silver or silver alloy, provided with minimum 2 NO and 2 NC auxiliary contacts. The push button should be of shrouded type and each should be provided with 1 NO and 1 NC contact. Colour coding shall be as per IS: 6875 (Part-II).

3.2 Air Circuit Breaker:

The circuit breaker shall be air break type and shall have trip free mechanism. It shall confirm to latest IS/IEC 60947 Part 1&2 and shall have minimum rupturing capacity of 35MVA at 415Vac 50/60Hz±10% or as specified elsewhere. The ACB shall comply with the suitability for isolation as per annexure 7.1.2.) function requirement shall symbol for the same marked in its main rating plate to provide safety to operating personnel while the breaker is in use.
ACB shall have service condition short circuit capacity (Ics) equal to its ultimate breaking capacity (Icu) and shall have same short circuit withstand capacity for 1 sec to achieve proper co-ordination i.e. Ics=100%Icu = Icw for 1 sec. It shall also have withstood capacity of not less than 26kA for 3 secs for co-ordination with HT breaker. ACB shall have impulse withstand voltage of 12kV & insulation voltage of 1000Vac.

It shall be provided with advance micro-processor based IDMT type overload (L), short circuit(S), instantaneous(I), earth fault(G) & neutral overload (N) protection as built-in feature along with 3-line LED/LCD display. It shall capture & store 20 trip records with current, voltage, time & date stamping and same shall be stored in non-volatile memory & shall be possible to display in release itself. The protection release shall have separate LED indication for Power ON, LSIGN, Trip & Alarm. The protection CT within the ACB shall have dual core to maintain linearity in case of higher currents.

ACB shall have minimum mechanical endurance of 20,000 cycles up to 2000A & 10,000 cycles beyond 2000A. It shall also have similar electrical endurance with minimum scheduled maintenance. ACB shall have break time of not more than 25msec to reduce let-through energy during short circuit. It shall have built-in mechanical & electrical anti-pumping to prevent auto re-closure on fault. Breaker shall have both option for spring charging manually and with motor mechanism if so specified. The trip coil shall be direct operating type & shall immediately trip the circuit breaker if so required. All current carrying part of the circuit breaker shall be made of copper with silver plating. Main contacts shall have silver strip as contact area & shall be provided with arcing contacts to protect main contacts. The contacts sets shall be self-aligned in design to maintain uniform contact pressure. Suitable arc chute for each pole of the ACB shall be provided and can easily be removed without any tool for inspection if so required. Interlocking shall be provided with Arc chute to prevent closing of ACB without Arch Chute properly secured.

In case of withdrawable ACB, it shall have 3 distinct position viz. SERVICE/TEST/ISOLATED and same shall be displayed during racking or racking position. ACB shall be provided with collapsible handle to further draw out the ACB to maintenance position without removing from the chassis. ACB shall be completely enclosed

in a moulded housing with class II insulation from front & shall have pollution degree 4. Chassis of the ACB shall be provided with automatic safety shutter to isolated the live bus-bar when withdrawn and the shall get positively earth.

Following interlocks shall be provided as standard features

(i) Interlocking to prevent the ACB from being withdrawn or replaced except in the fully isolated position.
(ii) Interlocking to prevent earth connection from being made by the earthing device except breaker is open.
(iii) Interlocking to prevent the breaker being closed unless it is fully in service position.
(iv) Interlocking to prevent open the ACB compartment door unless it is in open condition.

3.3 MOULDED CASE CIRCUIT BREAKER (MCCB):

MCCB shall confirm to the latest IS/IEC 60947 & IEC 60947. The service short circuit breaking capacity (Ics) at 415Vac 50Hz should be equal to ultimate short circuit breaking capacity (Icu) i.e. Ics=100% Icu and Ics value shall be as specified. MCCB shall have impulse withstand voltage of 8kV & insulation voltage of 1000Vac.It shall be working on current limiting principle and shall comprise of Quick Make-Quick Break switching mechanism to minimize let-through energy. MCCB shall be housed in a completely enclosed moulded assembly and the Arc extinguishing device and the tripping unit contained in a compact, high strength. Heat resistant, frame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.
MCCBs shall be fully rated at 50°C ambient temperature & up to 250A current rating shall be provided with thermal-magnetic based Overload & short circuit protection & beyond 250A shall be with built-in microprocessor based overload, short circuit & earth fault protection, unless specially mentioned otherwise. It shall be possible to mount minimum 2 nos. of accessories from front either Auxiliary+Trip Alarm contact, shunt coils or under voltage. All MCCB shall be provided with extended operating handle whenever mounted in panel & all ratings beyond 100A shall be provided with speader terminal for proper termination.

The service short circuit breaking capacity should be the minimum value for that feeders/panel, however if the rating of feeder mentioned is not available, the contactor shall use next higher rating without any extra charges. In case of earth-fault protection is required for ratings upto 250A. microprocessor based release with built-in earth fault protection shall be considered.

MCCBs for Motor feeder shall be specially designed to offer short circuit protection.

3.4 MOTOR PROTECTION CIRCUIT BREAKER (MPCB):

MPCB shall conform to IEC 60947 complaints and shall be fast operating within enclosing housing. It shall have short circuit breaking capacity of Icu=50kA as minimum across the current rating. It shall be compact in design, robust, high switching life, and shall have padlocking facility. MPCB shall be provided with built-in Overload, short circuit & Single phasing protection along with ambient temperature compensation. It shall have wide range for setting overload protection.

It shall be provided with extended operating handle and auxiliary+ trip alarm condition. MPCB shall have provision to mount shunt coil (240Vac 50Hz) & under voltage coil (415Vac 50Hz) if so required.

3.5 CONTACTORS:

All 3 Pole power contactors should comply with the latest IEC 60947-4 and corresponding IS/IEC 60947-4 standards. These contactors shall be UL & CSA approved. The contactor shall be rated for AC3 Duty at 415Vac 50Hz. Contactor shall have impulse Withstand capacity of 8kV& insulation voltage of 1000V. The coil shall have low VA burden & voltage rating shall be 240V/415Vac 50Hz/60Hz with. The contact assembly shall be fast operating type and shall have withstand capacity as specified in IEC 60947-4. All Contactors shall be provided with 1NO+1NC contact block and it shall be possible to mount additional contact block if so required. The control terminals shall be finger proof and shall be possible for both with lug or without lug termination. Contactor shall be provided with surge suppressor.
For 4 Pole contactor applicable operational duty will AC1 & it shall be possible to mechanical interlock using Mechanical Interlocking Kit, to be supplied along with the contactor.

For Capacitor Duty contactor the applicable duty will be AC6b, specially designed to withstand high inrush current while switching ON/OFF capacitor banks. Contactor shall have clear demarcation on its main label mention the equivalent KVAr rating to be used.

3.6 HRC Fuse & Switch Disconnector Fuse (SDF):

All **HRC fuses** shall conform to IS13703-2 / IEC 60269-2. Complete Range of HRC fuses & SDFs shall be of same make. Fuses shall have Fuse blown indication through a red pop-up indicator. It shall have low let through energy & low watt loss leading to power saving and cooler running of associated products like SDF Units. Suitable Fuse Bases & Fuse Pulling Handles shall be available as accessory from Same Manufacturer. Minimum Breaking Capacity shall be - (i) Cylindrical Type Fuse Links up to 63A – 80kA at 415V & (ii) Blade Type Fuse Links from 63A to 800A – 100kA at 415V

All **SDFs** shall conform to IS13947 (Part 3)/IEC60947-3 standards. Complete range shall conform to AC-23A Utilization Category & Pollution Degree 3 Norms. It shall have Electrodynamic compensation & Quad break contact system. SDFs shall be CE marked and Fuse barriers shall be provided to eliminate the possibility of inter-phase short circuit. It shall have True & Positive ON/OFF indication ensuring that the handle remains in OFF Position when main contacts are actually open & vice-versa. SDFs shall have in-built pad-locking arrangement to lock the unit in OFF Position thus preventing inadvertent operation of the unit. The shaft of the handle shall be telescopic thus ensuring adjustment of depth if required during installation. Wherever, SDFs are used for Motor Duty or Capacitor Duty, Manufacturer of SDF Units shall provide Triple Pole (TP) Type SDF. In all other applications Manufacturer shall provide Three Pole & Neutral (TPN) Type SDF

3.7 On-Load Changeover Switch:

The On-load changeover switch shall confirm IS/IEC 60947-3 & shall be designed for AC23A duty. It shall be 4pole type fully rated at 433Vac. Rated Impulse Withstand Voltage shall be 12kV for all C/O Switches and they shall comply to Pollution Degree 3 Norms. Changeover switch shall be provided with dual shaft position for mounting Extended Operating handle for ease of operation. It shall be possible to mount fuse-kit or to convert the manual changeover switch to stored energy type without any alteration in panel depth if required in later stage. It shall have built in 2 C/O auxiliary contact for indication.Changeover switch should not have in load-line bias & can easily converted as site or during installation. It shall be possible to mount Castle lock to achieve interlocking.

Motorized version of changeover switch shall be stored energy type & shall be easily integrated to auto changeover scheme.

In case, Changeover Switches are desired with SS Enclosures, then the same shall be factory-built supplied in SS Enclosure from C/O Switch Manufacturers. The Enclosure so offered shall provide IP54 Protection. SS Enclosures with C/O Switch shall have adequate space for cable termination so that additional cable entry boxes are not required. Cable gland plates shall be provided as in-built feature with this SS Enclosure C/O Switch

3.8 Digital Panel Meters:

Digital Ammeter shall be 96x96 mm flush mount type 3ph. Ammeter shall have "8 segment" single line LED display with metering accuracy Class 1.0. Ammeter shall have option of site selectable CT secondary of 1A/5A. Meter shall have wide of Auxiliary supply range from 80-300Vac.

Digital Voltmeter shall be 96x96 mm flush mount type 3ph. Ammeter shall have "8 segment" single line LED display with metering range from 50-550Vac (ph-ph). Meter shall have wide of Auxiliary supply range from 80-300Vac.

Multi-function Meter shall be 96x96 mm flush mount type with 4 line LED display with accuracy class 1.0. It shall be possible to program the CT secondary at site 1A/5A. The MFM shall be precise in measurement with 128 samples/ cycle. The MFM shall be capable of communication through RS485 for future integration with BMS/SCADA. The meter shall have wide band of Auxiliary Power Supply from 90-300Vac. The voltage measurement range shall be from 50-550Vac. The MFM shall measure & display V, A, F, PF, kW, kVA, kWh, kVAh, kVArh, Run hour, on-hour, plase-angle, THD, Event (High-Low) & Neutral Current.

3.9 Tariff Meter:

The tariff meter shall conform to latest IS standard applicable and shall measure for 3Ph. 4W system with accuracy class of Class 0.5. The meter shall be base mounted, CT operated & having built-in RS485 communication port.

3.10 Modular Devices:

All **MCBs** shall conform to IS/IEC 60898-1 & IEC 60947-1 and shall have minimum short circuit breaking capacity of 10kA. The MCBs shall be suitable for isolation & shall provide IP20 degree of ingress protection. It shall be possible to operate all MCBs at 240/415Vac 50/60Hz. It shall have impulse withstand voltage of 6kV & insulation voltage of 500Vac. It shall conform to Energy Limit Class 3 & Pollution degree of 3 also. MCBs up to 32A shall have Electrical Life (Operating cycle) of 20000, for ratings 40-63A shall have 12000 & beyond 63A, 5000 operating cycle. All MCBs shall be provided with separate short circuit fault indication on tripping in each pole for easy & faster diagnosis of the fault. It shall have wide operating temperature range from -25°C to +60°C.

RCCBs (2P or 4P) shall conform to IS 12640-1 & IEC 61008 and shall have sensitivity in range from 30mA to 500mA. It shall be suitable for isolation & shall provide IP20 degree of ingress protection. It shall be possible to operate all MCBs at 240/415Vac 50/60Hz. It shall have impulse withstand voltage of 6kV & insulation voltage of 500Vac. It shall have rated electrical life of 10,000 operating cycles & rated short-circuit breaking capacity of 10kA (in line with MCBs). It shall have wide operating temperature range from -25°C to +60°C.

RCBO (2P & 4P) shall conform to IEC 61009-1, IS 12640. It shall provide all the features & protections as offered by MCB & RCCB.

Surge Protection Device (SPDs) shall conform to IEC 61643-1. Type 1+2 SPDs shall be considered in case of LT Panel & Type-2 for MCB- Distribution Boards. SPDs shall be provided with mechanical indicator to indicate remaining life & shall be possible to replace the SPD cartridge when life is over. It shall have operation voltage of 240/415Vac.

Isolators shall conform to IS/IEC 60947-2 and shall have AC 22 utilization category. It shall have impulse with stand voltage of 6kV and operational voltage of 500V. Isolator shall be able to withstand 10x =In current for 1 sec. It shall conform to pollution degree 2 norms and shall have electrical life (operating cycle) of 20,000 up to 40A & 10,000 up to 100A.

Distribution Boards shall be type tested as per IEC 61439 & shall be made of minimum 18 gauge thick CRCA sheet steel. It shall be suitable for surface & flush mounting arrangement. DBs shall be provided with 100A phase bus bar (tin plated copper bus), Neutral bar and Earth bar and standard colour wire set. DBs shall be provided with removable top and bottom gland plates. It shall supplied with cement spill protector.

3.11 Modular Switch & Sockets:

All Modular switches shall conform to ISI 3854:1997 & shall have ISI mark on the product along with CML code. The plastic housing shall be made of FR grade virgin polycarbonate material. The rocker connector shall be made of copper up to 20A & with silver inlay for higher ratings. The contact tip shall be made of Silver alloy. All termination screw shall be captive by design & shall be made of brass. The switch shall offer 3,00.000 operations. The Modular plates shall be made of special grade ABS for grid frames to give more strength and it shall have provision for mounting horizontally or vertically.

Sockets shall conform to IS 1293: 2005 and shall have similar features like switches & shall have 1,00,00 in-out operations.

3.12 Sandwich Bus-Duct:

The sandwich bus bar system shall comply with IEC61439-2. It shall be rated at 415V±10% 50/60Hz and shall have insulation voltage of 1100V. It shall comply to Seismic Zone 5 as per IS 1983 (Part-1) -2002 and IEEE 693-2005 (tested with complete assembly with combination of Horizontal+ Vertical Bus-duct and Plug-in box). Bus duct shall be 12kV impulse withstand voltage & shall have 2.2kV for 5 sec rated dielectric voltage rating. The Insulation material shall be multilayer PET or Epoxy (UL listed) with insulation class-F (155°C). Joint shall be uni-block by design with twin-headed maintenance –free nut. It shall have Fire resistance properties verified for integrity: 240 min.The enclosure shall provide structural support & shall be of 1.6mm G.I. or 2.5mm Aluminium. The Enclosure shall act as a heat decapitator and can also be used as earthing conductor. The enclosure shall be painted with Epoxy powder coating with RAL 7032 paint shade.

Bus-duct shall be minimum IP54 for indoor application & IP66 for outdoor application along with canopy. Plug-in box & Tap-off box shall be supplied along with bus-duct along with other component as specified in BOQ. In case of Copper bus-bar the enclosure shall be of aluminium material to reduce losses. It shall be possible to use the enclosure as an Earthing conductor in case of both GI or Aluminium conductor.

Manufacturer shall provide complete data sheet for bus-bar cross-section used for each rating & voltage drop calculation.

3.13 NAME PLATES & LABELS:

i) Panel and all modules shall be provided with prominent engraved identification plates. The module identification designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

ii) All name plates shall be of non-rusting metal or 3-ply lamicold, with white engraved lettering on black background. Inscription and lettering sizes shall be subject to employer approval.

iii) Suitable stenticilled paint marks shall be provided inside the panel/module identification of all equipments in addition to the plastic sticker labels. These labels shall be partitioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring design.

3.14 PAINTING:

All steel work shall be pretreated in tanks and finally powder coated of approved shade.

3.15 WIRING:

Control and protective wiring shall be done with copper conductor PVC insulated 1100 volts grade multistranded flexible wire of 2.5sq.mm cross section. The colour coding shall be as per latest edition of IS: 375.
Each wire shall be identified by plastic ferrule. All wire termination shall be made with type connection. Wire shall not be taped or spilled between terminal points.
Terminal blocks shall preferably by grouped according to circuit function and each terminal block group shall have at least 20% spare capacity.
Not more than one wire shall be connected to any terminal block. All doorframe of L.T. switchboard shall be earthed with bare braided copper wire.

3.16 TESTING & INSPECTION:

After completion of all work at the manufacturer's works the switchboards shall be inspected and tested in presence of Purchaser's representative. However, stage inspection may be carried out from time to time to check progress of work and workmanship. The following tests shall be carried out:

i) All routine tests specified in relevant Indian/British Standards shall be carried out on all circuit breakers.
ii) Test for protective relay operation by primary or secondary injection method.
iii) Operation of all meters.
iv) Secondary wiring continuity test.
v) Insulation test with 1000 Volts megger, before and after voltage test.
vi) HV test on secondary wiring and components on which such test is permissible (2 KV for one minute)
vii) Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.
viii) Measurement of power required for closing/trip coil of the breaker.
ix) Pick up and drop out voltages for shunt trip and closing coils.
x) CT Polarity test.

Vendor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from Sub-Vendor for the components procured from them are to be submitted before dispatch of switchboards.

3.17 DRAWINGS AND INFORMATION:

The Vendor shall furnish following drawings/documents in accordance with enclosed requirements:

i) General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cutouts/trenches for external cables and elevations, transport sections and weights.

ii) Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.

iii) Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc.

iv) Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function
etc.

v) Relay wiring diagrams.

vi) Equipment List.

Vendor shall furnish required number of copies of above drawings for Purchaser's review, fabrication of switch boards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.

The information furnished shall include the following:

i) Technical literature giving complete information of the equipment.

ii) Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.

3.18 DEVIATIONS:

Deviation from specification must be stated in writing at the quotation stage.

In absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.

3.19 EARTHING:

All electrical equipment is to be earthed by connecting two earth tapes from the frame of the equipment to a main earth ring. The earthing ring will be connected via several earth electrodes. The cable armour will be earthed through cable glands. Earthing shall be in conformity with provision of rules 32, 61, 62, 67 & 68 of Indian Electricity Rules 1956 and as per IS-3843-1966.

The following shall be earthed:

1. Transformer & D.G. Set neutrals.
2. Transformer Housing.
3. H.T. Panels.
4. Non-current carrying metallic parts of electrical equipment such as switchgear, bus ducts, rising mains, panel boards, motor control centers, power panels, distribution boards, cable trays, metal conduits, welding sockets etc.
5. Generator & motor frames.
6. All fixtures, sockets outlets, fans, switch boxes and junction boxes etc. shall be earthed with PVC insulated copper wire as specified in item of work. The earth wires ends shall be connected with solder less bottle type copper lugs.
7. The third pin of Outlets on UPS shall be provided with separate PVC insulated Cu. Wire (green with yellow stripe) as Isolated ground earth wire apart from the earthing of box.

The earth connections shall be properly made. A small copper loop to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastened bolts, when there is a lightning surge, high voltage surge or failure of bushings.

The shop drawing for earthing system shall be prepared by the contractor and be got approved by Owner/Architect. The work shall be done in accordance with approved drawings.

All earth electrodes shall be given to a depth sufficient to reach permanently moist soil. Their location shall be marked and approval taken from Engineer-in-Charge before excavation for the same.

The earth electrodes shall be tested for earth resistance by means of a standard earth test ohms meter.

All tests shall take place during the dry months, preferably after a protected dry spell.

The resistance between earthing system and the general mass of earth shall not be greater than 2 ohm. The earth loop resistance to any point in the electrical system shall not be in excess of 1 ohms in order to ensure satisfactory operation of protective devices. The resistance to earth shall be measured at the following: -

a) At each electrical system ground or system neutral ground.
b) At one point on each grounding system used to ground electrical equipment enclosures.
c) At one point on each grounding system used to ground wiring system enclosures such as metal conduits and cable sheaths or armoured.

All earthing conductors shall be of high conductivity copper/ G.I. and shall protect against mechanical damage. The cross-sectional area of earth conductors shall not be smaller than half that of the largest current carrying conductor. Copper earthing conductor must have well protected and covered by required size of GI pipe up to man height and should not exposed if laid in ground.

a. Pipe Earth Electrode

G.I. pipe shall be of medium class and of the size as per NBC,2005. G.I. Pipe electrode shall be cut tappered at bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other upto 2m of length from bottom. The electrode shall be burried in the ground vertically with its top not less than 20cm below ground level.

b. Plate Earth Electrode

The plate earth electrode shall consist of copper plate or G.I. plate as per item of work. The plate electrode shall be burried in ground with its faces vertical and top not less than 2.5m below Ground level. The plate shall be filled with charcoal dust and common salt filling, extending 15cm around it on all sides.

A watering pipe of medium class G.I pipe shall be provided. The top of the pipe shall be provided with a funnel and a G.I. mesh screen for watering the earth. In the case of pipe electrode a removable plug shall be provided. This will be housed in a masonry sump (with cement plastering) of not less than 40 cm square and 40 cm deep. A C.I. frame with hinged cover of 10mm thickness and locking arrangement shall be suitably provided over the sump. The earthing lead from electrode onwards shall be suitably protected from mechanical injury by a suitable dia medium class PVC/ HDPE pipe. The overlapping in G.I. strips in joints shall be rivetted with revets and welded in approved manner. The protection pipe within ground shall be burried at least 30 cm deep (to be increased to 60cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth. In the case of plate earth electrode, two nos. 50mm x 6mm GI/Cu. Strip the earthing lead shall be securely bolted to the plate with two zinc passivated bolts, nuts, checknuts and washers. In case of pipe electrode, it shall be connected by means of a through bolt, nuts and washers and cable socket. Main earthing conductor is taken from the earth electrode with which the connection is to be made.

No earth pit shall be fixed within 2.5M of a wall of foundation. The location of the earth electrode will be such where the soil has reasonable chance of remaining moist. Effort shall be made to locate them in grass lawns or near flowerbeds or water taps. The distance between two earthing stations shall be at least 3.0 meters.

3.11 Testing and Commissioning:

Testing and commissioning shall be done as per the programme/ instructions to be given by employer or authorised representative. All testing equipments necessary to carry out the tests shall be arranged by the Contractor.

Before the electrical system is made live, the Contractor shall carry out suitable tests to the satisfaction of employer or authorized representative that all equipment wiring and connections have been correctly done and are in good working condition and will operate as intended.

All tests shall be conducted in the presence of the Owner authorized representative by the Contractor and shall be notified one week before tests are to take place.

All measurements shall conform to establish minimum acceptable test values. Owner's Engineer reserves the right to approve all test results before circuit or equipments are energized for the first time.

4. Specification for Lightening Protection System:

Specification – Lightning Protection Systems as per IEC/BS EN 62305-3 & NBC-2016

General Summary –

A) This Section specifies the lightning protection system for the building(s) or structure(s). This system provides safety for the building and occupants by preventing damage to the structure caused by lightning. The design of this system is to be in strict accordance with this section of the specification and all contract drawings that apply.

B) The work covered under this section of the specifications consists of furnishing labor, materials and services required for the completion of a functional and unobtrusive lightning protection system approved by the architect and engineer.

C) A specialty contractor actively engaged in the installation of certified lightning protection systems.

System Description –

The entire lightning protection system shall be designed and installed in accordance with:

A) National Fire Protection Assoc. (NFPA) Document # 780

B) Underwriters' Laboratories, Inc. (UL) Standard # 96A

C) Lightning Protection Institute (LPI) Standard # 175

Submittals –

A) complete drawing covering all the buildings shall be submitted to the architect and engineer for approval prior to commencement of the installation. The drawing will show the extent of the system layout designed for the structure along with details of the products to be used in the installation. The drawing will include the stamp of the LPI Master Installer responsible for the system design.

Quality Assurance –

A) The lightning protection contractor shall furnish an LPI Master Installation Certificate or a Limited Scope report upon completion of the installation.

B) The system installation shall be made by a contractor that specializes in the installation of lightning protection systems and be under the supervision of an LPI Certified Master Installer or Master Installer – Designer.

Products:

Standard –

All materials shall comply in weight, size, and composition with the requirements of a nationally recognized testing laboratory. All equipment shall be properly listed and labeled. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment and a member of LPI. Equipment shall be the manufacturer's latest approved design of construction to suit the application where it is to be used in accordance with accepted industry standards and with NFPA, LPI, & UL requirements.

Materials –

A) Class I materials shall be used for systems on structures not exceeding 75 feet in height and Class II materials shall be used for systems on structures exceeding 75 feet above grade.

B) Copper shall be of the grade ordinarily required for commercial electrical work, generally designated as being 95 % (percent) conductive when annealed. Aluminum conductors shall be of electrical grade aluminum.

C) Lightning protection materials shall be coordinated with building construction materials to assure compatibility. Aluminum lightning protection materials shall not be embedded in concrete or masonry, installed on or below copper surfaces, or used where contact with the earth is possible terminating 18" above grade level minimum. Copper lightning protection materials shall not be installed on aluminum surfaces. Copper system components within 2 feet of chimney exhausts shall be tin coated to protect against deterioration.
D) Strike termination devices shall be provided to place the entire structure under a zone of protection as defined by the Standards. Air terminals shall project a minimum of 10 inches above protected areas or objects. Air terminals shall be located within 2 feet of exposed corners and roof edges.

E) Metallic bodies having a thickness 3/16" or greater may serve as strike termination devices without the addition of air terminals. These bodies shall be made a part of the lightning protection system by connection(s) according to the Standards using main size conductors and bonding fittings with 3 square inches of surface contact area.

F) Cable conductors shall provide a two-way path from strike termination devices horizontally and downward to connections with the ground system. Cable conductors shall be free of excessive splices and sharp bends. No bend of a conductor shall form a final included angle of less than 90 degrees nor have a radius of bend less than 8 inches. Structural elements and design features shall be used whenever possible to minimize the visual impact of exposed conductors.

G) Cable down conductors may be concealed within the building construction or enclosed within PVC conduit from roof to grade level. Down conductors shall be spaced at intervals averaging not more than 100 feet around the protected perimeter of the structure. In no case shall any structure have fewer than two down conductors. Where down conductors exposed to environmental hazards at grade level, guards are shall be used to protect the conductor to a point 6 feet above grade.

H) In the case of structural steel frame construction, cable down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the protected perimeter of the structure.

I) Exposed cable conductors shall be secured to the structure at intervals not exceeding 3 feet – 0 inches. Fasteners, nails, screws, or bolts shall be of suitable configuration for the intended application and of the same material as the conductor or of electrolytically compatible materials. Galvanized or plated steels are not acceptable.

J) Connectors and splicers shall be of suitable configuration and type for the intended application and of the same material as the conductors or of Electrolytically compatible materials.

K) Ground terminations suitable for the soil conditions shall be provided for each down lead conductor. Where the structural steel framework is utilized as main conductors for the system, perimeter columns shall be connected to the grounding system at intervals averaging 60 feet or less on the protected perimeter. For any structure in excess of 60 ft. in vertical elevation above grade, a ground loop interconnecting all ground terminals and other building grounded systems shall be provided.

L) Common interconnection of all grounded systems within the building shall be accomplished using main size conductors and fittings. Grounded metal bodies located within the calculated bonding distance as determined by the formulas of the Standards shall be bonded to the system using properly sized bonding conductors.

M) Surge suppression shall be provided at every system entrance to the structure to prevent massive lightning over voltage from entering the structure. Additional surge protection for internal electronic equipment may be determined through cost-benefit analysis by a trained engineer.

Execution: Standard

The installation shall comply with the requirements of NFPA 780, UL 96A, and LPI 175.

Acceptable installers – The installing contractor company shall be listed with the Lightning Protection Institute. The installation contractor shall have personnel on staff Certified by the LPI as a Master Installer or Master Installer – Designer of lightning protection systems. LPI qualified staff shall provide supervision of the installation to the Standards.

Installation –

A) The installation of the lightning protection system components shall be done in a neat and workmanlike manner.

B) Roof penetrations required for down conductors or for connections to structural steel framework shall be made using through-roof assemblies with solid rods and appropriate roof flashings. The roofing contractor shall furnish the methods and materials required at roofing penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof. (Note: The roofing contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. The lightning protection roof penetrations and/or method of conductor attachment should be addressed in the roofing section of the specifications.)

C) LPI certification requires a signature by a representative of the owner for two stages of the installation – the concealed in-ground system and the exposed or roof level area at completion. LPI certification also requires photo documentation of the in-ground system and concealed portions of the installation. LPI certification requires inspection by their third-party field staff after completion of the installation. Upon completion of the lightning protection installation, the installing contractor shall provide to the owner an as-built drawing of the system, along with copies of the LPI Certificates of completion.

D) If the protected structure is an addition to or is attached to an existing structure that does not have a lightning protection system, the contractor shall certify that the system installed complies with the requirements of the Standards, and advise the owner of the lightning protection work required on the existing structure to obtain full certification for the structure. If the existing structure does have a lightning protection system, the contractor shall advise the owner of any additional work required on the existing system to bring it into compliance with current Standards and thus qualify for LPI certification.

TABLE 4.1:

TYPICAL SPECIFICATION OF LIGHTNING ARRESTOR:
S & F of Lightning conductor Air terminal made of 15mm dia 1000mm long, as per IEC/BS EN 62305-3 and NFPA 780 on the parapet of roof duly fitted with air terminal base as per IEC/BS EN 62305-3 including necessary holes etc complete with grouting on the parapet of the roof of the building including connection with earthing horizental conductor.
Supply & fixing GI (Hot Dip) strips 50 mm x 6 mm thick for **Horizental run** on the Parapet/Roof/ Water Tank / Lift Room / Stair room / Wall with GI Saddles 500 mm apart incl. mending good the damages to building works
Supply & fixing of GI (Hot Dip) strips 50mm x 6 mm thick for **Vertical run** on wall with GI saddles spaced not exceeding 750 mm apart incl. mending good damages to building work
Supply and Installation of Medium Pipe (10 ft. long, 2" dia G.I.Pipe along with earth rod and filled with highly conducting metallic compounds / Chemical Gel with permenant sealings at both ends for Earthing and for inter connection of Earthing underground (3 meters X 1no. per pit of 10 feet deep each).
Supply and Laying of maintenance free earthing terminal which consist of Ground Resistance Improving Furse Cem Conductive Aggregate material, tested as per IEC/BS EN 62305-3 and NFPA 780, (1 bags of 25 kg. per Pit) to make it maintenance free and provide low resistance in the earth terminal to be executed by OEM or Authorized channel Partner of OEM only.

Note:	
a.	Air Terminal should be installed maximum at 15 Mtrs. Distance or NBC 2016
b.	Down Conductor as per actual requirement as per NBC 2016.
c.	Earthing Pits and all chemical materials should be as per quantity of Air Terminal and NBC 2016
d.	Ground Enhancing Material is specified here to make the earthing to protect Earth electrode for years. (as per NBC 2016)

5. SPECIFICATION FOR CAPACITOR BANK & CAPACITOR CONTROL PANEL

Power factor correction capacitors shall conform in all respects to IS 2834-1964. The capacitors shall be suitable for 3 phases 415V at 50Hz. Frequency to form a bank of capacitors of desired capacity. All these units shall be connected in parallel by means of high conductivity electrolytic copper busbars of adequate current carrying capacity having S.C rating of 25 KA for 1 sec. Each capacitor bank shall be for PVC insulated aluminium conductor armoured cables. Two separate earthing terminals shall be provided for each bank for earth connection. The capacitor bank shall be housed indoor.

The capacitor bank shall be subject to routine tests as specified in relevant Indian Standard and the test certificate shall be furnished. The capacitor shall be suitable for indoor use up to 45 Deg. C over and above ambient temperature of 50degree C. The permissible overloads shall be as given below:

a) Voltage overload shall be 10% for continuous operation and 15% for 6 hours in a 24 hours cycle.

b) Current overloads 15% for continuous operation and 50% for 6 hours in a 24 hours cycle.

c) Overload of 30% continuously and 45% for 6 hours in a 24 hours cycle.

The capacitor banks shall be floor mounting type indoor housing using minimum floor space with protective guard or fencing. The capacitor bank shall be provided with 7% Detuned reactor filter to compensate third harmonics from being generated.

The insulation resistance between capacitor terminals and containers when test voltage of 500V A.C. is applied shall not be less than 50 mega ohms.

- Capacitor bank and switching equipments shall be housed in a cubicle having degree of protection IP-51 and constructed with sheet steel of minimum 2mm thickness.
- Capacitors shall be unit type having non-PCB, non-flammable non-toxic dielectric.
- Necessary discharge resistor shall be provided externally to reduce the terminal voltage to or less then 50V in 60 seconds of disconnection from supply.
- Testing shall be done as per applicable standards for shunt capacitors.

5.1 Capacitor Control Panel

The capacitor control panel shall general comprise of the following:

a) Automatic power factor correction relay.

b) Step controller with reversing motor.

c) Time delay and no-volt relays.

d) Protection MCCB / MCB.

e) Contactor (AC-3 duty) for individual capacitors of suitable rating.

f) Change over switch for either automatic operation or manual operation with push button control.

g) C.T.s with ammeter and selector switch

h) Voltmeter with selector switch.

i) Indicating lights RYB.

j) SCR based thyristor switch with zero crossing change over facility.

All the capacitors and contactors shall be interconnected with PVC insulated copper conductor wires of adequate size in a neat and acceptable manner. Three phases and neutral bus bar shall be provided in panel as required.

The above control gear, P.F. meter, Digital Microprocessor based P.F. correction relay, push button station etc. shall be housed in a sheet steel metal enclosure cubical type, free standing front operated with lockable doors. The panel shall be fabricated from MS sheet steel 2mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam-welded. The panel shall be totally enclosed design completely dust tight and vermin proof. Gaskets between all adjacent units and beneath all covers shall be used to render the joints effectively. All sheet steel material used in the construction of capacitor control panel should have undergone a rigorous rust proofing process comprising Alkaline Degreasing, descaling in dilute sulphuric acid and recognised phosphating process. The steel work should then receive two coats of primer before applying final coat of epoxy paint of approved shade.

5.2 Quality Assurance

Quality Assurance shall follow the requirement of Employer. Q.A. documents as applicable.

Q.A. involvement will commence at enquiry and follow through to composition and acceptable thus ensuring total conformity to purchaser’s requirement.

6. A) SPECIFICATION OF H.T. CABLE (XLPE) (11 KV)

The cross-linked polyethylene (XLPE) cable shall be aluminium conductor PVC outer sheath steel strip armoured over inner sheath construction. XLPE cable shall conform to testing in accordance with IS: 7098 (Part-I) 1977 and (Part-II) 1973. The screening shall be done on individual cover. The armouring applied over the common covering shall be flat steel wires. Each and every length of cable shall be subjected to routine test.
The termination and jointing techniques for XLPE cables shall be by using heat shrinkable or push on cable jointing kits.
While laying underground cables in ducts care should be taken so that any underground structures such as water pipes, sewerage lines etc. are not damaged. Any telephone or other cable coming in the way shall be properly protected as per instructions of the Engineer-in-charge. The H.T. cable shall be laid at least 900mm for cable upto 33 KV (E) below the ground level in a trench 450mm wide. Insulation tests shall be done before and after laying of cables.

6. B) SPECIFICATION OF L.T. CABLES & WIRES

a) Wires

The design manufacture, testing and supply of single core **FRLS PVC** insulated 1.1 KV grade multistranded twisted wires under this specification shall comply with latest edition of following standards.
IS : 3961 Current rating for cables.
IS: 5831 PVC insulation and sheath of electric cables.
IS : 694 PVC insulated cables for working voltage upto and including 1100 volts.
IEC: 754(i) FRLS PVC insulated cable.
Copper multi-stranded twisted conductor FRLS PVC insulated wires shall be used in conduit as per item of work.
The wires shall be colour coded R Y B, for phases, Black for neutral and Green for earth.
Progressive automatic in line indelible, legible and sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of wire.

b) **Cables**

The design, manufacture, testing and supply of the cable under this specification shall comply with latest edition of following standards:

IS : 8130	Conductors for insulated electric cables and flexible cords.
IS: 7098	XLPE insulation and sheath of electric cables.
IS : 3975	Mild steel wires, strips and tapes for armouring cables.
IS : 7098	Current rating of cables.
IS: 7098	XLPE insulated (heavy duty) electric cables for working voltage upto and including 1100 volts.
IS: 424-1475	(F-3) Power cable-flammability test.

Specification for cross-linked polyethylene insulated XLPE sheathed cable for working voltage upto 1.1 KV.
Specification for XLPE insulated (heavy duty) electric cables for working voltages upto and including 1100 volts.

ASTM-D: 2863	Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastics (Oxygen Index).
ASTM-D: 2843	Standard test method for measuring the density of smoke from the burning or decomposition.
IEEE : 383	Standard for type of test Class-IE, Electric cables, feild splices and connections for power generation station.

ASTME: 662IEC:754(x) Standard test method for specific optical density of smoke generated by solid materials.

IS : 10418 Cable drums.

c) **Testing of Cables**

Cables shall be tested at factory as per requirement of IS: 7098 Part-I. The tests shall incorporate routine tests, type tests and acceptance tests. Prior to laying of cables, following tests shall be carried out:

i) Insulation test between phases and phase to earth for each length of cable before and after jointing.
On completion of cable laying work, the following test shall be conducted in the presence of Architect/Owner.

ii) Insulation resistance test (Sectional and overall) 1000/5000V depending upon the voltage grade of cable.

iii) Continuity resistance test. iv) Sheathing continuity test. v) Earth test.

d) **Laying of Cable**

The cable drum shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming links. At all changes in directions in horizontal & vertical places, the cable shall be bent with a radius of bend not less than 8 times the diameter of cable.

The cable of 1.1KV grade shall be laid not less than 760mm below ground level in a 460mm wide trench (throughout), where more than one cable is to be laid in the same trench; the width of the trench shall be increased.

In case the cables are laid in vertical formation due to unavoidable circumstance the depth per tier shall be increased by 200mm (minimum). Cable shall be laid in reasonably straight line, where a change in direction takes place a suitable cur-vature shall be i.e. either 12 times the dia meter of the cable or the radius of the bend shall not be less than twice the diameter of the cable drum or whichever is less. Minimum 3-meter long loop shall be provided at both sides of every straight through joint & 3 meters at each end of cable or as directed at site.

Greater care shall be exercised in handling the cable in order to avoid forming 'Kinks'. The cable drum shall in-verbally convey on wheels and the cable unrolled in right direction as indicated on the drum by the manufacturer. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains.

Where the cables are to be laid in ducts (pucca trenches) inside the building, they will have to be laid on cable trays grouted in walls trenches. Cables sizing through floors shall be protected from mechanical damage by a steel channel to a height of one meter above the floor where cable pass through wall they shall be sleeved with PVC/steel conduit.

Where the cables are laid in open (in building) along walls, ceiling or above false ceiling, cable rack (wire mesh type) or cable tray shall be provided. The size of the cable tray or rack shall depend on the number of cables to pass over that rack. Cable tray shall be properly supported through wall/ceiling according to the site conditions. Cable laid on tray & riser shall be neatly dressed &clamped at an interval of 1000 mm & 750mm for horizontal & vertical cable run respectively either side at each bend of cable. All power cables shall be clamped individually & control cables shall be clamped in groups of three or four cables. Clamps for multicore cables shall be fabricated of 25x3 GI flats. Single core power cable shall be laid in trefoil formation & clamped with trefoil clamps made of PVC/fibre glass.

Cable openings in wall/floor shall be sealed by the contractor suitably by hession tape & bitumen compound or by any other proven to prevent ingress of water.

After the cables are laid, these shall be tested as per IS and the results submitted to Engineer and in case the results found unsatisfactory, all the repairing/ replacing of cables will be done by the contractor free of charge.

e) RCC Trench for Cable Laying:

Underground cable laying from Sub-station Building to different buildings should be passing through the RCC Trench with RCC cover slab considering the load of vehicles and other.
The layout of the trench shall be prepared in coordination with other parallel underground utilities. The details of the design shall be approved from the Employer before execution of the work.

f) **Fire Seal System:**

i) All the floor/wall opening provided for cable crossing shall be sealed by fire seal system.
ii) The fire proof sealing system shall fully comply with the requirements of relevant IS/BS: 476 Part-B. The fireproof seal system shall have minimum one hour fire resistance rating.
iii) The fire proof seal system shall be physically, chemically, thermally stable and shall be mechanically secured to the masonry concrete members. The system shall be completely gas and smoke tight, **ant rodent** and anti-termite.
iv) The material used in fireproof seal system shall be non-toxic and harmless to the working personnel.
v) Type of fireproof seal system shall be foaming type or **flame mastic** type compound or approved equivalent.

After laying and jointing work is completed, high voltage test should be applied to all cables to ensure that they have not been damaged during or after the laying operation and that there is not fault in the jointing.
Cables for use on low and medium voltage system (1.1KV grade cables) should withstand for 15 minutes a pressure of 3000V DC applied between conductors and also between each conductor and sheaths. In the absence of pressure testing facilities it is sufficient to test for one minute with a 1000V insulation tester In case the test results are unsatisfactory the cost replacements and extra work of removal &laying will be made good by the contractor.
Cable shall be installed so that separation shown in the table below are observed.
HV Cable (11 KV)- HV Cable (11 KV): 50 mm
ELV & LV 230 V/433 V - ELV & LV cable 230 V/433 V Equal to the diameter of the bigger cable.
HV cables (11 KV) - ELV & LV cables 230 V/433 V: 300 mm
LV cables 433 V - Telephone/Instrument cable: 350 mm
All cables - All hot pipe work: 200 mm

7. SPECIFICATION FOR INTERNAL ELECTRICAL WORKS

7.1 Conduiting (M.S Conduit):
All conduits shall be of heavy duty solid drawn ERW welded manufactured out of 16 (1.6mm) gauge MS Sheet up to 32mm dia and of 14 (2 mm) gauge for sizes higher than this. Both inner and outer surfaces shall be smooth without burrs, dents and kinks. Conduits shall be black stove enameled inside and outside. The cross section of conduit shall be uniform throughout. The welding shall be uniform such that welded joints do not yield when

subjected to flattening test. Welded joint shall not break when threaded or bent at an angle. Conduit shall conform to specifications of IS: 9537 (Part-II) and the capacity of conduits shall be in accordance with the standards and shall never be exceeded. The minimum size of the conduit shall be 20mm dia. Care shall be taken to ensure that all conduits are adequately protected while stored at site prior to erection and no damaged conduit shall be used. The size/diameter of conduit shall be such that required no. of wires can pass according to the latest BIS standard.

7.2 Conduiting (PVC Conduit):

All conduits shall be high impact rigid 2mm thickness PVC heavy duty type and shall comply with I.E.E. regulations for non-metallic conduit 2mm thick as per IS-9537/1983 (Part-III). All sections of conduit and relevant boxes shall be properly cleaned and glued by using epoxy resin glue and the proper connecting pieces. Inspection type conduit fittings such as inspection boxes, drawn boxes, fan boxes and outlet boxes shall be M.S. or otherwise mentioned. Conduit shall be terminated with adopter/PVC glands as required. The size/diameter of conduit shall be such that required no. of wires can pass according to the latest BIS standard.

7.3 Accessories

Conduit accessories such as normal bends, unions, circular junction boxes and pull boxes, locknuts etc. shall be heavy duty type and as per approved make. Conduit accessories shall conform in all respects to IS: 3837-1966 with latest amendment. Wherever several conduits are running together, adequately sized adoptable boxes common to all runs shall be used to avoid inserting inspection boxes in the individual run.

Conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed or in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Vertical drops shall be buried in columns or walls. Wherever necessary, chases will be cut by the contractor with the help of chase cutting machine or by hand. Separate conduit shall be used for:

1) Normal light, Fan and Call Bell points.
2) 16 A power Outlets.
3) Emergency Light Point.
4) Fire Alarm System.
5) Computer Outlets.
6) P.A System.
7) Telephone system.
8) TV Network.
9) Or any other services not mentioned here.

7.4 Switch Boxes:

The switch boxes shall be zinc passivity & shall not be less than **18 SWG** thick. It will be so designed that accessories could be mounted on integral pedestals or on adjustable flat iron mounting straps with tapped holes by brass machine screw. Leaving ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on either side of their walls. These shall be completely concealed leaving edges flush with wall surfaces. Earthing terminal inside box shall be provided.

The modular type switch board/box of different sizes comprising with 3 (three) nos. suitable copper bars with holes (for Phase, Neutral and Earth) fixed on Bakelite/ Hard Rubber insulator over the MS welded chairs.

The depth of the switch board enclosure will be such that phase link, neutral link, earth link can be provided in the enclosure box.

7.5 Junction Boxes:

Junction Box of different sizes made of polycarbonate with IP 65 degree of protection (EN60529), dust proof, water proof, insulated and shock proof, fire retardant, self extinguishing, halogen and silica free non toxic material, UV resistant with internally embedded gasket fitted with required terminals should have to be type test certificate and verifying glow-wire test in accordance with IEC 60695-2-11.

7.6 Lamp Holder:
Lamp Holder may be batten, Angle or Bracket type as required. The holder shall be made of brass and shall be rigid enough to maintain shape on application of a nominal external pressure. There should be sufficient threading for fixing the base to the lamp holder part so that they do not open out during attention to the lamp or shade.

7.7 Ceiling Rose:
A ceiling rose shall not be used on a circuit, the voltage of which normally exceeds 250V.

7.8 Ceiling fans:

a) Control of ceiling fan shall be through its own regulator as well as a switch in series.
b) All ceiling fans shall be wired with normal wiring to ceiling roses or to special connector boxes to which fan rod wires (3 core 1.5 sq. mm. Flexible cupper cable with suitable matching with ceiling colour) shall be connected and suspended from hooks or shackles with insulators between hooks and suspension rods. The suspension rod shall be of **power coated paint** with adequate strength to withstand the dead and impact forces imposed on it. Suspension rods should preferably be procured along with the fan.
c) Canopies on top and bottom of suspension rods shall effectively conceal suspensions and connections to fan motors, respectively.
d) The lead in wire shall be of nominal cross sectional area not less than 1.5 sq. mm. copper flexible cable with suitable colour matching with ceiling colour and shall be protected from abrasion.
e) Unless otherwise specified, the clearance between the bottoms most point of the ceiling fan and the floor shall be not less than 2.4m. The minimum clearance between the ceiling and the plane of the blades shall be not less than 300 mm.

7.9 <u>TABLE:</u>

Typical Specification of Ceiling Fan:			
	DESCRIPTIONS	**UNIT**	**SPECIFICATIONS**
A. BASIC DATA	**1.1 Product**		Electric Fan
	1.2 Type		Ceiling
	1.3 Sweep	mm	1200
B. MOTOR	**2.1 Type**		AC single phase
			permanent split
			capacitor type
	2.2 Rated Voltage	Volts	230
	2.3 Rated Frequency	Hz	50
	2.4 Performance		
	230V - Air Delivery	CMM	230
	- Power Input	Watts	75
	- Power Factor		0.9
	- Speed	RPM	380
	- Peak Air Vel.	Mt/Min.	

Typical Specification of Ceiling Fan:			
	DESCRIPTIONS	**UNIT**	**SPECIFICATIONS**
	200V - Air Delivery	CMM	210 Min
	- Power Input	Watts	66 Max.
	- Speed	RPM	350
	180V - Power Input	Watts	58
	- Speed	RPM	320
	2.5 Class of Insulation		
	Winding		' B '
C. DESIGN FEATURES	**3.1 Bearing** - Top Cover	Type	Ball
	- Bottom Cover	Type	Ball
	3.2 Appearance - Colour		White/Matt Brown/ Ivory or any other approved colour with gold lines.
	3.3 Blade -Material		Aluminium
	-Thickness	mm	1.08
	3.4 Downrod - Length	mm	260
	3.5 Motor cover-		
	Top	Material	Aluminium
	Bottom	Material	Aluminium
D. REGULATOR	**4.1 Type**		Step Type Electronics Regulators of Approved Make
	4.2 Speed positions	Nos.	5
	4.3 Regulation		Electronic
NOTES	1. Performance parameters shall be tested as per IS -374-1979.		
	2. Performance at 200 V is minimum guaranteed.Performance at other voltages is only indicative.		
	3. Colour of blades,canopies and down rod shall match with the colour of motor.		

8. Ceiling Fan Regulator:
Step Type (Five steps) Electronic Regulators should be used instead of resistance type regulators for controlling speed of fans.

9. Ceiling Fan Clamp:
Box type fan clamp of size 100 mm dia. And 80 mm depth made of 16 SWG CRCA sheet with one end duly sealed by cover, properly welded including S&F 12 mm dia. 600 mm long MS Rod duly bend by heat treatment at the centre position to grip the fan bobbin properly including binding the rod and fan box with reinforcement by 22 SWG steel binding wire including supplying and covering the box with Alkathene Sheet place in order to prevent concrete from entering the box.

Fan clamps shall be of suitable design according to the nature of construction of ceiling on which these clamps are to be fitted. In all cases fan clamps shall be fabricated from new metal of suitable sizes and they shall be as close fitting as possible. Fan clamps for wooden beams, shall be of suitable flat iron fixed on two sides of the beam and according to the size and section of the beam one or two mild steel bolts passing through the beam shall hold both flat irons together. Fan clamps for steel joints shall be fabricated from flat iron to fit rigidly

to the bottom flange of the beam. Care shall be taken during fabrication that the metal does not crack while hammer to shape. Other fan clamps shall be made to suit the position, but in all cases care shall be taken to see that they are rigid and safe.

10. Exhaust Fans:

The Exhaust Fan is provided with capacitor, start and run induction motor of robust construction, totally enclosed, continuous rated type and specially designed for fan duty. Direction of rotation can be changed simply by interchanging connections of the stator windings. Conforms to I.S. Specifications No. 2612/1297 and is generally provided with class 'A' insulation; class 'E' insulation can be offered to meet special requirements. Fan motors have tow ball bearings adequately lubricated.

For fixing of an exhaust fan, a circular hole shall be provided in the wall to suit the size of the frame which shall be fixed by means of rag-bolts embedded in the wall. The hole shall be neatly plastered with cement and brought to the original finish of the wall. The exhaust fan shall be connected to exhaust fan point which shall b e wired as near to the hole as possible by means of a flexible cord, care being taken that the blades rotate in the proper direction. Louver shutter where required shall have to be installed.

Fan Sweep	**Speed (R.P.M)**	**Power Input (Watts)**	**Current in Amps.**	**Current in Amps.**	**Sound Level**	**Air Displacement (in free air flow condition)**
			1 - Ph.	**3 - Ph.**		
			230 V.	**400 V.**		**C.F.M**
						m^3/h
230 mm (9")	1370	40	0.18		49	440/759
300 mm (12")	920	45	0.2		46	750/1270
	1420	82	0.38	0.18	Fairly Quiet	1120/1920
380 mm (15")	920	78	0.35	0.18	Quiet	1450/2460
450 mm (18")	720	90	0.40	0.2	Quiet	2000/3400
	920	132	0.60	0.30	Fairly Quiet	2550/4340

11. Wire Mesh CABLE TRAYS for POWER & ELV Cables:

Supply of Hot Dipped Galvanized Wire mesh cable Tray with between 50 and 100 microns of zinc to BS 729 in accordance with standard EN ISO14 61: at least 360 h of SST with all mounting accessories. Cable tray shall be manufactured from steel wires, welded together and bent into final shape prior to surface treatment. Steel Wire Cable Tray should be produced from lateral and longitudinal sidewall steel wires, with minimum diameters between 3.5 mm to 6.5 mm for trays depending on the widths of the trays as per the design parameters. Trays should be manufactured with a longitudinal safety edge along the top wire

of the sidewall. Trays should be constructed with a 50 mm x 100 mm mesh configuration. Trays should be coupled together using fast spring coupler. The coupling will have the same surface finish as the tray. Loading and deflection characteristics of the tray should be tested and the results published in accordance with the European Standard IEC 61537. Fire test certification should be published in accordance with the E30/E90 standard. Electrical continuity across a coupling should be demonstrated by means of a published test method and result.

8. SPECIFICATION FOR WIRING

All the wiring installation shall be as per IS: 732 with latest amendment. FRLS PVC insulated copper conductor cables shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic FRLS insulations of 660/1100 volts grade. Colour Code for wiring shall be followed.

- Lighting circuit shall feed light/ fan/ call bell points. Each circuit shall not have more than 800 watt connected load or more than 10 points whichever is less.
- Each power circuit in any type of building can feed following outlets:
  - **b)** Not more than 2 (two) numbers 16A outlets.
  - **c)** Not more than 3 (three) numbers 6A outlets.
  - **d)** Not more than 1 (one) number 16A and 2 (two) numbers 16A outlets.
- Socket outlets modular type shall be 6A 5 Pin, 6A/16A 6 Pin type.
- In case of wiring / cable passing / concealed under floor should be drawn through raceway / cable trunking.

Wires shall not be jointed. No reduction of strands is permitted at terminations. No wire smaller than 1.5 sq.mm shall be used. Wherever wiring is run through turnings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains/ sub-circuit wiring. The ferrules shall be provided at both end of each sub-main/ sub-circuit.

Where single-phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single-phase switches connected to different phase shall be mounted within one box. No twisting connection between conductors shall be allowed.

Distribution wiring in 1100 volt grade 2x1.5 sq. mm (22/3) single core multi strand F.R.L.S PVC insulated & unsheathed twisted copper wire (approved make) in PVC/conduit pipes with all its accessories partly recessed in wall and partly in surface with 20 mm size rigid conduit (FR) precision make (for ceiling points) with1x1.5 sq. mm (22/3) single core multi strand F.R.L.S PVC insulated & unsheathed copper wire to light/ceiling fan/exhaust fan/call bell points with modular type switch, call bell push, plate fixed on suitable size of G.I box of 3mm thick and 80 mm width as switch.

8.1 Table:

Conduit size	**20mm**		**25mm**		**32mm**		**40mm**		**50mm**		**60mm**	
Wire size in												

sq.mm.	S	B	S	B	S	B	S	B	S	B	S	B
1.50	7	5	12	10	20	14	-	-	-	-	-	-
2.50	6	5	10	8	18	12	-	-	-	-	-	-
4	4	3	7	6	12	10	-	-	-	-	-	-
6	3	2	6	5	10	8	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	-	4	3	7	6	-	-	-	-
25	-	-	-	-	3	2	5	4	8	6	9	7

Notes:

1) The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2) The columns heads 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns heads 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
3) Conduit sizes are the nominal external diameters.

8.2 DISTRIBUTION BOARDS & MCBs:

8.2.1 General

Distribution boards shall be of standard make with MCBs as per approved make given. Distribution boards shall be constructed out of steel sheet all weld enclosure with double door IP42 protection and shall be powder coated. The MCBs shall be mounted on high-grade rigid insulating support and connected by electrolytic copper bus bars. Each incoming MCB isolator shall be provided with solder less cable sockets for crimping. Phase separation barriers made out of arc resistant materials shall be provided between the phases. Bus bars shall be colour coded for phase identification.

Distribution boards shall be recessed in wall. Distribution board shall be provided with proper circuit identification name plate and danger sticker/plate as per requirements.

All the distribution boards shall be provided with engraved nameplates with 'lighting', 'power' or 'UPS' with DB Nos. as the case may be. Each DB shall be provided with a circuit list giving details of each circuit. All the outgoing circuit wiring shall be provided with identification ferrules giving the circuit number & phase.

Each distribution board shall have a separate neutral connection bar and a separate earth connection bar mounted within the DB each having the same number of terminals as the total number of outgoing individual circuits from the distribution board. Conduit & cable armouring shall be bonded together & connected to the distribution board earth bar.

Where oversized cables are specified due to voltage drop problems, it shall be contractors responsibility to ensure that satisfactory terminal arrangements are provided without an extra cost.

8.2.2 Earth Leakage Circuit Breaker

ELCB shall be 4 pole 415 volts 50Hz, 30-300mA sensitivity. These shall be of approved make. These shall be suitable for manual closing and opening and automatic tripping under earth fault circuit of 30-300mA as specified in item of work. The enclosure of the ELCB shall be moulded from high quality insulating material. The material shall be fire retardant, anti tracking, non-hygroscopic, impact resistant and shall with stand high temperature. All parts of switching mechanism shall be non-greasing, self-lubricating material so as to

provide consistent and trouble free operation. Operation of ELCB shall be independent of mounting position and shall be trip free type. The RCCB shall be protected against nuisance tripping by protective device.

8.2.3 Miniature Circuit Breaker

1. The MCB shall be current limiting type and suitable for manual closing and opening and automatic tripping under over current and short circuit. The MCB shall also be trip free type.
2. Single pole/three pole versions shall be furnished as required.
3. The MCB shall be rated for 10 KA/15 KA fault level.
4. The MCB shall be suitable for its housing in the distribution boards and shall be suitable for connection at the outgoing side by tinned cable lugs and for bus-bars connection on the incoming side.
5. The terminal of the MCBs and the open and close conditions shall be clearly and indelibly marked.
6. The MCB shall generally conform to IS: 8828. -1996
7. The MCB shall have 20,000 electrical operations up to 63A.
8. The MCB shall have minimum power loss (Watts) as per I.S./ IEC.

8.2.3 Equipment and Fittings:

a. The type, rating, the required features, location of fixing etc. should be as per logistic and conforming I.S specification. The materials shall be of good quality acceptable to Engineer-inCharge and to be fixed in position as directed by him.

b. Decorative fittings: Both single and twin tube assemblies LED fittings shall be of standard fittings and its cover plates in white colour, complete with all accessories, lamps and build wired etc as required.

c. Mirror Optics Type Light Fittings: Both single and twin tube assemblies shall be of standard LED fittings. the box finished in gray color and its cover plates in white colour complete with all accessories, lamps and earth terminal etc. with mirror reflector.

d. Bulk Head Fittings: The LED fittings with all accessories, lamp holders. earthing terminal wire nets and lamps.

e. Street/Compound Light Fittings: The fittings shall be LED type street light fittings. complete with all accessories suitable lamp holders, lamps, assembled and wired neatly and provided with clear acrylic molded cover held by spring loaded hooks against sponge rubber gaskets to make the whole unit dust, vermin and waterproof.

f. Ceiling Fans: The fans have to be suspended normally from the ceiling. These shall be single phase AC 230 V.50 Hz and of sizes indicated as required at site. However, if adequate vertical clearance is not available due to low ceiling, wall-bracket fans will have to be provided. Fans shall include choke type/ electronic step type regulators with hard rubber bushes, condensers, suspension couplings, terminal blocks, suitable top and bottom canopy (covers) etc. Coiling fans shall be of double ball-bearings type, conforming to IS 374 in all respects.

g. Exhaust Fans:
Heavy/ Light duty fans are required for exhaust ventilation in buildings. The fans shall be suitable for AC. single phase. 50 Hz, 230 V supply. These must be of robust construction having very low noise level.. All exhaust fans shall be impeller type with ring mounting arrangements for fixing on walls. The exhaust fans shall conform to IS: 3588 in all respects. Capacity and size of fans will be specified as per the volume of air of the room. The exhaust fans are also to be included with auto timer for its running at regular interval.

h. Metal Clad Switch Socket Unit: All the switch-socket units shall be made of non-corroding pressure-cast Aluminium alloy and these must be dust, vermin, water and

rust proof. Switchsocket units shall be provided with interlocking arrangement for switch and plug HRC fuses, Neon--Indicator lamps, terminal blocks and pin-top The units skill be suitable for both flush and surface mounting. Switch socket units shall comply with IS 4160.

i. **Installation of ceiling fan**: Unless otherwise specified, all ceiling fans shall be hung not less than 2.75 M (9 ft.) above floor. The suspension rod and clamp shall be painted with approved paint without involving extra cost.
j. **Installation of LED light fitting**: In case of suspension from ceiling by two rods, each fixing to the ceiling shall be capable at sustaining at least 1.1 Kg. of dead weight. The down rods and accessories shall be painted with approved paint without involving extra cost. Unless otherwise specified, this should be suspended 2.60 M (8'-6") above floors.
k. The D.Bs shall generally be installed at a height of 2.13 Mtrs. (7 ft) from floor level.
l. All fan clamps will have to be provided from R. C. ceiling as per PWD Specification.
m. Control switches for lights, fans, call bells; exhaust fans etc. shall be of rating 6 Amps, 230 Volt, and Modular-type- flush mounted, cream colour conforming to relevant Indian Standards. Ceiling roses also shall be of 6 Amps. Rating 230 V. cream color deluxe conforming to the relevant IS Specification. Switches of 16 Amp capacity and associated 16A six pins socket would also be required to provide facility of connection of power load up to 1 KW. Alternatively, Industrial type plug-socket board may be used In specific cases. Cable used for power load should be of suitable capacity. 230 Volt 5 amps plug socket should be 5 pin type cream clour conforming to the relevant IS specification.
n. After successful completion of the work, the final drawing/ Blue Print Plan showing the details circuit diagrams and fittings, fixtures are to be submitted along with the final bill.
o. **Cabin Fan: The fans should be wall mounted and installed with all accessories and proper electrical connection at those places, wherever there is a requirement as decided by the approving authority.** These shall be single phase AC 230 V.50 Hz and of sizes indicated as required at site.

9. SPECIFICATION OF DIESEL GENERATOR SET

9.1 Scope

This specification covers design, manufacture, assembly factory test, supply, delivery of diesel generator sets, complete in all respects with all equipment fitting and accessories for efficient and trouble free operation as specified hereunder.

9.2 Codes and Standards

The equipment shall comply with all currently applicable status, regulations and safety codes in the locality where the equipment shall be installed. Equipment shall conform to latest applicable Indian/British/ASA/ASIM/ASME/CPCB standard or other International Standard established to be equivalent or superior to the codes.

9.3 Technical Details

i. Generating Sets

The Diesel generating set (2 nos.) shall be complete with diesel engine conforming to BS:649/1958, alternator, alternator control panel, instruments, control cables and all other accessories and batteries.

The equipment shall have tropical and fungicidal treatment as per BS:CP:1014-1963 (protection of Electrical Equipment against climatic conditions).

ii. **Engine**

Diesel Engine of specified rating or equivalent BHP suitable for coupling with alternator. Engine shall be internal combustion type and direct injection. Electric starting suitable for diesel fuel, Prime duty Cycle, Multi stroke of suitable rating with provision of 10% overload for 1 hour during any continuous run of 12 hours.

The speed of engine shall be 1500 rpm and the engine shall be designed to operate in the most adverse conditions.

The engine shall be 6 cylinder 4 stroke type complete with the following accessories :

1) Flywheel to suit flexible coupling
2) Flexible coupling
3) Aspiration: Turbocharged, Charge Air Cooled
4) No of Stroke/Cylinder: 4 Stroke/6 Cylinder in-line
5) RPM: 1500
6) Type of Cooling: Liquid Cooled (EG Compleat 50:50)
7) Lube oil specification: CH4 15W40
8) Electrical starter motor with soft start engagement feature
9) Battery charging alternator.
10) Electronic governor
11) Duel Fuel filter system
12) Spin-on lube oil filter
13) Plate type lube oil cooler
14) Block Loading not less than 50%
15) Engine should have 10% overload capaccity
16) PT fuel system with Electronic Step Timing Control (ESTC) Injectors.
17) Hospital Grade Silencer
18) Air cleaner (heavy duty-paper element type)
19) Recovery bottle
20) Flywheel & Flywheel Housing
21) First Fill of lube oil and coolant
22) 2 x 12 V DC Batteries
23) Engine Should be Well designed air handling system with
    Dry type, Heavy duty, Replaceable paper element air cleaner with restriction indicator Outboard after cooling with 2 pump 2 loop system Optimized turbocharger for increased altitude.
24) Automatic safety control switch in case of high water temperature.
25) Automatic safety control switch in case of low lub-oil pressure.
26) Lub-oil pump, filter, cooler, piping
27) Heavy duty radiator cooled with guard, cooling fan, inbuilt water circulating pump, water circuit with corrosion resistor.
28) Instrument panel comprising of
    i) Water temperature gauge
    ii) Lub-oil pressure gauge
    iii) Lub-oil temperature gauge
    iv) Starting switch
    v) Safety control for low lub-oil pressure and high water temperature
    vi) Hour meter (mech.) and RPM indicator
29) Fuel filters
30) Fuel pump
31) Hoses for fuel tank

32) Air cleaner assembly
33) Hydraulic governor
34) Self starter
35) Dynamo & regulator
36) Mechanical tachometer and running hour meter
37) SILENT CANOPY Acoustic control
38) Vernier control system for speed regulation
39) Prime duty Cycle.

9.4 Starting System

The engine shall be Electric starting with 24V starter motor and 24 volt heavy duty lead acid battery of required ampere hour (Ah) with adequate battery leads.

The D.G. sets shall be provided with suitable base frame of sturdy design made of M.S. channel with necessary reinforcement to take the load of engine, alternator and provided with anti-vibration pad.

Daily service fuel tank suitable for required C a p a c i t y shall be provided complete with stand, level gauge, fuel piping for supply/return, vent, filling cover drain plug, valves etc.

9.5 Alternator

The alternator shall be brushless type with rotating field and static excitation circuit controlled by field control unit suitably compounded for voltage and load current for a self excited self regulated system.

The alternator shall be in SP-DP enclosure, foot mounted with ball and roller bearings on end shields.

The alternator shall conform to the latest publication of IS:4722/BS:2613 and shall be suitable for tropical conditions.

9.5.1 The alternator shall comply with the following specifications:

Make: Approve make list
Rating: Capacity in KVA. 415V, 3 phase, 50Hz, 0.8 pf.
Type of Alternator: Brushless, self excited & self-regulated through an AVR ,PMG Mounted.
Bearing-Single
Speed: 1500 RPM
Enclosure: IP: 23
Insulation: H
Excitation: Self excited, Self-regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at ± 5% at all load for p.f. not less than 0.8.
Overload: Permissible overload of 10% for 1 hour in 12 hours of operation
Terminal Box: Cable box suitable for incoming PVC Cable.
Earthing studs: 2 Nos.
Waveform distortion/ Total Harmonic Distortion: load < No 1.5 %, Non distorting balanced linear load < 5 %, across phases- less than or equal to 25%, Telephonic Harmonic factor < 2%.

The alternator shall be provided with space heater.

The alternator shall be capable of withstanding without injury single phase, 2 phase and

1/2 phase(s) to earth short circuit for a period of 3 sec. at rated speed.

9.6 Alternator Control Panel

Controller should be an integrated microprocessor-based generator set monitoring, metering and control system with LCD display designed to meet the demands of today's engine driven generator sets. Engine & Alternator protection should be Integrated part of Controller.

Intuitive operator interface which includes LED backlit LCD display with tactile feel soft-switches & generator set status LED lamps

The control panel shall be sheet steel enclosed and shall be dust, weather and vermin proof providing a degree of protection of IP-44. Sheet steel used shall be cold rolled and at least 2.0 mm thick and properly braced and stiffened.

Control panel shall be provided with hidden hinged door(s) with pad locking arrangement and suitable brackets/channels shall be provided for floor mounting.

All doors, removable covers and plates shall be gasketed all around with neoprene gaskets. All accessible live connections shall be shrouded and it shall be possible to change individual switches, fuses, MCCBs without danger of contact with live metal.

All live parts shall be provided with at least phase to phase and phase to earth clearances in air of 25 mm and 20 mm respectively.

Adequate interior cabling space and suitable removable cable gland plate shall be provided. Necessary number of cable glands shall be supplied and fitted on to this gland plate. Cable glands shall be screwed on type and made of brass.

Two number of earthing terminals shall be provided.

All sheet steel work shall be digressed, pickled, phosphate and then applied with two coats of zinc chromate primer and two coats of finishing synthetic enamel paint, both inside and outside of shade 631 (grey) and painted with epoxy.

The control panel shall be provided with the following accessories but not limited to complete the satisfactory operation:

1) Master engine control switch for OFF/AUTO/MANUAL/TEST.
2) Voltmeter 144 sq mm with selector switches for alternator/mains/phases complete with protection fuses.
3) Frequency meter 144 sq mm reed type.
4) Electronic meter with digital display: Current, Voltage, KW, KVA, KVAR, PF, KWHr, Frequency etc. Over load protection, unbalanced load protection, earth fault protection, Engine speed, Intake manifold temperature.
5) Current transformers required for metering.
6) Ammeter144 sq. mm with CT and selector switch.
7) Mains supply, voltage monitor.
8) Engine control monitor.
9) Alternator voltage monitor.
10) D.C. control relays, timers, Earth Fault Relay.
11) Window type annunciator with static relays, alarm/hooter and accept, test, reset push buttons for all functions.

12) Engine hours run counter
13) Earthing studs
15) Anti vibration pads
16) Auxiliary relays
17) **Paralleling Control Functions:** Digital frequency, synchronization and voltage matching, Isochronous kW and kVAr load sharing controls, Droop kW and kVAr control, Sync check, Extended paralleling (Peak Shave/Base Load),
Digital power transfer control (AMF), Load govern control, Load demand control.
18) **Data Logging:** Genset model data, Engine hours, Control hours, Engine starts, Load profile, kWh and upto 32 recent fault codes.
19) **Engine Protection:** Low lube oil pressure, High/Low coolant, temperature, Over speed, Under speed, Battery Over/Under/Weak Volts, Fail to crank/start, Cranking lockout, Low fuel level, Sensor failure, Water Temperatue.
20) **AC Alternator Protection:** Amp Sentry protective relays for short circuit shutdown, Over/Under voltage, Over/Under Frequency, Over current, Overload, Reverse power, Reverse VAr, Phase rotation and Loss of AC sensing, Earth fault protection, unbalanced load protection.
21) **Utility/AC bus protection:** Over/Under voltage, Under frequency and Phase rotation. Paralleling protections.
22) Self-Configuring PCCNet network.
23) Modbus Interface (RS485 RTU).
24) InPower Compatible (PC based service tool)
25) Remote Start-Stop
26) Integrated digital electronic voltage regulator with configurable torque matching.
27) Digital Electronic Governing with temperature compensation and Smart Starting.
28) SAE J1939 Interface to Full Authority Electronic (FAE) engines.
29) Annunciation System:
- Engine fails to start
- Generator overload
- Earth fault
- Generator prime mover failure
- Generator over voltage
- Engine over speed
- Engine high water temp.
- Stator temp. high
- Engine low oil pressure
- Any other annunciation considered essential etc.

9.7 Battery and Battery charging alternator

- As per manufacturer standard

9.8 Tests and Test Reports

Type tests, acceptance tests and routine tests for D.G. sets equipment shall be carried out as per relevant standards.

The certified copies of the test certificates/reports of the above mentioned tests shall be submitted to the purchaser before dispatch of equipment. The Bidder shall submit with his proposal, copies of available type test certificates of the equipment offered.

Control panel shall be subjected to the following tests:

a. High voltage test (2000 volts for 1 minute)
b. Megger test

9.9 Drawings and Data

As part of the proposal, the Bidder shall furnish relevant technical/descriptive literature of the D.G. set.

The Bidder shall also furnish complete filled in Data Sheet.

Control panel general arrangement drawing showing dimensioned views, cable entry location and mounting details.

Schematic wiring diagram of the control panel.

Bill of material listing equipment designation, make, type, ratings etc. of the various equipment mounted on the control panel.

9.10 TECHNICAL PARTICULARS FOR DG CONTROL PANEL

1.0 **Designation**: DG Control panel
2.0 **Location**: Indoor
3.0 **Design ambient temperature**: 50°C
4.0 **Type of mounting**: Floor
5.0 **Degree of protection of panel**: IP-44
6.0 **Cable entry**
6.1 Top/Bottom: Top/Bottom
6.2 Glands/conduit: Glands
7.0 **Painting**
7.1 Colour finish: As per manufacturer standard.
7.2 Epoxy paint required: Yes
8.0 Control voltage: 24V D.C.

9.11 ACCOUSTIC ENCLOSURE

Construction Details

The Structure is fabricated using CRCA sheets of 14/16 SWG Thickness and steel members. The enclosure is fabricated on a MS Channel Frame work further strengthened by suitable cross members to make it robust and sturdy.
The acoustic enclosure consists of following:

a) **Acoustic Insulation:**
- Specially designed to meet stringent MoEF/ CPCB norms of 75 dBA @ 1mtr at 75% load under free field conditions
- High quality noise absorbent and fire-retardant grade acoustic insulation material (Rockwool) complying to IS 8183
- Base lifting for easy handling at project site
- Designed to have optimum serviceability
- Air inlet louvers specially designed to operate at rated load
- 11 tank pretreatment process and UV resistant powder coating of all parts to withstand extreme environment
- Flush styling - no projections
- Fluid drains for lube oil and fuel
- Fuel filling arrangement inside the enclosure

b) **Noise Suppressor**:

A suitably designed absorption type Hospital noise suppressor is provided which minimize the exhaust noise of the engine.

c) **Exhaust System:**
The exhaust gas is taken out through a specially designed flexible pipe, which prevents any back pressure on the engine.

d) **Thermal Insulation:**
The exhaust system and noise suppressor is provided thermal insulation by using glass wool & covering it with Aluminum sheet. This prevents it from radiating excess heat on the engine, makes it safe for the operator and enhances aesthetics.

e) **Surface Treatment:**
The enclosure is surface treated and painted with high quality polyurethane epoxy paint with prior zinc oxide primer base, which makes it weather proof and suitable for outdoor application. The paint is highly resistant to acids, alkaline, salt sprays, halogens, solvents, lubricants etc and has very good dielectric properties and is resistant to abrasion and cracking.

f) **Air Circulation & Ventilation System:**
A suitable forced air circulation and ventilation system is designed to maintain safe operating temperatures inside the enclosure. Requisite air circulation for engine aspiration combustion and cooling is provided by means of Exhaust fans or tube axial fan driven by a 3 phase squirrel cage induction motor according to need of engine.

g) **Vibration Isolation:**
The engine and alternator is mounted on Anti-Vibration Mounting pads to eliminate engine vibration.

h) **Hardware:**
Inlet and Outlet for cable, draining of lube oil and diesel etc. are provided. The doors are gasketed with high quality EPDN gaskets to avoid leakage of sound. All doors are lockable.

i) **Fuel Tank:** Min. 990 LTRS, detachable tank built inside base frame complete with drain valve, air vent inlet & outlet connections, fuel gauge.

k) **BASE FRAME:** Common MS Channel fabricated base frame, primer coated & painted, containing the engine and the alternator mounted through AVM Pads.

l) **Testing / R&D:**
The Gen set shall be thoroughly tested on load before it is dispatched from factory. The test certificate shall be submitted to the owner at the time of delivery of the equipments.

10. Specification for Fire Detection System & Fire Fighting System

The scopes and specification will be in conformity with **National Building Code 2016 (NBC 2016)** and Laws, Codes and Standards of West Bengal Fire Services Department.
The successful bidder will have the responsibility to obtain all necessary NOC and Licenses from the respective Government Department/ Authority.

NOTE 10.1:

- **The renewal of the NOC and Licenses from the competent authority will be under the scope of Turnkey Agency within the Defect Liability Period (DLP).**

10.1 DATA SHEET:

SCOPE:

1.1 This specification covers the supply, installation, testing and commissioning of Addressable Fire Alarm system and various components, which constitute the

system. This system shall be microcomputer based utilizing distributed processing technique. The system shall generally include power supply indicating devices, cable and accessories etc complete.

1.2 The equipments shall be properly packed for transportation, supply and delivery of the equipments at site.

2.0 CODES AND STANDARDS:

2.1 The design manufacture, testing and commissioning of various components of the Automatic Alarm System shall comply with all currently applicable status, regulations, and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the tenderer of his responsibility.

2.2 Unless otherwise specified, the Fire Alarm System and the components shall conform to the latest applicable relevant NFPA codes. The relevant Indian Standards are.

a) Code of Practice for Automatic Fire Alarm System – NFPA 72
b) National Building Code 2016 (Latest Edition)
c) Fire Officers Committee regulations.

3.0 LIST OF COMPONENTS:

The following are the list of various components which generally constitutes the Fire Alarm System but not limited to it. The specific requirement of various equipments shall be as per enclosed specification.

a. Manual Pull station.
b. Electronic hooters/sounder.
c. Response indicators.
d. Addressable type Smoke detectors.
e. Addressable type Duct detectors.
f. Cables and wiring.
g. Fire alarm main panel.
h. Repeater Control Panel.

GENERAL REQUIREMENTS:

The design construction and operational features of all types of detectors shall be in accordance with relevant standards. The fire alarm system, shall be generally as per the schematic diagram and the location of detectors, manual call points etc.

Manual call points where the addressing capability is not an integral part a separate Addressable interface unit shall be provided.

FIRE ALARM SYSTEM OVER VIEW :

The FACPs used in the Building shall confirm with the UL - 9th Editions.

The fire detection and alarm system shall be designed to facilitate accurate identification of the source of heat / smoke / fire in their early stages to minimize occurrences of false alarms due to faulty equipments, electrical transients, system faults etc.

Facilities are provided to constantly monitor and check the following circuits and fault conditions:

The power supply to the loop/s

For open-circuit, short-circuit, earth fault and any other fault condition in the loop wiring

For communication failure and errors in all cards and loops.

Monitoring of all devices status to create a table of each 1 analogue channel for event analysis

All devices i.e. Detectors, MCP's, etc. shall be installed on the same loop.

Any event i.e. Fire, fault or warning shall be recorded with time, date and place of occurrence in the memory of FACP.

Provision shall be done at the fire alarm control panel to silence the alarm sounders but the visual indication shall remain until the system is reset.

The main fire alarm control panels shall be located either in the Control Room or at the Ground Floor. The main FACP shall be capable of accommodating 254 detectors and devices per loop. (i.e.) 1016 devices of any combination in an panel.,

The Fire Alarm System consists of the following elements.

1) Analogue Addressable Photo-Electric Smoke Detectors for the above and below false ceiling areas pertaining to Meeting Rooms, Cabins, Stores, Offices, Open Work-station areas and areas alike.

2) Analogue Addressable Thermal Detectors to detect unusual rate of rise of temperature for Basement areas, Electrical installation areas, Kitchen, Pantries and areas alike.

3) All fire sensors shall mount on a common base to facilitate the changing of sensor type if building conditions change.

4) If the Fire Alarm Panel determines that the sensor is in alarm, the Fire Alarm Panel shall command the sensor LED to remain on to indicate alarm.

5) Each sensor shall be capable of being tested for alarm via command from the Fire Alarm panel.

6) Each sensor shall respond to Fire panel scan for information with its type identification to preclude inadvertent substitution of another sensor type. The Fire Alarm panel shall operate with the installed type but shall initiate a mismatch (trouble) condition until the proper type is installed or the programmed sensor type changed.

7) Each sensor shall respond to Fire Alarm Panel scan for information with an analogue representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end-to-end sensor including the operation of the sensor electronics.

8) The detector shall meet the requirements of UL. It shall be possible to test the detector's working both from the panel as well as locally by means as designed by the Contractor and approved by the Engineer-in-charge. The approved coverage per detector for unhampered areas shall not be less than 50 Sq. M. The detector shall be capable of being reset automatically after any alarm condition.

9) Addressable Manual Pull station / manual call points are proposed to be installed at each Exit Staircase, Lobby areas on each floor to comply with relevant standard / norms or recommendation of local fire brigade authority.

10) Each device shall be assigned a unique address via easily understood decade (01 to 254) switch. Address selection via binary switches. Devices that take their address from their position in the circuit are unacceptable because if devices are later added, existing addresses, descriptors and commands need to be reprogrammed.

11) Each device shall contain screw terminals with rising plates for positive termination suitable for 1.5 Sq.mm. copper conductor wire.

12) The Fire Panel shall be capable of displaying the address of the occurrence of the smoke and shall be capable of activating Hooters. It shall have the provision for external actuation like ventilation fan control, fire damper control, if any and system should provide Open Protocol in case connectivity is required with BMS (Building Management System).

It shall be possible to program the Fire Panel such that meaningful alphanumeric descriptions can be assigned to each Detector Address. This shall be useful in identifying the location of Fire very quickly and easily.

13) It is important to note the essential requirement from the system mentioned as under. As it has been stated the system requirement are essential irrespective of whether any of the devices or components mentioned are presently being used as per bill of material / quantity or a future requirement.

Every detector should be loop powered and addressable by itself.

Every Manual Call point should be loop powered and addressable by itself.

Every Sounder / Hooter should be Non addressable and addressed through control module with 24VDC input.

Every Zone Monitor Interface (for connecting to Conventional beam/smoke detectors and Devices) should be loop powered and addressable by itself.

Separate 24 VDC power supply should be used for the Sounders / Hooters.

Separate Addressable interface unit / module should be used for the Sounders / Hooters which are supposed to be Non self Addressable type.

No separate Addressable interface unit / module should be used for the Zone Monitor Interface (for connecting to Conventional detectors and Devices) which are supposed to be self Addressable type.

Every Module in general Monitor module, Mini / Micro Monitor Module, Control Module, Isolator Module etc. should be loop powered and addressable by itself.

The alarm sounder shall consist of necessary solid state electronic circuit or printed circuit card, suitable to accept impulse from fire alarm panel.

FACP:

The fire alarm control panel (FACP) shall be suitable for Class-A Style 5, 6 or 7 wiring and Class–B Style 4 type of wiring as per NFPA-72. It shall have provision to accept the range of 110V - 230V ± 10% single phase, 50 Hz SMPS supply. The processor shall be of M3 32 bit, capability for Day & Night mode. The panel shall maintain 2000 events, each with a time and date stamp. The control panels shall exclusively maintain 1000 alarm event and 1000 other events (troubles supervisory pre alarm etc). The system shall support three password levels, (i.e. Advance / Admin/ user). It shall have inbuilt USB 2.0 Interface for easy configuration facility via PC/Laptop. The FACP shall have Minimum 160 Characters LCD in which the LCD clearly indicates the location of fire, Fault & Supervisory. The FACP should have capacitive Touch Keypad, instead of mechanical snap dome switches for trouble free operation. The panel shall have degraded operating mode. In case of main CPU failure the panel still gives audio and visual notification.

The FACPs shall have maximum capacity of four loops and can be configurable as one, two, three and four loop. It shall have inbuilt RS485 facility for networking. Peer to peer networking of at least eight panels should be possible in a system, comprising of not less than 8128 devices in any combination. The panel shall have two circuits for remote monitoring with at least one for Initiating device circuit. The FACP should have minimum two inbuilt Notification Appliances circuits. The FACP shall have provision to interface Ethernet, GSM module and any BMS. The FACP shall have the facility to connect the Printer by using Interface module directly to the panels.The panel shall have minimum three programmable form C, potential free Relays, loop wise Auto-learn facility for easy installation and commissioning, capability to add or delete the devices without affecting the existing configurations, facility to program 750 groups with label, built in visual alarm indication for minimum 40 zones, programmable time delay facility. The Panel should be capable of alerting duplication of address, mismatch on the device type. The panel shall have provision to restore factory default setting. The FACP should give audio and visual indication for main and/or standby power supply failure. The panel shall indicate degraded

power supply in case both the mains and standby power supplies are below the rated level with inbuilt battery charging circuit to charge up to 40Ah SMF batteries. The FACP shall be capable to integrate the voice evacuation system, shall have Programmable Trouble Reminder facility, AC loss Delay facility and also on site and off site programming.

The FACP shall have provision to connect with a Public addressing system thru RS485 for seamless integration without any third party modules,the grouping of FACP shall be correlated with corresponding zones in PA system.

The FACP shall have the following functions activated through the touch key pad:

- Acknowledge
- Silence
- Evacuate
- Reset
- Scroll
- Test

Loop card should have built in intelligence with 32 bit controller with auto addressing facility in respect to the slot it is inserted, shall be swappable without any configuration changes and should have LED for loop status indication. Each loop shall accommodate minimum 254 devices (detectors and modules) in any combination. All the alarm initiating devices shall be addressed through 8 way DIP switch without any configuration utility/ programming kit. (Binary –addressing). All types of detectors offered will be restorable type i.e. suitable for operating afresh after each actuation on alarm without replacement or adjustment. The sensitivity of smoke sensor shall be individually adjusted from the FACP to suit the conditions of each location. Each detector shall have self-test facility, which is monitored in the FACP. The FACP should be able to monitor each detector and raise maintenance alert once the drift compensation level is reached.

POWER SUPPLY UNIT:

A built in power supply unit shall be provided inside the control panel to feed voltage to the system as below:

a) The Control panel along with its detection and alarm circuits shall get its operating power from the normal supply source at 120 to 220 Volts single phase 50 / 60 Hz. In case this supply source fails, it should automatically

change over to its power supply unit consisting of battery charger, The battery charger unit shall be automatic trickle charging type.

The charger shall normally supply the battery trickle charging current and D.C. load of the fire alarm system. The battery shall normally float. In case the A.C supply on the input side of the charger fails. The complete fire alarm system shall be supplied by the battery.

b) Battery bank shall be 24 VDC sealed maintenance free type conforming to latest NFPA specification and adequate capacity to supply fire alarm system power for a period of 24 hours in non-alarm state followed by 60 minutes operation of all soundless and other connected equipments from the instant of charger.
c) Visible and audible annunciation for trouble or failure in the power supply system like charger failure battery low voltage etc shall be provided

REPEATER PANEL (UL LISTED):

The Repeater Panel shall have minimum 160 characters LCD display in which the LCD clearly indicates the location of fire, fault & supervisory status. The repeater panel should have capacitive touch keypad, instead of mechanical snap dome switches, for trouble free operation. Repeater panels shall be suitable for wall mounting or mounting on table which shall display all the parameters occurring on the fire alarm control panel. It shall connect to any of the fire panels in the network. It shall be provided with an external power supply. The repeater panel shall replicate the main panel indications and shall be accessed only by authorized users through password. The repeater panels shall be connected to the main panel and other repeater panels in such a way that failure in any of the panels shall not affect the performance of the other panels.

(ADDRESSABLE TYPE, DETECTORS, MULTI SENSOR, MANUAL PULL STATION, HOOTERS)

1.0 MULTI SENSORS (ANALOGUE / ADDRESSABLE):

The multisensors must comply fully with the general requirements for intelligent point sensors. Multisensors shall comply with standard NFPA for Enhanced Smoke Sensors. The multi sensors shall incorporate photo electronic optical smoke sensors, and high sensitivity thermal sensors, software interlocked to provide early warning from all types of smouldering and thermal fires. Multisensors shall be able to be operated as enhanced smoke sensors and thermal sensors. The smoke element shall be of the light scattering type using a pulsed

internal LED light source and a photocell sensor. The thermal element shall utilize high sensitivity, high speed thermistors optimized to measure small changes in temperature, and rate of change. The elements shall measure both absolute smoke and thermal levels, but also rate of smoke and thermal change. The smoke and thermal elements must report independently to the control panel, and must be software interlinked to enable intelligent high –level decision making.

The detector shall be capable of operating within the following environmental limits.

a. Temperature operating range -10◦C to + 37.8◦C
b. Humidity operating range 0% to 93% RH (without condensation)
c. The detector should have fixed temperature rating of 59 ◦C
d. The rate of rise of 11.1◦C/min
e. The multi detector shall be loop powered and addressed by DIP switches.
f. The detector shall have at least 3 levels of sensitivity settings.
g. The detector wiring shall be polarity free.
h. It shall have inbuilt drift compensation facility.
i. In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming.
j. The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.

2.0 MANUAL PULL STATION:

Each manual pull station unit shall comprise of a pull station of approved make with minimum 1 N.O. + 1 N.C contacts. This whole assembly of Pull station shall again be enclosed in an external die cast iron enclosure with all side covered included from the front side. In case of fire when pull down the lever and inside glass tube is broken to give fire warning, the pull station shall be released due to spring action hence giving remote fire alarm through the NO contact which has now changed over.

2.1 The enclosure shall be completely dust, damp, weather and vermin proof protection.
2.2 The complete unit shall be suitable for wall / column mounting with necessary surface / recess mounting accessories as required.
2.3 The complete unit and the pull station shall be painted Signal Red (Shade No. 537 as per IS: 5) the internal surface shall be painted with Red color.

3.0 Sounder :

The Sounder shall confirm to the relevant standards having the following features.

1. The Sounder shall be a Conventional. (Bidder shall consider external power supply, cable, conduits, modules required for activating externally powered sounders and include the costing as part of the item – Sounders)
2. The sounder shall have audibility level of 85dB
3. The sounder shall have the capability of being tested from the FACP
4. The Sounder Shall have Two different audible tone settings
5. Shall be UL listed

Sounder cum Strobe:

The Sounder Cum Strobe shall confirm to the relevant standards having the following features.

1. The Sounder Cum Strobe Shall have audibility level of 85dB.
2. The Sounder Cum Strobe shall have 4 Candela setting 15/30/75/110cd flashing capacity at 1HZ for Visual indications.
3. The Sounder Cum Strobe shall be integrated with Control Modules with necessary auxiliary voltages.
4. The Sounder Cum strobe shall be working on 24VDC auxiliary power supplies.
5. The sounder shall have two audible tone settings.
6. Shall be UL listed.

Strobe:

The Strobe shall confirm to the relevant standards having the following features.

1. The Strobe shall have 4 Candela setting 15/30/75/110cd flashing capacity at 1HZ for Visual indications.
2. The Strobe shall be integrated with Control Modules with necessary auxiliary voltages.
3. The strobe shall be working on 24VDC auxiliary power supplies.
4. Shall be UL listed

4.0 ADDRESSABLE TYPE REMOTE RESPONSE INDICATOR:

Whenever a detector is housed in an enclosed space or a number of detectors are housed in an enclosed space each detector or a group of detectors must have a single indicator outside the particular area for remote monitoring. This should be suitable for both surfaces and recess wall or ceiling mounting and of dust proof construction.

OPTICAL SMOKE DETECTOR:

The optical smoke detector must comply with UL 268 the general requirements for intelligent point sensors. Optical smoke detector shall comply with UL 268 for Enhanced Smoke Sensors. The optical smoke detector shall incorporate photo electronic optical smoke sensors, software interlocked to provide early warning from all types of smouldering. Optical

smoke detector shall be able to be operated as enhanced smoke sensors. The smoke element shall be of the light scattering type using a pulsed internal LED light source and a photocell sensor. The elements shall measure both absolute smoke levels. The smoke elements must report independently to the control panel, and must be software interlinked to enable intelligent high –level decision making.

The detector shall be capable of operating within the following environmental limits.

a. Temperature operating range -10 ◦C to + 37.8 ◦C
b. Humidity operating range 0% to 93% RH (with out condensation)
c. The optical smoke detector shall be loop powered and addressed by DIP switches.
d. The detector shall have at least 3 levels of sensitivity settings.
e. The detector wiring shall be polarity free.
f. It shall have inbuilt drift compensation facility.
g. In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming.
h. The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.

ADDRESSABLE HEAT DETECTOR:

The Heat Detector shall confirm to the relevant standards having the following features:

1. Detector shall be UL approved.
2. The detector should have fixed temperature rating of 59ºC and rate of rise of 11.1º C/min
3. The Detector shall be loop powered and addressed by DIP switches.
4. All the detectors shall have a visible dual blinking LED to indicate the healthiness/ trouble/ alarm condition of the detector. The LED shall be located in such a way that it shall be visible from the 360º.
5. It shall possess False alarm immunity and a superior signal to noise ratio.
6. It shall be capable of supporting style 7 wiring.
7. In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming.
8. The detector wiring shall be polarity free.
9. The detector shall have the connection details on the bottom.

Standard base:

1. The base shall be UL Listed.
2. The base shall be common for PHOTO, THERMAL AND MULTI SENSOR.
3. Terminals of base shall be rust resistant.

The base shall have separated in and out terminals.

4. The base shall have terminals to connect remote indicator.

ADDRESSABLE MODULES

Control Module (CM):

1. The Control Module shall be UL listed.

2. The CM shall have LED indication to show the status.
3. The CM shall activating notification devices and 24V DC operated devices.
4. It shall have a capability of handling at least 1A @ 30VDC to integrate with third party system.
5. The CM shall be capable of powering through the auxiliary source and shall supervise the auxiliary power. The CM shall communicate faults and troubles related to the NACs, power supply to the panel.
6. The CM shall be addressed by means of dip switches.
7. The CM shall be loop powered.

Monitor Module (MM):

1. Monitor Module shall be UL Listed.
2. The MM shall have LED indication to show the status.
3. The MM shall have supervised monitoring circuit.
4. The MM shall monitor any number of potential free NO contact.
5. The MM shall be addressed by means of dip switches.
6. The MM shall be loop powered.

Relay Module (RM):

1. The Relay Module shall be UL Listed.
2. The RM shall provide two dry potential free contacts for activating a variety of auxiliary devices and other firefighting / ventilation equipment.
3. The RM shall have contact rating of 2A @30V DC, 0.5 @125 VAC
4. The RM shall be addressed by means of dip switches.
5. The RM shall have LED for status indication.
6. The RM shall be loop powered.

Isolator Module/ Base:

Isolator module/ base shall be part of the loop. These modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is rectified, the isolator module shall automatically reconnect the isolated section. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

Addressable Zone Interface Module (ZIM):

1. The zone Interface module (ZIM) will facilitate connection of conventional detectors in the same circuit /loop consisting of addressable detectors.
2. The ZIM shall be capable of powering the detectors through the auxiliary source and shall supervise the IDC power supply.
3. The ZIM shall communicate alarm and troubles related to detector and power supply to the Panel.
4. The ZIM shall allow resetting conventional detectors from the panel.
5. The ZIM shall have LED status indication
6. The ZIM shall be capable to connect at least 16 Initiating Devices.

LPG detector:

The propane LPG gas detector is suitable for use with conventional fire detection control panel as well as addressable fire detection control panel that can accept conventional detector via zone module.
1. Advanced algorithms provide advanced detection, discrimination.
2. Stable gas sensing chamber .No adjustment or replacement required.
3. High immunity against unwanted alarms
4. Four wire system operation
5. Detector auto- reset once gas level fall below alarm threshold level
6. Internal reed switch for hush and test functions.
7. N/O alarm output
8.70dB internal sounder
9. Easy installation and not required any programming
10. Connect to zone module or monitor module for use addressable control and indicating equipments.

Beam Detector:

The Beam Detector Shall confirm to the relevant standards having the following features.

1. Shall have a Infrared transmitter and receiver in a single housing.
2. Shall have an interoperating Prism Reflector.
3. Shall supports from 5 meter to 100 meter in range.
4. Shall have an inbuilt LASER light for easy alignment with the reflector.
5. Shall have a adjust screws for precise alignment.
6. Shall have inbuilt Drift level compensation.
7. Shall have three levels of sensitivity threshold settings (i.e) 18%, 30%, 50%
8. Shall operates on the temperature of -25ºC to 55 ºC
9. Shall have Twin color LED, Healthy condition GREEN LED Blink on fire condition RED LED glow steady.
10. Shall operate on 24VDC power supply.
11. Shall have 4 wire detector.
12. Shall have a provision to connect the Response Indicator.

Intelligent Duct Smoke Detector:

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the FAC panel.

2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system

3. This design of the housing along with the detector technology is capable of detecting unsafe conditions by sampling the air through the duct. When the smoke is detected, it will gives a signal that will create the proper action to be taken to turn off circulating fans, blowers and any other auxiliary devices that are connected to the system through Fire Alarm Control Panel. The actions taken will enable the management of hazardous smoke through the entire space that is being protected by the duct detection arrangement.

4.This detector can be installed on any side of the duct. At velocities below 300ft./min the diverter model RE-428DU-DV (ordered separately) needs to be installed for normal operation. For velocities above 300ft./min the diverter is not required for normal operation.The venturi tubes are available in 4 lengths 1, 2, 5 and 9 ft (0.3, 0.6, 1.5 and 2.8 m).

MIMIC PANEL:

The mimic system uses flexible, LED guide to illuminate the areas on a floor plan. This unique system distributes completely with wiring and allows indicator to be moved, removed or added on site without the need for any wiring.
All indicators can be configured via zone grouping through the FACP. The Mimic panel shall be supplied with common LED s and Controls. The Common LED s are like Power On, Fire & Fault. Housed in attractive & slim enclosure to match AVANI fire alarm panel with high quality, full colour or monochrome floor plans.
Up to 512 LEDs can be controlled from AVANI FACP (Stand alone or Network)
Available in a range of standard enclosure to suit any application and Customized size can be made up on request.

Batteries:

(i) Battery shall have sufficient capacity to power the fire alarm system for not less half an hour in alarm condition and at least 24 hours in normal condition.
(ii) The batteries are to be completely maintenance free.
(iii)The batteries shall be of Lead acid type.

Ethernet (TCP/IP) module :

The Ethernet Module provides a communication between local network and fire alarm control panels using the RJ45 communication protocol. The user shall take a control over and monitor fire alarm panel from the local Personal computer. This central monitoring software shall install to maximum 4 personal computers and among them one PC shall be Configured as master who can control over the Fire Alarm Panel.

10/100M auto-sensing Ethernet mini card for embedded device networking. Ready-to-use TCP/IP firmware for fast integration.TCP Server & UDP driver operation modes.
Easy configuration with Web browser, serial console, Telnet console or Windows utility.

CMS Software:

- CMS software shall monitor and control maximum of 64 panels thru Local area network and Wide area network.
- All the panels in the network shall have a static IP address on Local Area Network.
- All the panels in the network shall have single public static IP address on Wide Area Network.
- The Bandwidth of the LAN or the WAN shall be of minimum 1Gbps.
- CMS shall be GUI based User Friendly Software
- CMS shall be able to identify the fire with location name as shown in the fire alarm control panels.
- CMS shall be able to identify the faults in the FACP.
- CMS shall have facility to program the location of the devices.
- CMS shall have the Event storage facility and printing facility of the events.
- CMS shall have configurable Visual and Sound Alerts for the fire and fault conditions
- CMS shall have Instant Pop-up alerts for any fire and Fault Events to override the

existing application on the screen.
- CMS shall have the acknowledgement facility.
- CMS shall get stored all the events in the networked panel.
- CMS shall have two Level of access Admin and User levels

GSM Module:

GSM Module Interface integrates with Analogue addressable Fire Alarm
Control Panel through the RS485 protocol. If any fire is detected in fire alarm control
Panel, text message will be sent to specified mobile number for fire condition with details of
Devices address and loop card. The mobile number shall be configured to GSM module
Through the Software.
Communication Interface: Addressable Panel to GSM Module via Rs485.
GSM Module to PC interfaces via Rs232.

- Quad Band GSM/GPRS : 850 / 900 / 1800 / 1900 MHz
- Built in SIM (Subscriber Identity Module) Card holder
- Notification includes location details
- Configurable notification on all or priority basis.
- Maximum of 10 mobile numbers can be configured through the GSM module software.

Network Control Station (**Graphical software**)

SCOPE:

- PC based graphical facilities monitoring system shall be installed in accordance to the project specifications and drawings.
- The PC based graphical facilities monitoring system shall include, but not be limited to, one or more PC based graphical workstations, all input/output devices, network communications media, control equipment, auxiliary control devices, power supplies, and wire / fiber optic media as shown on the drawings and specified herein.
- A supervised interface to fire alarm control panels shall be made available.
- The system shall employ an advanced technology network to monitor and control various fire, and other facility information over a Lon Works network.
- The system shall include an interface to digital alarm communicator receivers for wide area network monitoring.
- The system shall allow a mixture of different technologies and manufacturers' equipment to operate on the same network and provide the operator with a consistent look and operation for all monitored equipment.
- The system shall support a variety of topologies and media and shall provide an Industry standard open architecture transport layer protocol.
- Using standard RS 232 ports on existing and future monitoring and control systems used by the facility, the system shall connect to and interpret status change data transmitted from the ports and provide graphic annunciation, control, history logging and reporting as specified herein.
- Proprietary network systems that cannot interface to existing addressable fire alarm systems at the facility or systems requiring the use of a "dry contact" or "voltage monitoring" interface shall not be accepted.
- The system shall be electrically supervised and monitor the integrity of all

conductors.

WORKSTATION PERFORMANCE:

- The network will interface and report the individually monitored system's status via a User-friendly Graphical User Interface (GUI) based software workstation.
- The software shall operate under Microsoft® Windows® XP Professional as Manufactured by Microsoft Corporation.
- The GUI based software must be capable of graphically representing each facility being monitored with floor plans and icons depicting the actual locations of the various systems; and / or sensors' locations.
- The software shall use a 1024 X 768 GUI display capable of showing a large primary floor plan display, a key map representative of a larger view of the primary display and its relationship to the facility being monitored, the current operator, number of fire, supervisory, pre-alarms, troubles and events within the network as well as outstanding events and acknowledged events.
- The workstation shall have the ability to support graphic printing of all data including graphical floor plans, system activity, history, and guidance text. A Windows compatible printer shall be supported for the graphics and report printer options.
- The workstation software shall permit automatic navigation to the screen containing an icon that represents the system or sensor in the event of an off-normal condition.
- The system/sensor icon shall indicate the type of off-normal condition and shall flash and change to the color associated with the off-normal condition (e.g., RED for ALARM and YELLOW for TROUBLE).
- The software shall allow the attachment of text (TXT) files, sound (WAV) files, image (BMP) files and video (AVI) files to each system or sensor icon allowing additional information to be provided to the system operator for responding to the off-normal condition.
- The software shall allow the importation of externally developed floor plans in Windows Metafile (WMF), JPEG (JPG), Graphics Interchange Format (GIF) and Bitmap (BMP) format.
- The software shall provide auto-navigation to the screen containing the icon of any system or sensor when an event is initially annunciated. In addition, operator navigation to screens containing outstanding events shall be accomplished by "clicking on" the event from either the acknowledged or unacknowledged event.

History Manager:

The software shall contain a History Manager, which shall record all system events with a time and date stamp as well as the current system operator's name.

- The system shall provide for the ability to store all off-normal events experienced by the various sub-systems that are monitored by the system.
- All events shall be recorded with a time and date stamp and the system operator shall be provided with the ability to log a pre-defined response or a custom comment for each off-normal event and have that comment stored in the history file with the time, date and operator name.
- Provide for the ability to conduct searches and generate subsequent reports, based on all events for a single system / device address, a specific node, a specific type of off-normal condition and date range (mm/dd/yy to mm/dd/yy) or combinations of these search parameters. The number of entries in the history file

that match the determined search criteria will be displayed.

- The History Manager shall signal a need to back-up the history file at 100,000 events and then remind the operator at intervals of 100 events thereafter.
- It shall be possible to pre-select data fields for reporting and then saving the report as a template with a file name. It shall also be possible to schedule the pre-defined report to print at a designated time.

Alarm Monitoring :

The system shall provide for continuous monitoring of all off-normal conditions regardless of the current activity displayed on the screen.

- If an operator is viewing the history of a sub-system and an alarm condition should occur, the system shall automatically navigate to the graphic screen showing the area where the off-normal event is occurring.
- The system shall prioritize all off-normal events as defined by Underwriter's Laboratories into the following categories: fire alarms, troubles, supervisory alarms, pre-alarms and security alarms.
- The system shall display a running count of all events by type in an alarm event counter window. The event counter window shall include five counters, defaulted to Alarm, Trouble, Security, and Supervisory events.
- The system shall show a running list of all unacknowledged events and acknowledged events and allow the system operator to acknowledge an event by "double-clicking" on that event in the Unacknowledged Events box. The Unacknowledged and Acknowledged Events boxes shall contain an abbreviated description of the off-normal condition.
- The details of the condition may be viewed by selecting event in the unacknowledged events box.
- The system shall allow the attachment of user-definable text files, image files and sound files, to each device / system monitored in order to facilitate the operators and response personnel's response to the off-normal condition.
- The system shall record all events to the system's hard drive. A minimum of 100,000 events may be stored.

Reports & Logs:

- The system shall provide for the ability to generate reports based on system history.
- The system shall allow the system operator to enter custom comments up to 160 Characters for each event and have those comments recorded in the system's History file.

WORKSTATION:

- The system shall be a Facilities Monitoring System.
- The system shall operate on an UL listed Intel Pentium 4 processor operating at no less than 800 MHz on the Microsoft® Windows® XP Professional platform 7&8.
- The workstation shall have: no less than 512MB of RAM, a hard drive with no less than 50 Gigabytes of storage space, a minimum of 8 megabytes of video RAM, a CD-R/W for system backup, internal supervisory CPU watchdog board with audible annunciator, 100 Base-T Ethernet NIC card, a 104 key keyboard, and a mouse type pointing device.
- The workstation shall come equipped with all necessary gateway modules to allow connection to the network it monitors as standard equipment. All workstations shall support Ethernet communications when multiple workstations are required.
- The workstation shall support an SVGA monitor and be supplied with a 17" flat screen LCD monitor.

- The computer shall be capable of networking to additional computers and these Computers shall be capable of operating as workstations and/or gateways for local area or wide area networks.
- Alarm annunciation shall appear on all workstations and may be silenced at each local Workstation.
- Only one workstation and operator shall be in command of the system for global alarm acknowledgement at any time.

MONITORING NETWORK:

- The network shall have the ability to use fiber optic cable (single-mode and multi-mode), wire (twisted pair copper media in a style 4 or style 7 configuration), or combination wire/fiber communications with support of up to 32 nodes.
- Wire networks shall support 12 AWG, 1 Pair Shielded to 24 AWG, 4 Pair Unshielded
  following the manufacturer's guidelines.
- Fiber optic networks shall support 62.5/125µm cable 8dB limit (50/125µm cable 4.2dB limit).
- Wire to fiber conversions using repeaters.
- MONITORING NETWORK point Data speed to 12 Mbps on wire.

MODBUS:

The AFD shall communicate the Modbus protocol using the on board RS485 connection. The device shall be able to receive remote configuration as well as the monitored remotely. Shall give full status of all detectors, outputs & inputs for FACP available as RS 232 & RS 485 interface. It can be interface SCADA, IBMS etc.

Cables/conduits:

All cables/conduits to be laid on wall, ceiling and on the hangers wherever necessary and as directed by the authority with required hardware. The cables shall be armored PVC twisted 2 core 1.5 sq mm multi strand insulated, copper conductor, conforming to IS: 1554 and shall be of specified make. The cables shall be properly terminated and labeled.

LOCATION:

The location of the main fire alarm control panel shall an in an easily accessible position as well continuously monitored area.

Digital Alarm and Voice Evacuation System :

- This DSP based voice alarm and Public Address System. The System comprising router, Digital Amplifier and Power supply. This unit provides audio routing, full system control and fault Reporting functions. The Ekonics, router provides digital storage (4X30 second) or (2X60 second) DVA messages, four audio outputs and four MIC / line inputs. The router has a front panel display control interface for commissioning the system, fault monitoring an diagnostics.

- 4 or multiple of 4 audio inputs to any combination of 4 or multiple of 4 outputs.
- Full system control and fault reporting functions.
- 19" Rack mountable.
- All-call or zone paging facilty.
- Built-in 6 Programmable DVA messages.
- 40x4 LCD Display.
- USB 2.0 Interface for PC connectivity.
- 3 Levels of Password protection.
- 'All call' failsafe emergency evacuate alarm in the event of DSP failure.
- RS485 communication facility.
- Event log with RTC.
- User selectable digital filter, noise suppresser, attenuation for audio inputs.
- Zone wise volume control.
- Zone wise input priority level, permanent input, scheduled digital voice announcer.
- All field circuits are supervised.
- Rotary encoder for speed and user friendly operations.
- Analogue input interfaces : 8 Contacts
- Input Voltage : 24 VDC

Digital Amplifier:

Input Voltage: 24 VDC

Maximum DC Current: 10Amps

Maximum Watts: 125/250Watt

Operates on 220V, A.C supply.

Battery backup with built in charging.

Low battery visual warning with audible tone.

DC Output indication.

PA Ceiling Speaker:

- Flush mount 15cm dynamic cone speaker.
- Three field selectable power taps.
- ABS plastic grill with metal punched net.
- Easy to install with spring catch mount.
- Connectors with screw for hooking up the wires tightly.
- Protective dust cover at rear.
- The white color of the grill has been selected to be obtrusive in virtually all interiors.

- Power : 10W
- Toppings 100V line : 1.5W / 3W / 6W
- Sound Pressure Level : 92dB (1W,1M),Frequency : 60-15000Hz
- Material : ABS Plastic
- Dimensions: ø160 mm, H 70 mm.

PA Wall Speaker:

- Wall mounted with cone speaker for announcement and paging.
- Attractive, stylish ABS white plastic box.
- The specially designed slim speaker is obtrusive in all interiors.
- Equipped with the transformer to provide 100v line.
- Ideal for office cabin, work stations, classrooms, shops, malls etc.
- Optional Volume control.
- Music Power : 10W
- Impedance : 100V line
- Tapping's : 1.5, 3W, 6W
- Dynamic Cone Speaker : 1 X 12.5 CM
- Frequency : 60 - 15000Hz
- SPL@(1W/1M) : 90 dB
- Dimensions : (135 H X 190 L X 120D) mm

PA Horn Speaker:

- PA Horn has been provided with 100V line Matching Transformer with multiple taps easily selectable by changing the rotary switch at the rear of the sealed assembly. This is indoor/outdoor applications.
- Input Power :15W(RMS) 24W(Max)
- Taps : 2.5W, 5W, 7.5W, 10W, 12.5W, 15W
- Impedance : 100V Line
- Frequency Response : 275 - 7000 Hz
- Type : ABS Plastic
- Size : 205 ø (271 L)
- SPL @1Khz : 106dB

11. SPECIFICATIONS FOR P.A. SYSTEM

11.1 Scope of PA system:

The bidder should design an efficient **public address system** (**PA system**) showing exact position of each component like microphone, amplifier and loudspeakers in the blue print.

11.2 Stand Microphone for PA:

The microphone shall be a rugged dynamic cardiod goosneck microphone with good off – axis rejection for high gain before feedback and suppression of unwanted ambient noise It shall have On/Off switch with 3 pin XLR connector.

11.3 Audio Signal Processor for PA:

INPUTS	:	up to 16 Analogue; electronically balanced on Phoenix/Combicon removable screw connectors.
Mic/Line Inputs	:	Nominal gain 0dB, electronically switchable up to +48dB,in +6dB steps, input impedance 3.5kOhm
Maximum input level	:	+20dBu with 0dB input gain, (+8dBu with 12dB gain)
CMRR	:	>75dB at 1KHz
Equiv. Input Noise (EIN)	:	<-128dBu typ with 150 Ohms source Phantom power: 48V nominal, selectable per input
OUTPUTS up to 16 Analogue	:	electronically balanced on Phoenix/ Combicon removable screw connectors.
Maximum Output Level	:	+19dBu
Frequency Response	:	15Hz to 20KHz (+0.5dB/-1dB)
THD	:	<0.01% (20Hz to 20KHz, +10dBu output)
Dynamic Range	:	108dB typ. (22Hz to 22KHz un-weighted)
Crosstalk	:	<-75dB
CONTROL PORTS 12 inputs and 6 outputs		
Control Input Voltage	:	0 to 4.5v
Control Input Impedance		4.7kOhms to +5V (2-wire mode) >1MOhm (3-wire mode)
Logic Output Voltage		0 or +5V unloaded
Logic Output Impedance	:	440 Ohm
Logic Output Current	:	10mA source, 60mA sink
Withstanding voltage	:	80V maximum (Off)
Series Impedance	:	220 Ohms (isolated)
Mains Voltage :		85-
270V AC, 50/60Hz Power Consumption		:
<35VA		

11.4 Professional Grade CD player for PA:

Professional Grade CD Player cum Cassette Deck comprised of combination CD Player and auto reverse cassette deck, pitch control for dance and exercise studio, continuous play CD-to-tape and tape-to-CD, independent displays for CD and tape functions

CD Player		
Digital Filter	:	4-times oversampling
Sampling frequency	:	44.1 kHz
DA converter	:	16-bit linear/channel
Frequency response	:	10Hz – 20kHz + 0.5dB
Signal to noise ratio	:	90dB
Dynamic range	:	80dB
Total harmonic distortion:		0.02% (1kHz)
Cassette Deck		

Heads	:	Record/playback x 1 (rotary reverse), Erase x 1
Motor	:	DC motor
Wow and flutter	:	0.08%
Frequency response	:	50Hz – 15kHz + 3dB metal
Signal to noise ratio	:	69dB, dolby B NR ON

11.5 Cabinet Speaker/recess Mounted speaker for PA:

Cabinet speaker with 6W-30W-15W-60W RMS power housed in cabinet.

Specifications:

Woofer Size	:	6.5”
Tweeter Size	:	1”
100V Transformers Power Taps	:	60-30-15-6 watts
Impedance	:	16 Ohms
Low Impedance RMS Power	:	150W
Max SPL 1m	:	110 dB
Main construction material	:	ABS Plastic
IP Rating	:	64
Vertical Dispersion angle 1000Hz:		180 degree

11.6 AV system for lecture Theatre:

11.6.1 Wireless Handheld Microphones for AV systems.

Handheld transmitter shall have infrared datalink for set up with 50 mw output. It shall have built in charging contacts for charging. LCD display for frequency, group and hours of remaining battery life The receiver shall operate in two 30 Mhz band with 1200 frequencies with infra red link through which uploading of frequency and set up of data can be done quickly. It shall have two color backlit display for easy monitoring of all operating parameters and turns from green to red when a fault condition occurs. Specifications:

Carrier frequency range:		650 to 680, 680 to 710, 720 to 750,760 to 790, 790 to 820, 835 to 865
Audio Bandwidth	:	35 to 20000 Hz
T.H.D.	:	<0.3% at 1 Khz
S/N ratio	:	120 dBA
Selectable channels	:	1200

11.6.2 Wireless Collar Microphone for AV system.

Transmitter shall have infrared data link for set up with 50 mw output . It shall have built in charging contacts for charging. LCD display for frequency, group and hours of remaining battery life

The receiver shall operate in two 30 Mhz band with 1200 frequencies with infra red link through which uploading of frequency and set up of data can be done quickly. It shall have two color backlit display for easy monitoring of all operating parameters and turns from green to red when a fault condition occurs.

Specifications :

Carrier frequency range:		650 to 680, 680 to 710, 720 to 750,760 to 790, 790 to 820, 835 to 865
Audio Bandwidth	:	35 to 20000 Hz
T.H.D.	:	<0.3% at 1 Khz
S/N ratio	:	120 dBA
Selectable channels	:	1200

11.6.3 Stand Microphone for AV system.

The microphone shall be a rugged dynamic cardiod goosneck microphone with good off – axis rejection for high gain before feedback and suppression of unwanted ambient noise It shall have On/Off switch with 3 pin XLR connector.

11.6.4 Vocal Microphone for AV system.

Microphone shall be dynamic with a choice of three output modules, varimotion diaphragm, spring steel wire mesh grill.

11.6.5 Audio Signal Processor for AV system.

INPUTS	:	up to 16 Analogue; electronically balanced on Phoenix/Combicon removable screw connectors.
Mic/Line Inputs	:	Nominal gain 0dB, electronically switchable up to +48dB,in +6dB steps, input impedance 3.5kOhm
Maximum input level	:	+20dBu with 0dB input gain, (+8dBu with 12dB gain)
CMRR	:	>75dB at 1KHz
Equiv. Input Noise (EIN)	:	<-128dBu typ with 150 Ohms source Phantom power: 48V nominal, selectable per input
OUTPUTS up to 16 Analogue	:	electronically balanced on Phoenix/ Combicon removable screw connectors.
Maximum Output Level	:	+19dBu
Frequency Response	:	15Hz to 20KHz (+0.5dB/-1dB)
THD	:	<0.01% (20Hz to 20KHz, +10dBu output)
Dynamic Range	:	108dB typ. (22Hz to 22KHz unweighted)
Crosstalk	:	<-75dB
CONTROL PORTS 12 inputs and 6 outputs		
Control Input Voltage	:	0 to 4.5v
Control Input Impedance		4.7kOhms to +5V (2-wire mode) >1MOhm (3-wire mode)
Logic Output Voltage		0 or +5V unloaded
Logic Output Impedance	:	440 Ohm
Logic Output Current	:	10mA source, 60mA sink
Withstanding voltage	:	80V maximum (Off)
Series Impedance	:	220 Ohms (isolated)
Mains Voltage 50/60Hz	:	85-270V AC,
Power Consumption	:	<35VA

11.6.6 Professional Grade CD player cum Cassette Deck for AV system.

Professional Grade CD Player cum Cassette Deck comprised of combination CD Player and auto reverse cassette deck, pitch control for dance and exercise studio, continuous play CD-to-tape and tape-to-CD, independent displays for CD and tape functions

CD Player		
Digital Filter	:	4-times oversampling
Sampling frequency	:	44.1 kHz
DA converter	:	16-bit linear/channel
Frequency response	:	10Hz – 20kHz + 0.5dB
Signal to noise ratio	:	90dB
Dynamic range	:	80dB
Total harmonic distortion:		0.02% (1kHz)
Cassette Deck		

Heads	:	Record/playback x 1 (rotary reverse), Erase x 1
Motor	:	DC motor
Wow and flutter	:	0.08%
Frequency response	:	50Hz – 15kHz + 3dB metal
Signal to noise ratio	:	69dB, dolby B NR ON

11.6.7 Three-Way Loudspeaker only for AV system.

Frequency Range1 (-10 dB)	:	41 Hz to 17 kHz
Frequency Response1 (±3 dB)	:	49 Hz to 15 kHz
Coverage Pattern	:	60° x 40°
Directivity Factor (Q)	:	22.4
Directivity Index (DI)	:	13.5 dB
Crossover Modes	:	Tri-amp/Bi-amp (passive mid-high) switchable
Passive Crossover2	:	6th order (36 dB/oct) Linkwitz-Riley HP & LP, 1.5 kHz
Transducer Power Ratings LF	:	1600 W (6400 W peak), 2 hrs. 1200 W (4800 W peak), 100 hrs
(AES)3	:	MF: 350 W (1400 W peak), 100 hrs
HF: 75 W (300 W peak), 2 hrs		
Long-Term System Power		LF: 1200 W (4800 W peak)
Bi-amplified Passive Mode		
Rating (IEC)4		M/HF: 300 W (1200 W peak), 100 hrs
Maximum SPL5	:	Tri-amp mode: LF: 128 dB-SPL cont avg (134 dB peak)
MF: 135 dB-SPL cont avg (141 dB peak)		
HF: 135 dB-SPL cont avg (141 dB peak)		
Passive mode	:	135 dB-SPL cont avg (141 dB peak)
System Sensitivity6 (1W @ 1m)	:	Passive Mode: 110 dB-SPL (mid/high section only)
Low Frequency Driver	:	2 x 2206H 300 mm (12 in) driver with 100 mm (4 in) voice coil
Nominal Impedance	:	4 ohms (2 x 8 ohms, internally wired in parallel)
Sensitivity6 (1W, 1m)	:	96 dB-SPL
Mid Frequency Driver	:	CMCD-82H cone midrange compression driver with integral 200 mm (8 in) Differential Drive® dual 75 mm (3 in) voice coil driver
Nominal Impedance	:	8 ohms
Sensitivity6 (1W @ 1m within Operaional Band)	:	110 dB-SPL
High Frequency Driver	:	2431H, 38 mm (1.5 in) exit compression driver with 75 mm (3 in) voice coil
Nominal Impedance	:	8 ohms
Sensitivity6 (1W @ 1m)	:	116 dB-SPL

11.6.8 Line Array Speaker for AV system.

Extended Line Array 30W column speaker with extended listening area, better intelligibility with speech and music, uniform distribution of natural sound throughout the room, excellent directivity for use in acoustically difficult reverberant applications, ultra slim housing, voice evacuation complaint as standard Specifications :

Specifications :

Maximum power	:	400W Peak @ 8ohms

Rated power	:	100W @ 8 Ohms
Coverage Pattern	:	Vertical 20° (1.5 kHz - 16 kHz, ±10°)
	:	Horizontal 150°
Sensitivity (2.83V@ 1m)	:	93 dB (SPL)
Effective frequency range (-10dB)	:	80 Hz to 20 kHz
70V/100V Transformer Taps	:	60W, 30W, 15W, (7.5W at 70V Only)

11.6.9 Cabinet Speaker for AV system.

Cabinet speaker with 6W-30W-15W-60W RMS power housed in cabinet.

Specifications:

Woofer Size	:	6.5”
Tweeter Size	:	1”
100V Transformers Power Taps	:	60-30-15-6 watts
Impedance	:	16 Ohms
Low Impedance RMS Power	:	150W
Max SPL 1m	:	110 dB
Main construction material	:	ABS Plastic
IP Rating	:	64
Vertical Dispersion angle 1000Hz:		180 degree

Sound System for Arena and Broadcast System for Complete Building, Car Calling System

11.7 Network Controller

The network control unit shall be able to routes up to 28 simultaneous audio channels, delivers power to the system, reports faults and controls the system. Audio inputs can be announcements from call stations, background music or local audio. The configuration can be done comfortably and efficiently via a PC. The network controller shall have four analog audio inputs.

11.7.1 Features:

Public Address and Emergency Sound System Control Unit
Fully Digital with Four Audio Inputs and Four Audio Outputs
Control and routing of 28 audio channels
Eight supervised control inputs and five control outputs
Ethernet interface for configuration, control, diagnostics, and logging
Digital storage for prerecorded messages
Stores the last 200 fault events

11.7.2 Controls and Indicators Front

2 x 16-character LCD display
Rotary/push button

Back

Mains switch
Voltage selector
Interconnections
Front
Headphone output
Back
Mains input
Battery backup input
Eight control inputs
Two analog audio mic/line inputs
Two analog line audio inputs

Five control outputs (two dedicated fault)
Four analog audio line outputs
Ethernet
RS 232
Two system network connections

11.8 Call Station Basic

Call station is used to make manual or pre-recorded announcements to any pre-assigned zones or to executing pre-defined actions. The call station basic has a microphone on a flexible stem to transmit speech over the network, one push-to-talk button and a headset socket.

Features:

Redundant network connection
Power 'ON' indication Status/fault indications
Supervision of microphone capsule
The call station keypad is used in combination with the call station basic to make manual or prerecorded announcements to any assigned zones, to select the zones or to execute pre-defined actions.
8 freely programmable selection keys
Each key on the call station keypad has one 2-color LED
The keys of the call station keypad can be programmed for momentary or toggle operation

11.9 Car calling station

Car calling station shall have a flush mount microphone with heavy duty press to talk switch, clear busy indication, connected via CAT-5 cable.

11.10 Mixer

Frequency Response	:	+/-0.5dB, 20Hz-30kHz
THD	:	<0.009% @ 1kHz
Noise	:	-129dBu
Crosstalk		
Channel Mute	:	> 96dB
Fader Cut-off	:	>90dB
Routing Isolation	:	> 90dB
Aux Send Pots Offness	:	> 84dB
EQ		
HF	:	12kHz, +/-15dB, Q=1.5
MF	:	240Hz-6kHz, +/-15dB
LF	:	80Hz, +/-15dB, Q =1.5
Power Consumption	:	42W

11.11 Remote Car Call station Interface

Remote Call station interface shall work as an interface between remote call station and main controller. It shall have built in DSP circuit for audio processing function

11.12 Horn Loudspeaker

Horn Loudspeaker shall have 15W RMS housed in weatherproof IP 65 Housing. Frequency response 500 Hz to 5 Khz. SPL 103 dB.

11.13 Amplifier

Frequency Response (at 1 watt, 20 Hz – 20kHz)	:	±0.25 dB.
Signal to Noise Ratio below rated		105 dB A-weighted.
Total Harmonic Distortion (THD) < 0.1%. CTs 2000/3000 <		at full rated power, from 20 Hz to 20 kHz:

0.35%.

Damping Factor	:	10 Hz to 100 Hz: > 3000.
Crosstalk (below rated power, 20 Hz to 1 kHz)	:	> 80 dB
Common Mode Rejection (CMR) (20 Hz to 1 kHz)	:	50 dB.
DC Output Offset	:	< 2 mV.
Input Impedance (nominal) balanced, 5 kilo ohms unbalanced.	:	10 kilo ohms
Maximum Input Level dBu absolute maximum.	:	+20 dBu before input compression, +32
Load Impedance Bridge Mono: 4/8/16 ohms, 140V.	:	Stereo: 2/4/8/16 ohms, 70V.

11.14 Digital Amplifier

The amplifier shall be digital class D amplifier for low power consumption and better sound quality, built in Digital signal processing like 3 section parametric equalization, automatic volume control, 2x 16 character LCD display for status information.

Specifications :

Frequency response for input	:	-3 dB at 50 hz and 20 Khz
S/N ratio for audio input	:	>87 dB
CMMR	:	> 40 dB at 1 Khz

12. Surveillance Closed Circuit Television (CCTV) System

The requirements of security system vary as per employer requirement along with its geographical location. Scope of this report highlights security system for Common areas only. The security system proposed for Common area is very minimum amount in the following form:

Following spaces in college shall be provided with cameras:

- Main entrance
- Reception
- Lift Lobby
- Parking Zone
- Staircase
- Fire Exit
- Corridor
- All other public areas.

The security console shall be located in the centralized security room. This room shall have no windows. Ample space shall be provided to view monitors. Digital NVR based CCTV camera system that shall give monitoring team flexibility in viewing the images from multiple locations. Care shall be taken to ensure that the number of displays per screen is limited so that “individuals” can be recognized when viewing the display in all areas.

Table 12.1:

Standalone Network Video Recorder

1	Type	Rack-mountable, Dedicated Network Video Recorder with suitable hardware to connect up to 100 IP cameras (minimum) can be expanded upto 250 CHANNELS with N+1 redundancy. The N+1 configuration has been mentioned to achieve redundancy as in when 01 NVR fails the other should serve as standby for main NVR. In the event of failure of primary NVR(s), the recording should switch over to this redundant NVR) offered storage is not an externally attached device to NVR, the total recording storage requirement shall be met through internally installed HDD itself. The bidder to submit the storage analysis for required no of cameras for a period of 90 days @30fps on minimum 1080P resolution. All channels must support recording resolution of 1080p@30fps. In 250 channel configuration, the NVR should support recording resolution of 720p@30fps (ii) Additional hardware/ software/ license, if any required by the bidder to meet its offered solution, should be considered accordingly by the bidder in its offer. The redundant NVR shall be equipped with same hardware and storage capabilities as is being offered for Primary NVR
2	Storage Capacity	Each NVR storage unit should be provided with usable 24 SATA HDD slots from day one after RAID 5 configuration , with provision of future expansion minimum 24 SATA HDD slots using additional expansion slots or SAS
3	Fault Tolerance	RAID-5 or better
4	Network Connections	Dual Gigabit Ethernet (RJ-45 port) – 10/100/1000 Mbps.
5	Operating System	Linux or Embedded or Microsoft
6	Memory	Minimum 8GB DDR3
7	Video Compression	H.265, H.264, MJPEG/MPEG
8	Recording Support	The offered NVR must be able to support simultaneous recording of 120 + IP cameras at 1080p resolution at 25/30 fps
9	No. of playback streams	minimum 120
10	Throughput	Suitable for meeting the intended recording and simultaneous 120 + camera playback requirements (Minimum 1Gbps)
11	Recording Resolution	4K, 5MP, 3MP, 1080P, 720P, 960H, D1
12	Network Protocol Support	HTTP/HTTPS, TCP/IP, RTSP, UDP, NTP, DHCP, IPC Search
13	On-board diagnostics	Web based support for system configuration & Diagnostics
14	Minimum	• Minimum 500Mbps incoming bandwidth and 500Mbps outgoing

	Function / Features	bandwidth • Up to 128 channels 1080P @ 4Mbps, 256 channels 720P @ 2Mbps real-time recording • 24 bay HDDs, up to 192TB storage with SATA interface • Hardware RAID 0, 1, 5, 6, 10, to protect video data • N+1 redundancy to ensure continuous operation • Support SAS to expand storage space, up to 192TB • ONVIF Profile S Conformance • Network failure recovery (NFR) function between IP cameras (with edge storage) and NVR to minimize the risk of video loss • Intelligent event-trigger recording and alarm linkage, flexible schedule alarm configuration • Remote IP camera setup and image enhancement • Automatic IP search and "One-Click" IP camera import • Disk space quota for different IP cameras to help store critical video for longer time • E-signature (watermark) verification by ONVIF Player to protect against video tampering
15		• Dual Ethernet bonding supports three work mode: Standalone, Failover, Load balance • Redundant power supply • Virtual Disk for more flexible disk management • Defog function reduces blurring and improves image clarity • Electronic Image Stabilizer (EIS) minimizes blurring and compensates camera shaking to deliver improved image quality • Hot swap technology for quick and easy HDD replacement
16	Accessories	Under bidder's scope: All required cables, connectors & interfaces, mounting arrangement, software's etc. for successful installation, commissioning of NVR and integration of the same with existing IAF LAN
17	Document ation	Installation guide, Operation & Maintenance Manuals, Installation CD/DVD for licensed software
18	Input Voltage	100~240 V AC, 50/60 Hz. Dual Power. Any power converter that is required to power the NVR has to be supplied by Bidder.
19	Compatibility	The supplied NVR must be compatible in all respects to the cameras being supplied at the locations
20	Power Consumption	Bidder to specify
21	Operating temperature	10°C ~ 40°C or better
22	Operating Humidity	20% to 80% RH, non-condensing
23	HDD	Hot swap, 24 bays SATA HDD, up to 128TB storage, 1 SAS up to 192TB
24	Product Safety	To comply with CE, FCC, UL
25	Details required with offer	Bidder to submit the details of complete offered solution (Item make, model/part code, block diagram etc.) as stated above along with the offer
VMS		
26	LICENCE	Video license Extension Package: IP video channel extension package, each package supports additional 100 channels IP video

27	HUS-NVR	Network Video Storage : 128CH @ 1080P / 256CH @ 720P HUS NVR, 24 HDDs max 144TB, RAID, Hot Swap, 1 SAS, 2 1000M Ports, ONVIF, N+1 Redundancy, NFR with Camera, Dual Power
Dome Camera		
28		IP Network TDN Low-Light IR Indoor Dome Camera, 1/2.7" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.01 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.7–12 mm motorized focus & zoom lens, BLC, HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 50m IR distance, Dual channel Audio G.711a/G.711u/AAC, 128GB SD card support, Alarm: 2 In/ 1out, PoE, H.264 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –30°C to 50° C. Certifications: ONVIF Profile S & Profile G compliant, UL, CSA 60950-22, CE (EN 50130-4 & EN 55022) , FCC Part 15 & RoHS compliant.
Bullet Camera		
29		IP Network TDN Low-Light IR Bullet Camera, 1/2.7" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.01 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.7–12 mm motorized focus & zoom lens, BLC, HLC, 3DNR, Privacy Mask, 4 IR LEDs Smart IR with upto 60m IR distance, Dual channel Audio G.711a/G.711u/AAC, 128GB SD card support, Alarm: 2 In/ 1out, PoE, H.264 High Profile and MJPEG, PoE Class 3 and 12V DC, IP 67, IK 10 vandal proof, Having Operating temp range : –40°C to 60° C. Certifications: ONVIF Profile S & Profile G compliant, UL, CSA 60950-22, CE (EN 50130-4 & EN 55022) , FCC Part 15 & RoHS compliant.
Display		
30		Screen Size Class (diagonal) 42" Class (41.9" diagonal) Resolution 1920 x 1080p Refresh Rate TruMotion 120hz. Aspect Ratio 6 Modes (16:9, Just Scan, Original, 4:3, Cinema Zoom, Zoom) Just Scan (1:1 Pixel Matching) HDMI: 1080i, Component: 1080p, RF 720p. HDMI™/HDCP In 2 (1 rear, 1 side) USB 3.0/2.0 In 1 (side) Digital Audio Out (Optical) 1 (rear) RS-232C (Control & Service) 1 via 3.5mm mini jack (rear)
Work Station for monitoring		
31		Highend workstation for monitoring all cameras from multiple locations, minimum configuration as below. Intel Core i5 processor 3.33 Ghz or higher, 8Gb DDR3 SDRAM, 2gb nvidia Geforce GT 710 or higher graphics card, With Wifi, USB 3 ports, Keyboard, Mouse, Monitor

13. SPECIFICATIONS FOR IT NETWORK SYSTEM & TELEPHONE SYSTEM

13.1 Scope:

The objective of this report is to give an overview of services designed for the proposed medical college.

The scope of design is in the areas:

Local Area Network
(LAN) Wireless
Network Access
Telephone &
Closed Circuit Television (CCTV),
CATV Network

Contractor shall supply & install conduit & wiring including I/O box, Faceplate etc. complete as required.

13.1.1 IT Network & IT rooms including high speed internet service.

The bidder should design an efficient computer network, Including sufficient Infrastructure for LAN and Web Connectivity IT rooms and data closets/Rooms, IT Sockets with networking for providing Inter-building Connectivity and Intra Building Web Connectivity to Lecturers and Staffs.

Horizontal and Vertical Distributions for LAN, Wireless Network Access and WAN.

13.1.2 Telecommunications service:

The bidder should design a suitable capacity telecommunication / EPABX system showing actual position of all equipment such as telephone with intercom floor wise in the blue print.

13.1.3 Video Conferencing:

Design a HD video conferencing system suitable for real-time interactive communication. Actual position each component like Definition Video Conferencing Codec, Eagle Eye 1080 Camera and license, Microphone array, presentation sharing to remote sites, Infrared Remote control & standard cables should be shown in the drawings.

13.1. 4 General Criteria:

1) All products must be supported with 3 years on site back to back warranty support from OEM. A declaration in this regard must be submitted in the letter head of OEM for this project.
2) Specifications given in the RFP are minimum, bidder may propose any higher specification to suit the purpose.
3) All active product (i.e. switch, IPEPABX, CCTV, Server) should be enterprise Grade.
4) Separate Online UPS (2nos with 100 % redundancy) must be provided for Sever / BMS room for ELV system for continuous UPS power supply. One UPS will serve as backup in case of Other's failure. Minimum 30 min. backup with 100 % load of entire IT system shall be provided for every UPS.

TABLE 13:

OEM Qualification Criteria:

1	The OEM should have office in Kolkata.
2	The OEM of the equipment's quoted for should be profitable in the last 3 consecutive financial Years.
3	The OEM of the equipment's quoted for should have a minimum of 10 custom paid spare depots in India (one of which must be in Kolkata) to support failure of equipment's.
4	The OEM should support next business day delivery against defective spares in major locations in India. OEM should have 24x7x365 support in India
5	The OEM should support registered office in India at least from last 10 Years.
6	The Network Solution i.e. Core and Access Switches should be from single OEM. This is done to have better integration between all products. The OEM must be in latest report of the Gartner's leaders or challengers quadrant for Wired and Wireless LAN. Documentary evidence for the same should be provided.
	The IP EPABX solution should be from single OEM. The OEM must be in latest report of the Gartner's leaders or challengers quadrant for Unified Communication. Documentary evidence for the same should be provided.
7	The Physical Security Solutions i.e. Video Surveillance Software, IP Cameras should be from single OEM. This is done to have better integration between all products.
8	The OEM shall have certification ISO 9001:2000 & ISO 14001.
9	OEM should have at least one reference in India of Integrated physical security system with video surveillance system having minimum deployment of 200 cameras for Campus Surveillance.

13.1.5 Broad concept of services:

The services systems for the project have to be conceptualized based on existing experience and acceptable international design standards. Effort shall be made to conceal all services a n d still provide access to these for accommodating c h a n g e s in t h e future. Conservation of energy, optimization of resources, eco-friendliness and state of the art technology shall be the key factors in the design concept to ensure least downtime and reduce maintenance problems.

Every effort shall be made to design, layout and install equipment in locations that will tend to encourage routine preventive maintenance by providing easy access for operation personnel. Manual isolation will be provided to enable servicing, expansion or renovation of any part of the system without interrupting the services in adjacent areas.

13.1.6 METHODOLOGY OF LAN / TEL DESIGN FOR WB MEDICAL COLLEGES

Primarily, it would be considered all the medical college as one unit. Then the connectivity solution becomes easier to understand. An important factor in the connectivity is linking of each medical college to the **S**tate **W**ide **A**rea **N**etwork (SWAN). This makes it imperative that the data and voice (computer and phone) connections are IP based.

Therefore, each medical college will have an IP Exchange. This does not mean that normal phone calls are not possible. With the SWAN infrastructure in place, it means that the medical college can call each other without incurring any recurring expenses. In fact the medical college may call any office or administration connected to the SWAN without incurring subscriber charges.

Another advantage of an IP network is the great decrease in the local infrastructure costs. Since there will be only one IP network; a separate phone line infrastructure will not be necessary.

13.1.7 THE IP INFRASTRUCTURE

- Each medical college will have a Fiber Optic Backbone with redundancy
- Each floor will have the termination / computer points connected to switches placed in Network Enclosures on each floor
- These Enclosures will be in turn connected to the Fiber Optic Backbone
- The Backbone will be terminated / originated from the Server Room / Data Centre of each hospital
- The Server Room / Data Centre will have the provision for locating the following equipment in individual Network Enclosures Servers Switches Passive Components
- E P A BX : Adequate Backup for Points and Power need to be provided

13.1.8 THE END POINT INFRASTRUCTURE

The End Pont Infrastructure begins at the end of the points provided by the IP Infrastructure. These shall consist of the following equipments:

⇒ Servers – for Email and Internet

⇒ Terminals – For accessing the HMIS

⇒ Printers.

These are some of the basic points on which the whole IT Infrastructure will grow on.

13.1.9 LAN

OBJECTIVE

The objective shall be to provide infrastructure provisions for LAN and telecommunication backbone within each room or occupied area for data and voice transmission.

Ethernet is standardized as IEEE 802.3. The combination of the twisted pair versions of Ethernet for connecting end systems to the network, along with the fiber optic versions for site backbones, is the most widespread wired LAN technology.

SYSTEM DESCRIPTION

LAN points will be provided on a need basis. It will be structured with

- Rack Mounted Layer 2 Switches & Core Switches.
- Cat#6a Mounting Chords.
- Cat#6a Patch Panels.

- Cat#6a Horizontal Cables.
- Cat#6a Input / Output Point (Box).
- Cat#6a Patch Chords to the NIC of the PC.

The switches will have uplink ports as and where necessary. The cabling termination will be done by IEEE 568B standards.
All points will be duly marked and numbered especially for future MAC (Moves, Additions & Changes)

These cables shall run in dedicated low voltage conduits, away from electrical cables, to avoid any electromagnetic interference.

The following shall be used for carrying wires / cable: -

- PVC conduits wherever the conduit runs exposed in ceiling or chased in wall.
- HDPE conduits for external, underground laying of OFC
- Wire mesh cable tray for carrying multi-conductor cables.

13.2 ELV Schedule:

Note 1:

The proposed ELV Schedule as furnish below may be changed as per Employer requirement.

TABLE 2:

ELVS SCHEDULE For Medical college campus in West Bengal										
(Tentative Area Programme of Medical college)										
S. No	**Facility**	**ELV system for Academic Block**								**Remarks**
		PA System for Fire Evacuvation	**CCTV System**	**ETBS System**	**Audio Visual system for Lecture Hall**	**IT Network Data Point**	**IP - Telephone System**	**CATV System**	**Wi-fi system**	
						No. of Points for Location				
1A	**ADMINISTRATIVE BLOCK**							NA		
	Principal office	N	N	N	N	2	2			

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						No. of Points for Location				
	Staff room	A	A	A	A	5	5			
	College Council room					2	1			
	Officer Superintendent room					2	1			
	Office					24	24		✓	
	Record room					1	1			
	Common room - Boys & Girls					2	2			
	Cafeteria						1			
	Examination room					1	1			
	Central Library					8	1		✓	
	Lecture Theatres (120 Seating Capacity)				✓	5	1		✓	
	Lecture Theatres (250 Seating Capacity)				✓	5	1		✓	
	Common Laboratories					1	1		✓	
	Common Laboratories					1	1		✓	
	Central Research Laboratory					1	1		✓	
	Central Photographic Section				NA	1	1			Not provided in MCI
	Medical Education Unit					1	1			
	Enrty to the Building					2	2			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							

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						No. of Points for Location				
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
	Stilt floor car parking	✓	✓							
1B	**DEPARTMENT BLOCK**									
A	**ANANTOMY**									
	Demonstration room	NA			NA	1	1			
	Dissection Hall					1	1			
	Museum					1	1			
	Embalming room					1	1			
	Storage Tanks									
	Storage Tanks									
	Cold Storage room									
	Histology Lab					1	1			
	Preparation room									
	Research Lab					1	1		✓	
	Museum - Preparation rooms					1	1			
	Department Library					1	1			
	Staff Accommodation									

ELVS SCHEDULE For Medical college campus in West Bengal										
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						No. of Points for Location				
	Professor & Head					2	1			
	Asso. Prof/ Reader					2	1			
	Asst. Prof/ Lecturer					2	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
	Stilt floor car parking	✓								
B	**PHYSIOLOGY INCLUDING BIOPHYSICS**									
	Demonstration room	NA			NA	1	1	NA		
	Amphibian Lab					1	1			
	Preparation room									
	Mammalian lab									
	Preparation room									
	Human Lab - Haematology									

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						No. of Points for Location				
	Preparation room									
	Clinical Physiology Lab					1	1			
	Department Library					6	1			
	Research Lab					2	1		✓	
	Staff Accommodation									
	Professor & Head					2	1			
	Asso. Prof/ Reader					2	1			
	Asst. Prof/ Lecturer					2	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
C	**BIOCHEMISTRY**									
	Demonstration room				N A	1	1			
	Practical Class room	NA				1	1			
	Ante room									

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						No. of Points for Location				
	Department Library					1	1			
	Research Lab					1	1			
	Staff Accommodation									
	Professor & Head					2	1			
	Asso. Prof/ Reader					2	1			
	Asst. Prof/ Lecturer					2	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
D	**PATHOLOGY**									
	Demonstration room	NA			N A	1	1			
	Museum					1	1			
	Practical Labs					1	1		✓	
	Preparation room									
	Service Laboratory					1	1			

ELVS SCHEDULE For Medical college campus in West Bengal										
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		PA System for Fire Evacuvation	**CCTV System**	**ETBS System**	**Audio Visual system for Lecture Hall**	**IT Network Data Point**	**IP - Telephone System**	**CATV System**	**Wi-fi system**	
						No. of Points for Location				
	Balance room					1	1			
	Store room					1	1			
	Special room for High Centrifuge					1	1			
	Wash									
	Autopsy Block									Shall be planned as a Separate Block
	Department Library					1	1		✓	
	Research Lab					1	1		✓	
	Staff Accommodation									
	Professor & Head					2	1			
	Asso. Prof/ Reader					2	1			
	Asst. Prof/ Lecturer					2	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	

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						No. of Points for Location				
	Fire Stair case	✓	✓	✓						
E	**MICROBIOLOGY**									
	Service Laboratories	NA			NA	1	1	NA		
	Museum					1	1			
	Demonstration room					1	1			
	Practical Lab					1	1			
	Preparation room									
	Media Preparation & Storage					1	1			
	Autoclaving									
	Washing & Drying									
	Department Library					1	1		✓	
	Research Lab					1	1		✓	
	Staff Accommodation									
	Professor & Head					1	1			
	Asso. Prof/ Reader					1	1			
	Asst. Prof/ Lecturer					1	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			

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S. No	**Facility**	**ELV system for Academic Block**								**Remarks**
		PA System for Fire Evacuation	**CCTV System**	**ETBS System**	**Audio Visual system for Lecture Hall**	**IT Network Data Point**	**IP - Telephone System**	**CATV System**	**Wi-fi system**	
						No. of Points for Location				
	Corridor	✓	✓			5			5	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
F	**PHARMACOLOGY**									
	Demonstration room	NA			NA	1	1	NA		
	Museum					1	1			
	Practical Labs					1	1			
	Preparation room									
	Department Library					6	1		✓	
	Research Lab					1	1		✓	
	Staff Accommodation									
	Professor & Head					1	1			
	Asso. Prof/ Reader					1	1			
	Asst. Prof/ Lecturer					1	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	

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		PA System for Fire Evacuation	**CCTV System**	**ETBS System**	**Audio Visual system for Lecture Hall**	**IT Network Data Point**	**IP - Telephone System**	**CATV System**	**Wi-fi system**	
						No. of Points for Location				
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	
	Lift lobby	✓	✓							
	Fire Stair case	✓	✓	✓						
G	**FORENSIC MEDICINE INCLUDING TOXICOLOGY**									
	Demonstration room	NA			NA	1	1	NA		
	Museum					1	1			
	Practical Lab					1	1			
	Department Library					1	1		✓	
	Research Lab					1	1		✓	
	Staff Accommodation									
	Professor & Head					1	1			
	Asso. Prof/ Reader					1	1			
	Asst. Prof/ Lecturer					1	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	

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						No. of Points for Location				
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
H	**COMMUNITY MEDICINE**									
	Museum	NA			NA			NA		
	Demonstration room					1	1			
	Practical Lab					1	1			
	Department Library					6	1		✓	
	Research Lab					1	1		✓	
	Staff Accommodation									
	Professor & Head					1	1			
	Asso. Prof/ Reader					1	1			
	Asst. Prof/ Lecturer					1	1			
	Statistician cum Lecturer					1	1			
	Epidemiologist cum Lecturer					1	1			
	Tutor/ Demonstrator					1	1			
	Dept Office/ Clerical Room					1	1			
	Non Teaching staff room					1	1			
	Corridor	✓	✓			5			✓	
	Staircase	✓	✓							
	Main Entrance	✓	✓			3	3		✓	

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						No. of Points for Location				
	Lift lobby	✓	✓						✓	
	Fire Stair case	✓	✓	✓						
2	**ANIMAL HOUSE**									NOT PROVIDED IN MCI
	Lobby						1			
	Change/ Lockers									
	Toilet									
	Laboratory/ Sterile Store									
	Staff room/ Doctors room					1	1			
	Operation Theatre					1	1			
	Animal rooms				NA					
	Feed Room									
3	**CENTRAL WORKSHOP**									
	Lobby						1			
	Bio-Medical Engineers room					1	1			
	Instruments repair area/ Workshop area					1	1			

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						No. of Points for Location				
4	**GYMNASIUM**									
	Lobby						1			
	Change/ Lockers									
	Toilet									
	Carrom/ Chess room									
	Gym room (Tread Mill, Cycling, Work area)									
5	**AUTOPSY BLOCK**									
	Lobby/ Reception						2			
	Office / Staff room/ Doctors room					1	1			
	Demonstration room									
	Autopsy room				N A			N A		
	Cold room									
	Store									
	Toilet									

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						No. of Points for Location				
6	**HOSTEL**									
	U.G Hostels (Boys & Girls)									500 Students
	PG cum Interns Hostel (Boys & Girls)									200 Students
i	Lobby						1			1 no of telephone in each floor
ii	Student room									
iii	Visitor room/ Care taker room						1			1 no of telephone
iv	Study room (With Computer & Internet)									
v	Common Toilet (WB/ WC/ Bath)									
vi	Dining room									
vii	Recreation room							1		
viii	Service room									
	TOTAL (HOSTELS)									
7	**QUARTERS**									
	Superintendent / Principal Housing									
i	Lobby									
ii	Living room/ Family room									
iii	Kitchen							1		

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						No. of Points for Location				
iv	Bed room -1						1			
v	Bed room -2									
vi	Bed room -3									
vii	Toilets (WB/WC/Bath) (Common/ Attached)									
	Doctors Quarters									
i	Lobby									
ii	Living room/ Family room						1	1		
iii	Kitchen									
iv	Bed room -1									
v	Bed room -2									
vi	Bed room -3									
vii	Toilets (Common/ Attached)									
	Paramedics/Admin. Staff Quarters									
i	Lobby									
ii	Living room/ Family room						1	1		
iii	Kitchen									

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						No. of Points for Location				
iv	Bed room -1									
v	Bed room -2									
vii	Toilets (WB/WC/Bath) (Common/ Attached)									
	Nurse Quarters									
i	Lobby									
ii	Living room						1	1		
iii	Kitchen									
iv	Bed room -1									
v	Toilets (WB/WC/Bath) (Common)									
	SUB TOTAL (QUARTERS)									
	ADDING 27% FOR WALLS, CIRCULATION, WAITING LOBBIES, CORES, STAIRWELLS, AHU'S, ELECTRICAL ROOMS, LIFT MACHINE ROOMS ETC.,									

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						No. of Points for Location				
	GRAND TOTAL (QUARTERS)									
8	**SERVICE BUILDINGS**									
	UG Sump & Pump Room, Electrical Sub station, Transformer Yard, HVAC Plant room						1	N A		**One telephone for each service building**

13.3 Specification for IP based Telephone system:

Sr. No.	Required Minimum Specifications
A	**IP Telephony System**
1	The IP telephony system should be a converged communication System with ability to run TDM and IP on the same platform using same software load based on server and Gateway architecture. The OEM should be in the Gartner magic quadrant.
2	The system should be capable of supporting analog and IP Telephones. The single IP EPABX system should be scalable to support up to 3000 stations to achieve the future capacity.
3	All the users to be managed in a single database, which is managed centrally, no multiple databases. CLI facility for all users should be provisioned from day 1.
4	The system should be based on server gateway architecture with external server running on Linux OS. No card based processor systems should be

	quoted.
5	The voice network architecture and call control functionality should support both SIP & H.323.
6	The call control system should be fully redundant solution with no single point of failure and should support 1:1 redundancy. The solution should support geographical redudancy by separating the servers over LAN/WAN. i.e. if the server/s in the main data center fails, the other server/s, which is installed at geographically different location over LAN/WAN should take over the entire communication network.
7	The system to have distributed architecture and the centralized control for all the IP PBX entities in the network.
8	The communication feature server and gateway should support IPv6 from day-1 so as to be future proof.
9	It should support Survivable Call Control functionality so that the survivable system at the remote location shall provide fall back call control service in case the remote site loses all connectivity to the main Call Control system placed at datacenter. It is expected that the survivability call control system will provide a minimal set of essential telephony features to the end-users that could be a subset of the feature that are available from the main call control system.
10	It should be possible for the IP phone to be connected on the same line which is connected to the computer i.e. Single wire to desk.
11	Call control server / appliance should be Intel based hardware with necessary configuration to support the desired expandability. No proprietary hardware is acceptable. The servers should be loaded with 2 number of CPU with 2.4 GHz 4C/10MB Cache or better, 8 GB DDR3 RAM, 2 number of 500 GB SATA HDD, RAID controller and necessary Hypervisor to creat multiple VM (virtual machine).
12	The system software version offered should be the latest release as on the date of supply of EPABX as available globally.
13	The offered solution must provide a standard based mechanism for QoS (quality of service) implementation.
14	System should allow direct registration / profile creation of SIP endpoints onto it and perform all functions of Proxy / Registrar / Redirect etc.
15	In progress PSTN Calls at each of the locations should not be interrupted in the event of any call control server failure.
16	Quality of Services (QoS) would be configured to administer the call and ensure voice traffic get priority over normal traffic.
17	The System should support Call Admission Control to configure number of calls that can be active between locations.
18	Should support Active Directory integration for directory synchronization and user authentication.

19	**The system should support the following Call processing and call control protocols and standards:**
19.1	Should support signaling standards / Protocols – SIP, H.323, Q.Sig.
19.2	Voice CODEC support - G.711, G.729, G.729ab
19.3	Video codecs: H.261 or H.263 or H.264
19.4	Video telephony support (H.323 or SIP)
19.5	Support for configuration database (contains system and device configuration information, including dial plan)
20	**System Management and monitoring**
20.1	Having inbuilt administration web based administration. No additional thick client for administration on the Admin PC. Should also support HTTPS for management.
20.2	The System should have GUI support web based management console
20.3	System should support management tool to monitor system performance, device status, device discovery and CTI applications.
20.4	Should support alert notifications for troubleshooting performance
20.5	Should support to Generate various alerts in the form of e-mails, for objects when values go over / below preconfigured threshold levels.
20.6	Should support to monitor the system in real-time on a set of preconfigured parameters.
20.7	It should support to configure the sample interval rate for the applicable performance monitoring.
20.8	The management platforms should support different levels for accessing the system based on the role being played by the user who is accessing the system. The administrator should have the highest authority.
21	**Security**
20.1	The protection of signaling connections over IP should be supported by means of authentication, Integrity and encryption should be carried out using TLS.
20.2	The password and Access Control must Include the following:
20.3	Passwords to prevent the possibility of an aggressor to easily read or deduce system or account access password.
20.4	Password aging with Configurable time periods.
20.5	System should support MLPP feature.
20.6	System should support SRTP for media encryption and signaling encryption by TLS.
20.7	Secure HTTP support for Call Server Administration, Serviceability, User Pages, and Call Detail Record Analysis and Reporting Tool.

20.8	The administrator logging on to the call control server needs to authenticate by suitable mechanism such as User Login Information and Passwords / Radius Server.
20.9	Phone Security: TFTP files (configuration and firmware loads) are signed with the self-signed certificate of the TFTP server. The Call Server system admin will be able to disable http and telnet on the IP phones
21	**System Features**
21.1	Hunt groups
21.2	Dial-plan partitioning
21.3	The system should support at least 8 digit numbering scheme.
21.4	Distributed call processing
21.5	Hotline and private line automated ring down (PLAR)
21.6	Interface to H.323 gatekeeper for scalability, CAC, and redundancy
21.7	Multi-Level Precedence and Preemption (MLPP)
21.8	Q.SIG (International Organization for Standardization [ISO])
21.9	SIP trunk (RFC 3261) and line side (RFC 3261-based services)
21.10	SIP trunk Call Admission Control (SIP CAC)
21.11	Time-of-day, day-of-week, routing and restrictions
21.12	The proposed system should support automatic route selection (ARS) and least Cost routing (LCR) features to route the calls based on priorities related to user profile, tariff, and network availability, along the most cost-effective path. This service will be transparent for users and irrespective of the physical carrier connection.
21.13	Distinctive Ringing: The system should provide audibly different station ringing patterns to distinguish between internal and external calls
22	**User Features**
22.1	User should be able to log in from any IP Phone using username and password and all the privilege should extend to that physical IP phone
22.2	Should support Mobility features providing Simultaneous ringing on both Desk phone and GSM Mobile phone. There should be seamless transfer of a live call from Mobile phone to desk phone and vice-aversa.
22.3	Should support at least28 party meet-me conferencing.
22.4	Message-waiting indicator (MWI)
22.5	Abbreviated Dial
22.6	Click to Dial
22.7	Callback busy, no reply to station

22.8	Call park and pickup
22.9	Call status per line (state, duration, number)
22.10	Calling Line Identification (CLID)
22.11	Calling party name identification
22.12	Direct inward dial (DID)
22.13	Direct outward dial (DOD)
22.14	Directory dial from phone—corporate, personal
22.15	Directories—missed, placed, received calls list stored on IP phones
22.16	Distinctive ring (on net vs. off net)
22.17	Shared Line support
22.18	Multiple line appearances per phone
22.19	Music-on-hold
22.20	Station volume controls (audio, ringer)
22.21	Transfer
22.22	Boss-secretary feature support
22.23	On-hook dialing
22.24	Call waiting
22.25	Call Conference
24	**Video Telephony Features and Support**
24.1	The call control system should provide integrated video telephony features to the users so that user with IP Phone / Soft phone and video telephony end point should be able to place video calls with the same user model as audio calls.
24.2	The users should be able to transfer video calls as audio calls
24.3	Call-Server should provide a common control agent for signaling, configuration, and serviceability for voice or video end points.
25	**Upgrade Protection for Software Licenses:**
25.1	Bidders should include Upgrade Protection for all the Software Licenses quoted for this requirement. The Upgrade Protection should cover period of 3 years. During this 3 year period the bidder should provide software upgrade of any major and minor release free of cost to customer. Bidder should also provide AMC cost for next 3 years.
26	**License Required from Day-1**
26.1	The system should have necessary license for all the supplied IP/SIP Phones
26.2	The system should have necessary license for 35 voice mail boxes.

27	**Type-1 IP Phone (for reception) - Qty-2**
1	It should be possible to expand the attendant set capacity with additional key modules providing a 28 additional programmable keys. The add-on modules keys must be associated to an electronic icon and label. Each key should be programmable as a resource or supervision key. It should be possible for the system manager. To lock some of the keys.
2	Display: 3.0 inch color, 210 x 300 pixels or better effective display area, LCD Backlight, Ambient light sensor
3	Should have an integrated 2-port 10/100/1000 Ethernet switch so that single data cable can be used for IP Phone and PC connectivity.
4	Should fixed keys for mute, speaker and volume control
5	Support DHCP and static IP Support for Wideband BLUETOOTH handset
6	Should provide the directory services to the user by displaying the missed, received and dialed call details including the caller ID. Qwerty alphabetical keyboard for dial by name
7	Should support IEEE 802.3af PoE and external AC power adapter option. The bidder should provide AC power adapter for all the IP Phones.
8	Audio Codec Support: G.711, G.729, Wideband G722, voice activity detection (VAD)
9	Should have Full-duplex speakerphone, acoustic echo cancellation,
10	QoS support: IEEE 802.1p/Q tagging (VLAN), Layer 3 TOS, and DSCP
11	IPV6 Compliant. Phone should of same OEM as of IPPBX
28	**Type-2 IP Phone - Qty-10**
1	Should support graphical monochrome 2.0 inch or better 3 Line display with a resolution of 120 x 50 pixels or better, black & white, white backlight
2	Should support Comfort-noise generation (CNG) and voice-activity-detection (VAD) programming is provided on a system basis.
3	Should have an integrated 2-port 10/100/1000 Ethernet switch
4	Should fixed keys for mute, speaker and volume control, 4 programmable keys with LED, Navigation Key
5	Support DHCP and static IP
6	Should provide the directory services to the user by displaying the missed, received and dialed call details including the caller ID
7	Should support IEEE 802.3af PoE and external AC power adapter option

8	Audio Codec Support: G.711, G.729AB, G722
9	Should have Full-duplex speakerphone
10	QoS support: IEEE 802.1p/Q tagging (VLAN), Layer 3 TOS, and DSCP and QoS Tickets
11	IEEE 802.1 AB/equivlaent (IPv4/ IPv6, automatic VLAN acquisition, PoE management, inventory information).
12	Phone should be from same EPABX OEM
29	**Type-3 IP/SIP Phone - As per requirements.**
1	Should support graphical monochrome display with a resolution of 128 x 32 pixels or better. Display. Minimum 5 lines shown with backlight
2	Should support Comfort-noise generation (CNG) and voice-activity-detection (VAD) programming is provided on a system basis.
3	Should have an integrated 2-port 10/100 Ethernet switch
4	Should fixed keys for mute, speaker and volume control 2 SIP account keys • Conference key • Redial key • Transfer key • Hold key Message key with LED • Headset key with LED • Call indication LED • Cancel key • 4-way navigation and OK key
5	SIP Telephony
6	Should provide the directory services to the user by displaying the missed, received and dialed call details including the caller ID. Phonebook • Individual phonebook (300 entries) • Enterprise phonebook (800 entries) • LDAP/XML directory service
7	Should support IEEE 802.3af PoE and external AC power adapter option
8	Audio Codec Support: G.711, G.729AB, G722
9	Support DHCP and static IP

10	QoS • 802.1p (SIP and RTP QoS) • DSCP
11	Security • 802.1x • Support VPN • VLAN tagging (802.1q) • Transport Layer Security (TLS) • Digest authentication using MD5/MD5-sess • Secure configuration file via AES, encryption • Admin/user 2-level configuration mode
12	Phone should be from same EPABX OEM
30	**Type-4 IP Phone – 2 Nos**
1	7 inch capacitive LED backlit touch screen, 750x450 pixels display or better, Touch screen navigation
2	Gigabit Ethernet 10/100/1000 connectivity for LAN and PC
3	HD audio (Wideband loudspeaker, Wideband Bluetooth handset, Wideband, comfort and wired handset).
4	Full-duplex speakerphone, Acoustic echo cancellation, Automatic Gain Control (AGC) to adjust audio volume and comfort while in conference.
5	802.3AF power over Ethernet (PoE)
6	3.5 mm stereo headset port
7	Embedded a 5M pixels HD camera with Mechanical shutter for privacy
8	HDMI output for screen replication, and a dedicated video HD display on an external monitor
9	Phone should be from same EPABX OEM
Sr. No.	**Required Minimum Specifications**
	PSTN Gateway - Qty – 1
1	**Architecture:**
1.1	Should have support for Data, Voice, Video, Security and mobility services.

1.2	Should be chassis based & modular non-blocking architecture for scalability must support more than 512 time slot, ease of management.
1.3	Shall support Redundant Power supply
1.4	Chassis should be 19" rack mountable type.
1.5	Should be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.
2	**High Availability**
2.1	Shall support redundant Gigabit Ethernet connection to LAN.
2.2	Shall support Redundant Power supply via FCBC in N+1 redundant configuration
2.3	Shall support fast reboot for minimum network downtime.
2.4	Shall support boot options like booting from Flash Memory
2.5	Shall support link aggregation using LACP as per IEEE 802.3ad
2.6	Media Gateways should not host services such as proxy, FTP or local dynamic routing except those required for software Up-gradation /backup etc. to prevent exploitation in Distributed Denial of Service attacks.
2.7	Offered solution must support at least 50 remote media gateways
2.8	Must have universal slots and cards should be interchangeable without switching off the exchange or removing power supply for the shelf.
2.9	Media Gateway shall work on 48V DC. Should have backup batteries powering it for 04 hrs.
2.10	Analog Subscriber card: Should have 24/32 or more ports, Each port should support CLIP features (FSK or DTMF). Loop resistance >1700 ohms
2.11	Digital Subscriber card: Should have 24/32 or More ports,Provide digital ports for connecting digital telephones.
2.12	Should Support Q SIG standards over IP/ TDM/ WAN trunks.
2.13	(i) Heterogeneous, open numbering plan.
2.14	(ii) Calling/Connected Line Identification Presentation and Restriction.
2.15	(iii) Calling/Connected Name Identification Presentation and Restriction.
2.16	(iv) Call Forwarding Unconditional, Busy, No Reply ,Call Transfer.
2.17	(v) Call Completion to Busy Subscriber, on No Reply, call Offer.
2.18	The system should have options to network over any of MPLS, IP, ISDN
2.19	The system must support the following external telephony interface signaling:-
2.20	(i) E1 CCS PRI

2.21	(ii) E1 CAS (R2 MFC)
2.22	(iii) ISDN PRI (ETSI)
2.23	(iv) Analog Loop Start and Ground Start
2.24	Numbering Scheme The IP PBX should be suitable for up to 8 digit extension numbering scheme. This numbering scheme should be flexible. System should also allow mixed numbering scheme.
2.25	The system should provide distinctive ringing for internal calls, junction calls, auto call backs, back up service and emergency reporting service.
2.26	The system should support the attribution of an external number DDI or individual line or a bundle head to a trunk, a bundle, an attendant, a group of attendants, a subscriber, a group of subscriber or virtual equipment. The unanswered DDI communication can overflow, to Attendant or attendant group, Local subscriber, Network subscriber, Voice mailbox, automated attendant, abbreviated number, External number.
2.27	The proposed system should support automatic route selection (ARS) and least cost routing (LCR) features to route the calls based on priorities related to user profile, tariff, and network availability, along the most cost-effective path. This service will be transparent for users and irrespective of the physical carrier connection.
2.28	Voice guidance for Telephone features to be offered as standard.
2.29	DTMF and Busy Tone Resources As many busy tone detectors are to be offered as the number of trunks.
2.30	All the tone generation and tone detection should be local to the gateway.
2.31	The system should be able to restart automatically without human intervention when the external ac power supply is resumed after complete power failure i.e Even after batteries are discharged.
2.32	The call server should support the two or more different Geographically locations more than 10 Kms in the network.

13.4 Specification for L3 Core Switch (2 per location for redundancy):

S/N	Specifications
1	**Hardware Features**
	The switch should be modular and should be flexible enough for deploying 24 x 1/10G SFP+ ports from day-1 and capable of including 4 x GE SFP or 2 x 10GE SFP+ uplinks in future.
	The Switch shall provide inbuilt redundant hot swappable fans and power supplies for highest resiliency with no single point of failure.
	The switch should be loaded with minimum 4 GB RAM and 1 GB Flash memory

	The switch must be loaded with dedicated stacking port of 320 Gbps or higher. In case stacking port with such capacity is not available, chassis based switch with similar or better performance can be supplied.
2	**Performance and capabilities:**
	Switch should offer minimum 400-Gbps switching capacity.
	Synthetic traffic generation and monitoring through built-in IP SLA capabilities
	The proposed switch should support Netflow or J-flow or equivalent.
	Should support 400 Mpps of forwarding rate
	Should support multicast in hardware
	Shall have hardware based unicast, multicast and broadcast suppression.
	Shall support multi-layer switching, Layer 2 (MAC), Layer 3 (IP address) and Layer 4 (TCP UDP port) switching and application classification and redirection
	Shall support minimum 8 queues per port for classification and scheduling of network traffic on a packet-by-packet basis
	While deployed in redundancy i.e two switches, the switch should have support for virtualization by working as single virtual switches providing double the system bandwidth capacity and should eliminate the dependence and Spanning Tree Protocol.
	While deployed as Virtual switching system with two switches, switches should have support for maximum resiliency with Nonstop Forwarding, Stateful Switchover
3	**Layer 2 Features:**
	Shall have Layer 2 switch ports and VLAN trunks
	Shall have IEEE 802.3 ad Link aggregation and port trunking across line cards
	Shall have IEEE 802.1Q VLAN encapsulation
	Should support minimum 10K instance of spanning tree
	Should Support Automatic mechanism to ensure that once QoS enabled on switch then it will prioritize voice traffic independent of QoS on each and every port.
	Should support Secure VTP with MD5 or equivalent protocol to reduce administrative burden of configuring VLANs on multiple switches in turn eliminating the configuration errors & troubleshooting in secure manner
	Should be able to discover the neighboring device of the same vendor giving the details about the platform, IP Address, Link connected through etc, thus helping in troubleshooting connectivity problems or equivalent

	Should support a mechanism to detect connectivity issues with both fiber and copper cabling. Ensures that a partially failed link is shut down on both sides, to avoid L2/L3 protocol convergence issues.
	Should support Layer 2/3 trace route or equivalent to ease troubleshooting by identifying the physical path that a packet takes from source to destination
	Should support layer 2/3 debugging for troubleshooting
	Display and Clear MAC address information in MAC Address Table
	Switch ports should automatically detects the type of device connected and offers a best-practices configuration to the ports
	Shall have IEEE compliance for 802.1Q VLAN, 801.2p, 802.1d STP, 802.3ad, 802.1w RSTP, 802.1s MSTP, RPVST+,802.3ad LACP, IEEE 802.1ab, Link Layer Discovery Protocol.
	Shall have 50K Media Access Control (MAC) Entries
	Shall have minimum 4000 VLAN including port-based, source MAC based, protocol based and subnet based VLANs.
4	**Layer 3 Features:**
	Shall have basic Routing-Static IP routing, RIP v1/v2, RIPng and Policy Based Routing.
	Shall have hardware enabled advance IP routing protocols OSPF, OSPFv3, BGPv4, PIM-SM, PIM-DM , OSPF,BGP should be enabled from day-1
	Shall have VRRP or equivalent for redundancy
	Shall have IGMP v1, v2, v3
	Should support multicast features like PIM RP accept filter, PIM neighbor filter, multicast route limit.
	IPv4 and IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks. Should support minimum 15K IPv4, IPv6 enteries
	The switch should support minimum 2K IPv4, IPv6 Multicast enteries
	MLD Snooping for IPv6 in hardware
5	**QoS Features:**
	Shall have sophisticated QoS and Traffic Management
	Shall have Per-port QoS configuration
	Support for IEEE 802.1p QoS policies.
	RFC 2474 based Diff Serv QoS on all ports
	Shall support 8 queues per port and QoS Hardware Entries
	Shall have strict priority queuing.
	Shall have IP differentiated service code point (DSCP) and IP precedence
	Shall have classification and marking based on full Layer 3, 4 headers
	Shall have input and output policing based on Layer 3, 4 headers.
	Shall support Congestion Avoidance feature
	Shall provide Local and Remote Port Mirroring
6	**Security Features**

	RADIUS, which allow centralized control of the switch and restrict unauthorized users from altering the configuration
	Standard and extended ACLs on all ports
	802.1x user authentication (with VLAN assignment and Guest VLAN extensions)
	Router ACLs (RACLs) on all ports (no performance penalty), VLAN ACLs (VACLs),Port ACLs (PACLs)
	Private VLANs (PVLANs) on access and trunk ports
	Dynamic Host Configuration Protocol (DHCP) snooping and Option82 insertion
	Port Security, Secure Shell (SSH) Protocol versions 1/2
	Unicast MAC filtering, Unicast port flood blocking
	Dynamic Address Resolution Protocol (ARP) inspection, IP source guard
	Switch should Support the following functions: IPv6 snooping, IPv6 FHS binding, neighbor discovery protocol (NDP) address gleaning, IPv6 data address gleaning, IPv6 dynamic host configuration protocol (DHCP) address gleaning, IPv6 device tracking, neighbor discovery (ND) Inspection, IPv6 DHCP guard, IPv6 router advertisement (RA) guard
	The switch should be EAL3/NDPP certified under Common Criteria Certificate.
7	**Management Features**
	The switch should support NetFlow or euivalent and IP SLA for enhanced visibility.
	Configuration Rollback for improved configuration management
	Single console port and single IP address to manage all features of the system
	Manageability through common network-management software on a per-port and per-switch basis, providing a common management interface for routers, switches of the same vendor
	Support for SNMP versions 1, 2, and 3
	Remote Monitoring (RMON) software agent to support four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis.
	Analysis support, including ingress port, egress port, and VLAN mirroring
	Support for Port Mirroring, Remote Mirroring & ACL filtering for Port mirroring used for IDS functionalities.

13.5 Specification of L2 24 port POE Switch – quantity as per requirement:

S/N	Minimum Specifications
1	**General Features**

1.1	The switch should support a minimum of 48 nos. 10/100/1000 Ethernet Ports in 1 RU form factor and 19" rack mountable.
1.2	The switch should support a minimum of 4 nos. of GE Uplinks that supports copper and fiber transceivers with with SFP form factor.
1.3	The switch should support MTBF of 275,000 hours or more
1.4	The switch should support Operating temperature up to 1500 m -5º to 45ºC and operating relative humidity 10 % to 95% no condensing.
1.5	The switch should support an auto-ranging power supply with input voltages between 100 and 240V AC
2	**Performance and Scalability**
2.1	The switch should support Forwarding bandwidth of 50 Gbps and Full-duplex Switching bandwidth of 30 Gbps
2.2	The switch should support 64-Byte Packet Forwarding Rate of 30 Mpps for 24-Port switch.
2.3	The switch should have at least Dual Core CPU, 1 GB of DRAM and 1 GB Flash
2.4	The switch should support 1000 VLANs and 4000 VLAN IDs
2.5	The switch should support Jumbo frames and MTU of at least 9000 bytes
2.6	The switch should support 16000 Unicast MAC addresses
3	**Stacking**
3.1	Should support virtual resilient stacking feature for single IP management up to 300mtr distance
3.2	Stacking module should be Hot-swappable.
4	**Standards**
4.1	The switch should support IEEE 802.1D, IEEE 802.1p, IEEE 802.1Q, IEEE 802.1s, IEEE 802.1w, IEEE 802.1x, IEEE 802.1ab, IEEE 802.3ad, IEEE 802.3ah, IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z
5	**Layer-2 Features**
5.1	The switch should support Automatic Negotiation of Trunking Protocol, to help minimize the configuration & errors
5.2	The switch should support IEEE 802.1Q VLAN encapsulation

5.3	The switch should support Centralized VLAN Management. VLANs created on the Core Switches should be propagated automatically
5.4	The switch should support should support STP.RSTP
5.5	The switch should support UplinkFast & BackboneFast or equivalent technologies to help ensure quick failover recovery, enhancing overall network stability and reliability
5.6	The switch should support Spanning-tree root guard to prevent other edge swicthes becoming the root bridge.
5.7	The switch should support IGMP filtering
5.8	The switch should support discovery of the neighboring device of the same vendor giving the details about the platform, IP Address, Link connected through etc, thus helping in troubleshooting connectivity problems.
5.9	The switch should support Per-port unicast, broadcast and multicast storm control to prevent faulty end stations from degrading overall systems performance
5.1	The switch should support Voice VLAN to simplify IP telephony installations by keeping voice traffic on a separate VLAN
5.1	The switch should support Automatic media-dependent interface crossover (MDIX).
5.1	The switch should support Unidirectional Link Detection Protocol (UDLD) and Aggressive UDLD to allow for unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
5.1	The switch should support Local Proxy Address Resolution Protocol (ARP) working in conjunction with Private VLAN Edge to minimize broadcasts and maximize available bandwidth.
5.1	The switch should support IGMP v1, v2, v3 Snooping
5.2	The switch should support MVR (Multicast VLAN Registration)
6	**Quality of Service (QoS) & Control**
6.1	The switch should support 4 egress queues per port to enable differentiated management
6.2	The switch should support scheduling techniques for QoS

6.3	The switch should support Weighted tail drop (WTD) to provide congestion avoidance
6.4	The switch should support Standard 802.1p CoS field classification
6.5	The switch should support Differentiated services code point (DSCP) field classification
6.6	The switch should support Strict priority queuing mechanisms
6.7	The switch should support Rate Limitting function to guarantee bandwidth
6.8	The switch should support rate limiting based on source and destination IP address, MAC address and Layer 4 TCP / UDP information
6.9	The switch should support availability of at least 250 aggregate or individual polices per port.
7	**Management**
7.1	The switch should support Command Line Interface (CLI) using Telnet & SSH interface for comprehensive in-band management.
7.2	The switch should support CLI-based management console to provide detailed out-of-band management.
7.3	The switch should support Serial / USB Console Port.
7.4	The switch should support four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis.
7.5	The switch should support Layer 2/3 trace route to ease troubleshooting by identifying the physical path that a packet takes from source to destination.
7.6	The switch should support Trivial File Transfer Protocol (TFTP) for software upgrades..
7.7	The switch should support SNMPv1, SNMPv2c, and SNMPv3
8	**Network security features**
8.1	The switch should support IEEE 802.1x to allow dynamic, port-based security, providing user authentication.
8.2	The switch should support Port-based ACLs for Layer 2 interfaces to allow application of security policies on individual switch ports.
8.3	The switch should support SSHv2 and SNMPv3 to provide network security by encrypting administrator traffic during Telnet and SNMP sessions.

8.4	The switch should support TACACS+ and RADIUS authentication enable centralized control of the switch and restrict unauthorized users from altering the configuration.
8.5	The switch should support MAC address notification to allow administrators to be notified of users added to or removed from the network.
8.6	The switch should support Port security to secure the access to an access or trunk port based on MAC address.
8.7	The switch should support Multilevel security on console access to prevent unauthorized users from altering the switch configuration.
8.8	The switch should support Private VLAN
9	**IPv6 Features Support**
9.1	IPv6 over Ethernet Dual IPv6/IPv4 stack
	IPv6 neighbor and router discovery
	IPv6 stateless address auto-configuration
	Duplicate address detection ICMPv6
	IPv6 QoS - Prioritize IPv6 packets
	IPv6 Security - RA guard, ND inspection, DHCPv6 guard
9.2	IPv6 support for Ping, Traceroute, VTY, SSH, TFTP, SNMP, Syslog, HTTP, HTTPS
9.3	The switch should support IPv6 unicast Static Routing
9.4	The switch should support IPv6 MLDv1 & v2 Snooping
9.5	The switch should support IPv6 Host support for IPv6 Addressing
9.6	The switch should support IPv6 Port Access Control Lists
9.7	The switch should support IPv6 Router Access Control Lists
9.8	The switch should support IPv6 Stateless Auto Config
9.9	The switch should support Radius and TACACS+ over IPv6
10	**PoE Features**
10	Total PoE Power budget should be at least 365 W
10	The switch should support both IEEE 802.3af Power over Ethernet (PoE) and IEEE 802.3at PoE+ standard.
10	PoE power allocation of the switch should be dynamic and flexible power allocation should be supported across all ports.

13.6 Specification of L2 8 port POE switch- quantity as per requirement:

S/N	Item	Specification
1	Hardware	8 x 10/100/1000BaseT PoE, 2 x 1G SFP or 2 x 1G Copper
2		19" Rack mountable, support for 23/24" rack.
3		Internal power supply unit that supports input voltages between 100 and 240VAC.
4		Operating temperature: 0°C to +45°C
5		Support for IEEE 802.3az or Energy-Efficient Ethernet (EEE)
6		The switch should be capable of working in an ultra-low power mode during periods of nonoperation hours.
7		Mean time between failure - at least 550,000 hours
8	Power over Ethernet (PoE)	Support for PoE and PoE+as per IEEE standard
9		PoE Power budget of at least 65 watt, so that each of the 8 downlink port is capable of supplying 15.4 W PoE power.
10	Performance	Forwarding rate for 64 Byte Packet - at least 14 Mpps
11		Switching Bandwidth - at least 20 Gbps
12		At least 250 VLAN
13	Memory	At least 256 MB DRAM
14		At least 128 MB Flash

13.7 Specification of L2 24 port NON POE Switch (1 Per Location)

S/N	Minimum Specifications
1	**General Features**
1.1	The switch should support a minimum of 48 nos. 10/100/1000 Ethernet Ports in 1 RU form factor and 19" rack mountable.
1.2	The switch should support a minimum of 4 nos. of GE Uplinks that supports copper and fiber transceivers with with SFP form factor.
1.3	The switch should support MTBF of 275,000 hours or more
1.4	The switch should support Operating temperature up to 1500 m -5º to 45ºC and operating relative humidity 10 % to 95% no condensing.
1.5	The switch should support an auto-ranging power supply with input voltages between 100 and 240V AC
2	**Performance and Scalability**
2.1	The switch should support Forwarding bandwidth of 50 Gbps and Full-duplex Switching bandwidth of 30 Gbps

2.2	The switch should support 64-Byte Packet Forwarding Rate of 30 Mpps for 24-Port switch.
2.3	The switch should have at least Dual Core CPU, 1 GB of DRAM and 1 GB Flash
2.4	The switch should support 1000 VLANs and 4000 VLAN IDs
2.5	The switch should support Jumbo frames and MTU of at least 9000 bytes
2.6	The switch should support 16000 Unicast MAC addresses
3	**Stacking**
3.1	Should support virtual resilient stacking feature for single IP management up to 300mtr distance
3.2	Stacking module should be Hot-swappable.
4	**Standards**
4.1	The switch should support IEEE 802.1D, IEEE 802.1p, IEEE 802.1Q, IEEE 802.1s, IEEE 802.1w, IEEE 802.1x, IEEE 802.1ab, IEEE 802.3ad, IEEE 802.3ah, IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z
5	**Layer-2 Features**
5.1	The switch should support Automatic Negotiation of Trunking Protocol, to help minimize the configuration & errors
5.2	The switch should support IEEE 802.1Q VLAN encapsulation
5.3	The switch should support Centralized VLAN Management. VLANs created on the Core Switches should be propagated automatically
5.4	The switch should support should support STP.RSTP
5.5	The switch should support UplinkFast & BackboneFast or equivalent technologies to help ensure quick failover recovery, enhancing overall network stability and reliability
5.6	The switch should support Spanning-tree root guard to prevent other edge swicthes becoming the root bridge.
5.7	The switch should support IGMP filtering
5.8	The switch should support discovery of the neighboring device of the same vendor giving the details about the platform, IP Address, Link connected through etc, thus helping in troubleshooting connectivity problems.

5.9	The switch should support Per-port unicast, broadcast and multicast storm control to prevent faulty end stations from degrading overall systems performance
5.1	The switch should support Voice VLAN to simplify IP telephony installations by keeping voice traffic on a separate VLAN
5.1	The switch should support Automatic media-dependent interface crossover (MDIX).
5.1	The switch should support Unidirectional Link Detection Protocol (UDLD) and Aggressive UDLD to allow for unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
5.1	The switch should support Local Proxy Address Resolution Protocol (ARP) working in conjunction with Private VLAN Edge to minimize broadcasts and maximize available bandwidth.
5.1	The switch should support IGMP v1, v2, v3 Snooping
5.2	The switch should support MVR (Multicast VLAN Registration)
6	**Quality of Service (QoS) & Control**
6.1	The switch should support 4 egress queues per port to enable differentiated management
6.2	The switch should support scheduling techniques for QoS
6.3	The switch should support Weighted tail drop (WTD) to provide congestion avoidance
6.4	The switch should support Standard 802.1p CoS field classification
6.5	The switch should support Differentiated services code point (DSCP) field classification
6.6	The switch should support Strict priority queuing mechanisms
6.7	The switch should support Rate Limitting function to guarantee bandwidth
6.8	The switch should support rate limiting based on source and destination IP address, MAC address and Layer 4 TCP / UDP information
6.9	The switch should support availability of at least 250 aggregate or individual polices per port.
7	**Management**

7.1	The switch should support Command Line Interface (CLI) using Telnet & SSH interface for comprehensive in-band management.
7.2	The switch should support CLI-based management console to provide detailed out-of-band management.
7.3	The switch should support Serial / USB Console Port.
7.4	The switch should support four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis.
7.5	The switch should support Layer 2/3 trace route to ease troubleshooting by identifying the physical path that a packet takes from source to destination.
7.6	The switch should support Trivial File Transfer Protocol (TFTP) for software upgrades..
7.7	The switch should support SNMPv1, SNMPv2c, and SNMPv3
8	**Network security features**
8.1	The switch should support IEEE 802.1x to allow dynamic, port-based security, providing user authentication.
8.2	The switch should support Port-based ACLs for Layer 2 interfaces to allow application of security policies on individual switch ports.
8.3	The switch should support SSHv2 and SNMPv3 to provide network security by encrypting administrator traffic during Telnet and SNMP sessions.
8.4	The switch should support TACACS+ and RADIUS authentication enable centralized control of the switch and restrict unauthorized users from altering the configuration.
8.5	The switch should support MAC address notification to allow administrators to be notified of users added to or removed from the network.
8.6	The switch should support Port security to secure the access to an access or trunk port based on MAC address.
8.7	The switch should support Multilevel security on console access to prevent unauthorized users from altering the switch configuration.
8.8	The switch should support Private VLAN
9	**IPv6 Features Support**
9.1	IPv6 over Ethernet Dual IPv6/IPv4 stack
	IPv6 neighbor and router discovery

	IPv6 stateless address auto-configuration
	Duplicate address detection ICMPv6
	IPv6 QoS - Prioritize IPv6 packets
	IPv6 Security - RA guard, ND inspection, DHCPv6 guard
9.2	IPv6 support for Ping, Traceroute, VTY, SSH, TFTP, SNMP, Syslog, HTTP, HTTPS
9.3	The switch should support IPv6 unicast Static Routing
9.4	The switch should support IPv6 MLDv1 & v2 Snooping
9.5	The switch should support IPv6 Host support for IPv6 Addressing
9.6	The switch should support IPv6 Port Access Control Lists
9.7	The switch should support IPv6 Router Access Control Lists
9.8	The switch should support IPv6 Stateless Auto Config
9.9	The switch should support Radius and TACACS+ over IPv6

13.8 Specification of Router:

S. No.	Feature	Specification
1	**Architecture**	a) Should be chassis based & modular architecture for scalability and should be a single box configuration for ease of management. b) Should have support for IPSEC VPN. c) Should have minimum of 256MB of RAM and 32 MB of Flash Memory
2	**Interface**	a) 2 x 10/100 Base interface. b) At least 2 free additional slots for future 1. Note: These additional slots should support both the following interfaces: • V.35 (2 Mbps) interface including necessary cables • 10/100 Ethernet Base interface.
3	**Performance**	a) Should support high performance traffic forwarding with concurrent features like Security, Voice enabled b) Should support variety of interfaces like V.35 Sync Serial (2 Mbps), E1, ADSL for remote office aggregation c) Should support 3G USB modem for connectivity or support external 3G modem or 3G card in the

S. No.	Feature	Specification
		router d) Should have at least one USB 2.0 ports for storing OS images
4	**High Availability**	a) Should support redundant connection to LAN b) Should support Non-Stop forwarding / Graceful Restart for fast re-convergence of routing protocols c) Should support boot options like booting from TFTP server, Network node d) Should support VRRP or equivalent
5	**Protocols**	a) Should support Routing protocols like RIP ver1 (RFC1058)&2, (RFC 1722 and 1723), OSPF ver2 (RFC2328), BGP4 (RFC1771), IS-IS (RFC1195), Telnet (RFC854) b) Multicast routing protocols support : IGMPv1,v2, v3 (RFC 2236), PIM-SM (RFC2362), PIM-SSM and PIM-DM, M-BGP/ MSDP c) Should have full IPv6 features from day 1. d) Should have RIPng and OSPFv3 for IPv6.
6	**QoS Features**	a) Classification and Marking: Policy based routing, IEEE 802.1p b) Congestion Management: WRED, Priority queuing, Class based queuing c) Traffic Conditioning: Committed Access Rate/Rate limiting d) Bandwidth guarantee e) Signalling: RSVP f) Link efficiency mechanisms: cRTP, LFI, MLPPP g) Per VLAN QoS. Time Based Shaping and Policing for QoS h) Port mirroring
7	**Security Features**	a) Support for GRE Tunneling, NAT b) Support for MD-5 / SHA-1/SHA-2 route authentication for RIP, OSPF and BGP c) Shall support multi-level of access d) Support for SNMPv3 authentication, SSHv2 e) AAA support using Radius and/or TACACS+ f) Support for PAP and CHAP authentication for P-to-P links g) Multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server. h) Time based & Dynamic ACLs for controlled forwarding based on time of day for offices i) IEEE 802.1x support for MAC address

S. No.	Feature	Specification
		authentication
8	**Management**	a) Shall have support for Web based management, CLI, Telnet and SNMPv3 b) Shall support Secure Shell for secure connectivity. c) Shall support Out of band management through Console and external modem for remote management
9	**Certification**	a) Common Criteria Certified b) FCC c) Safety EMI/EMC
10	**Power**	AC 200 – 240V

13.09 Specification of Server (2 per location):

Sl. No	Component	Specifications
1	Processor	Minimum 2 X 8 Core latest series/generation 64-bit x86 processors with clock speed of 2.5 GHz or higher & minimum 20 MB Cache memory
2	Memory slots	At least 32 DIMMS supporting ECC DDR3 RAM
3	Primary Memory	Minimum 64 GB DDR3 Registered (RDIMM) with highest frequency as applicable in the quoted model to be offered per processor. Memory should support RAID and memory mirroring.
4	Primary memory expandable upto	Minimum upto 1 TB
5	HDD	2 x 500 GB SATA HDDs Or Higher, speed 15K RPM
6	HDD bays	4 or more
7	Internal HDD controller	RAID 5 Controller
8	Network controller	Integrated Gigabit Server Ethernet dual port controller with full duplex with Wake-on-LAN & PXE. 4 Ethernet Ports of minimum 10/100/1000 Mbps. 4 nos USB 2.0 compliant ports.
9	L3 Cache	Total Cache to be minimum 20 MB per processor socket
10	Chipset	Latest Generation Server Class Mother Board based on associated chipset supporting the above processor. Same OEM make as that of Processor

11	Graphics	Integrated Graphics with at least 8MB Video Memory
12	I/O slots	3 PCI/ PCIe slots with combination of x1, x4 and x8 slots, 4 USB 2.0 Port,. 1 Serial port, 1 dedicated Management port other than the network port, 1 Keyboard, 1 mouse port, 1 Graphics port.
13	Systems Management Processor	Dedicated system Management processor/controller IPMI 2.0 to manage health of server. LEDs for Power on, System Health, HDD activity, Dignostics (with error codes) etc.
14	Remote management	Integrated remote management controller
15	Power supply	Redundant Power Supply to sustain above configuration with Hot plugging. Power Supply with 80% efficiency for better utilization.
16	Form factor	Tower/ Rack mounted (for rack mounted servers, all necessary hardware like racks etc. are to be supplied along with)
17	Cable & Accessories	All required Power cables and required accessories are to be provided. Cables required for redundancy are also to be provided.
18	Optical drive	DVD RW Drive 22x or Higher
19	Security	Power-on password / administrator password / unattended boot /selectable boot / unattended start mode
20	OS Compatibility	Support for Windows Server 64 bit Editions, **Enterprise Edition** Red Hat Enterprise Linux 64 bit Editions, UNIX 64 bit Editions
21	Warranty	3 years 24x7 support with comprehensive onsite warranty for all components
22	Support	In case of any fault occurs in the hardware then you must provide support to rectify that faulty part and if required to reload the operating system after modification of any hardware components then you must load operating systems in the systems. For the quoted product, support should be available for minimum Five (5) years.
23	Compliance / Certification	For OEM- ISO 9001 and 14001. For Quoted Model- UL/CSA, FCC or Equivalents, RoHs, CE, Energy Star, ACPI, IPMI etc.
24	Host interface and others	• SAN HBAs should be connected on separate slots for high throughput requirements. • Fiber Channel Adapters 2 x minimum 4Gbps. • All cards should be on 64 bit PCI-X/PCI-e slots.
25	Driver/Software utility	Provide all necessary driver CDs and manuals for the server

13.10 CABLING FOR DATA SYSTEM

Structured Cabling System and Component Specifications

Structured cabling system, ANSI/TIA 568-C.2 addendum Category 6A Cabling system	
Networks Supported	Support for Ethernet (10BASE-T), Fast Ethernet (100BASE-TX), Gigabit Ethernet(1000BASE-T), 10 Gigabit Ethernet (10GBASE-T), Token Ring,ATM 155 Mbps, TP-PMD 100 Mbps, ISDN, video analog and digital,(VoIP), and IEEE 802.3an 10Gigabit Ethernet.
Qualification	Offered product OEM shall be of global repute and be part of standard committees like TIA or ISO. Documentary evidence to be submitted.
Support in India	OEM shall be having presence in India for atleast 10 years. OEM shall have ISO 9001:2015 and 14001 certified manufacturing facility in India.
Performance characteristics to be provided along with bid	Shall have Intertek certified 4 connector channel compliance to the requirements of ANSI/TIA 568-C.2 and ISO/IEC 11801 for CAT6A. Certificates to be provided with test results for Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR.
Site Certification	Site certification to be done by OEM certified installer for 25 years and certificate to be issued from OEM.

13.11 Category 6A, ANSI/TIA 568-C.2

1	CAT-6A F/UTP Cable, 23 AWG bare solid copper, with cross filler pair separator, Channel optimized to 500 Mhz or more.
2	Meets ANSI/TIA 568-C.2 Category 6A specifications. Cat 6A F/UTP Cabling channel report need to submit for 4 Connector Channel Performance tested by Intertek (ETL)in compliance to ANSI/TIA 568-C.2 & ISO 11801
3	Aluminium Foil Shielded. Polyester tape encapsulating the 4 pairs beneath the AL Foil. Must have Drain wire and Rip cord to be integrated in the cable.
4	Worst Case Cable Skew :45nsec/100 meters
5	Mutual Capacitance:5.6 nF/100 m @ 500 MHz
6	Characteristic Impendence : 100± 15 Ohm
7	Cable Outside Diameter:not more than 7.3 mm
8	Insulation: Polyethylene / Polyolefin
9	Support for transmission standards of ANSI/TIA-568-C.2, CENELEC EN 50288-6-1, ISO/IEC 11801 Class EA
10	DC Resistance Max: 66.58 ohms/km
11	Operating Voltage, maximum:300 Vac
12	Nominal Velocity of Propagation (NVP): 72 %
13	Solid Cable should be compliance to RoHS.
14	LSZH outer jacket in compliance to IEC 60332-1, IEC 61034-2, IEC 60754-2 and UL
15	Bend Radius: upto29.00 mm
16	Performance under 4 connector channel @ 500Mhz shall comply the min values as below – NEXT : 40dB or higher PSNEXT: 36.5 dB or higher Return Loss : 25 dB or higher Insertion Loss: 42.74 dB or less
17	Shall be RoHS 2011/65/EU compliant

1	Modular Shielded Jacks shall meet and exceed following application standards: ISO/IEC 11801 Ed.2.2, Class EA ANSI/TIA 568-C.2

	ISO/IEC 60603-7-1 3rd Edition ISO/IEC 60603-7-51 1st Edition IEEE 802.3at IEEE 802.3bt Type 4; 4-Pair PoE
2	DC Resistance: 69 milli ohms.
3	DC Resistance imbalance : 20 milli ohms.
4	Insulating resistance 500 Mega ohms minimum.
5	Jack retention in panel/faceplate: 50N
6	Shall have optional integrated hinged dust caps for protection from dust ingress.
7	Contact Material: Beryllium copper, plated with 1.27 mm [.000050] thick gold
8	Meets and exceeds ISO/IEC 11801 Class EA, ANSI/TIA 568-C.2 Category 6A component specifications
9	Conductor type: Shall be capable to accept 26–22 AWG solid conductors and in cable OD range of 5 – 9 mm.
10	The outlet is of IDC (insulation Displacement Contact) 180 deg punch type
11	Voltage: 150 volts AC maximum
12	Flammability: UL 94V-0
13	Termination: Shielded jack should support uniform hassle free termination technology and be able to ensure performance in each termination without dependency on expertise of technician. The modular jacks should contain integrated cutting blades used during termination to allow all four pairs of a four pair cable to be terminated at one time.
14	RoHS 2011/65/EUcompliant

13.12 Jack Panels

Type - 24-port, Shielded Twisted Pair, Category 6A, ANSI/TIA 568-C.2

1	Modular, PCB based Shielded Twisted pair, Category 6A, ANSI/TIA 568-C-2, Jack Panel with rear cable manager
2	Panel shall accept individual shielded CAT6A jack modules and pre loaded with grounding strip.
3	Automated punching mechanism for all 4 pairs termination in single punch, allowing wires between 22 – 26 AWG sizes.
4	Category 6A shielded patch panels shall meet or exceed channel specifications of ANSI/TIA-568-C.2 Category 6A and ISO/IEC 11801 Class EA up to 500 MHz
5	Shall support T568A/T568B colourcoding.
6	Cable Guide way to guide the cable on the rear side
7	1U size for 6/12/24 Ports and 2U for 48 Ports.
8	UL Listed & ETL channel certified.

9	Jack Panel should be RoHS Complaint.

13.13 Faceplates

Type	1-port, White shuttered with admin labels and label covers
Material	ABS / UL 94 V-0
No. of ports	One / two
	High Impact Plastic Body ABS FR Grade 86 x 86 mm
	Flush mountable or surface mountable with a back mount frame

13.14 Workstation / Equipment Cords

Type - Category 6A, ANSI/TIA 568-C.2

1	CAT6A S/FTP Patch cords shall be of multi strand copper cable with ETL 4 connector channelcertified for ANSI/TIA 568-C.2 and ISO/IEC 11801
2	With transparent slim snag-less boot
3	Terminals with gold contacts, 1.27 micron
4	Patch cord shall haveInsulation Resistance of minimum500 mOhm
5	Outer sheath shall be LSZH as per IEC 60332-1
6	Cord outer diameter shall be not more than 6 mm.
7	Cable construction of patch cord shall be of CAT7 stranded copper, 7/26AWG
8	Pairs in Metal Foil, 4 pair stranded S/FTP cable
9	Compliance: UL 1863 IEC 60603-7
10	Material : ROHS compliant

13.15 Specification for Fiber

Multimode Fiber optic Cable

Cable Type	**6/12-core, Multimode, 10G Ethernet OM3, Armored, loose-tube, CST armour, Gel Filled**
Fiber type	50 / 125, Laser Grade, 250 micron primary coated buffers
No. of cores	6/12
Fiber identification	Individual fibers shall be color coded as per TIA 598 color scheme
Cable Compliance	Shall meet and exceed the requirements of Telcordia GR-20; EN 50173; ISO/IEC 11801; ANSI/TIA 568 C.3
Attenuation	
@850nm	2.7 dB / KM

@1300nm	0.7 dB / KM
Bandwidth	
@850nm	1500 MHz-KM
@1300nm	500 MHz-KM
Max distance supported	
1000 Base SX	100m
1000 Base Lx	600m
10GBase-SR & SW	300m
10GBase-LX4	300m
Tensile rating	1250N or better
Maximum Crush resistance	3000N or better
Operating Temperature	-20 Degree C to +70 Degree C
Armor	Corrugated Steel tape Armor
Outer jacket	High density polyethylene, anti - termite, anti - rodent suitable for direct burial application. Min thickness 2mm.
Strength member	Cable shall have peripheral strength member of aramid glass yarns.
Compliance	ROHS compliant

13.16 Fiber Optic Patch panels

Specifications	**Requirement**
Fiber Management shelf	The fiber management shelf shall have compact design and be ideal for high density front patching applications.
	Should be fully loaded and factory fitted assembly with **no assembling** required during installation at site
	• High Density: 1U: 6/12/24/48 Fiber terminations
	• Should be supplied loaded with LC adapters, splice trays, LC MM OM3 Pigtails and fiber management rings
	Shall have latching locks to protect drawer shelf from accidental slides.
	• Shall have min 4 cable inlets from rear of shelf
Drawer style shelf	o Easy access to splicing tray
	o Easy access to back side of connector
Accessories	Fiber management guides, radius controls & secure tie downs provided
	Pre loaded with labeling strips and grounding lugs
	Sealed cable inlets for dust and rodent protection
Material	Min 16 gauge CRCA sheet with powder coating

Compact size (mm)	44 x 450 x 320 (HxWxD)
Pigtails loaded in Shelf:	
Type	LC Type, OM3, min 1 mtr
Attenuation	<=0.3 dB, at 850 nm
Return Loss	>= 20 dB
Cable Info	50/125 um
Outer Dia	0.9 mm
Jacket material	LSZH
Compliance	ROHS / ELV Compliant

13.17 Fiber Optic Patch Cord LC-LC TYPE.

Fiber Optic Patch Cords	OM3 Patch Cord MM patch cord LC/UPC-LC/UPC TYPE
Make and Type	LC to LC Duplex tuned Fiber Optic Patch Cord, 50/125 Micron, OM3
Cable Sheath	LSZH
Cable Diameter	1.8 x 3.6 mm
Insertion Loss	MAX .3 db at 850nm
Return Loss	> 30 db at mated condition
Length	3 Mtrs, 5 Mtrs
Temperature Range	-10 Degree C to +60 Degree C
ROHS	ROHS/ELV Compliant

14. Specification of ACMV System

Reference Standards:

Following standard & guidelines shall be adopted while designing the ACMV System.

1. National Building Code of India (NBC 2016)
2. Energy Conservation Building Code (ECBC 2007)
3. ASHRAE Hand Books.
   - Fundamentals 2009
   - HVAC Systems and Equipment 2008
   - HVAC Applications 2007
   - Refrigeration 2006
   - HVAC Design Guidelines for Hospital & Clinics - ASHRAE

4. Duct construction standards as per relevant BIS codes & SMACNA standards.
5. Air filters as per ASHRAE 52.1-1992 and 52.2-2007
6. Indoor Air quality as per ASHRAE 62.1-2007
7. Motors, Cabling, Wiring and accessories as per BIS codes.
8. National Electric Codes (NEC)
9. ANSI/ASHRAE/IESNA standard 90.1-2009: Energy standard for building except low rise residential buildings.
10. ASHRAE standard 55: Thermal Comfort.

The specification is required to cover the design, manufacture, testing and delivery, duly for site, for complete Air- conditioning Work.

Note 1: AC area may be changed as per requirement of employer.

Table 14.1: <u>ACMV SCHEDULE.</u>

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
	ACADEMIC BUILDING & OTHER BUILDINGS	
1	**ENTRANCE LOBBY**	Normal or Mechanical Ventilation as per requirement.
2	**RECORDS & STORE ROOM**	Normal or Mechanical Ventilation as per requirement.
3	**COMMON ROOM (Boys and Girls)**	Mechanical Ventilation
4	**KITCHEN BLOCK**	Mechanical Ventilation
5	**OTHER ROOMS**	Air Conditioning as per requirement. Normal or Mechanical Ventilation as per requirement.
6	**CORRIDOR & LOBBY**	Normal or Mechanical Ventilation as per requirement.
16	**LIFT LOBBY**	Normal Ventilation
7	**BODY STORAGE**	Air Conditioning System, Ventilation system
8	**RECEPTION/ WAITING**	Air Conditioning as per requirement. Normal or Mechanical Ventilation as per requirement.

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
9	**STAIRCASE**	Normal or Mechanical Ventilation as per requirement.
10	**ACCOUNT OFFICER,TUTOR / DEMONSTRATOR**	Air Conditioning System
11	**PRINCIPAL, MSVP , HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR ,DOCTOR'S ROOM**	Air Conditioning System
12	**COLLEGE COUNCIL ROOM**	Air Conditioning System
13	**All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM**	Air Conditioning System except Autoclave room where ventilation system shall be provided
14	**ALL LIBRARY AREA**	Air Conditioning System
15	**LECTURE HALL/THEATRE**	Air Conditioning System with 100 % redundancy
17	**AUDITORIUM**	Air Conditioning System
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Normal or Mechanical Ventilation as per requirement.
19	**TOILETS**	Mechanical Ventilation System
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Air Conditioning System shall be provided in UPS room, AV room, ELV room. Natural or Forced ventilation in other room.
21	**LIFT WELL**	Normal or Mechanical Ventilation as per requirement.

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
22	**STRONG ROOM**	Normal or Mechanical Ventilation as per requirement.
23	**LIFT MACHINE ROOM**	Air Conditioning System
	TERRACE	-
	BOYS & GIRLS HOSTEL BUILDING	
1	**ENTRANCE LOBBY**	Normal or Mechanical Ventilation as per requirement.
2	**CORRIDOR & LOBBY**	Normal or Mechanical Ventilation as per requirement.
16	**LIFT LOBBY**	Normal Ventilation
3	**ROOMS**	Normal Ventilation
4	**KITCHEN BLOCK**	Mechanical Ventilation System
5	**DINING HALL**	Normal or Mechanical Ventilation as per requirement.
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Air Conditioning System shall be provided in UPS room, AV room, ELV room. Natural or Mechanical Ventilation in other room.
21	**LIFT WELL**	Normal or Mechanical Ventilation as per requirement.
23	**LIFT MACHINE ROOM**	Air Conditioning System
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Normal or Mechanical Ventilation as per requirement.
9	**STAIRCASE**	Normal or Mechanical Ventilation as per requirement.

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
19	**TOILETS**	Forced Ventilation
	TERRACE	-
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING	
1	**ENTRANCE LOBBY**	Normal or Mechanical Ventilation as per requirement.
2	**CORRIDOR & LOBBY**	Normal or Forced Ventilation as per requirement.
16	**LIFT LOBBY**	Normal or Mechanical Ventilation as per requirement.
3	**ROOMS**	Normal Ventilation
4	**KITCHEN BLOCK**	Mechanical Ventilation
5	**DINING HALL**	Normal or Mechanical Ventilation as per requirement.
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Air Conditioning System shall be provided in UPS room, AV room, ELV room. Natural or Mechanical Ventilation in other room.
21	**LIFT WELL**	-
23	**LIFT MACHINE ROOM**	Air Conditioning System
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	Normal or Mechanical Ventilation as per requirement.
9	**STAIRCASE**	Normal or Mechanical Ventilation as per requirement.
19	**TOILETS**	Mechanical Ventilation
	TERRACE	-

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING	
1	**ENTRANCE LOBBY**	Normal or Mechanical Ventilation as per requirement.
2	**CORRIDOR & LOBBY**	Normal or Mechanical Ventilation as per requirement.
16	**LIFT LOBBY**	Normal or Mechanical Ventilation as per requirement.
3	**DRAWING ROOM**	Provision for Air Conditoning System to be provided
3	**BED ROOMS**	Provision for Air Conditoning System to be provided
4	**KITCHEN**	Mechanical Ventilation
5	**DINING ROOM**	Provision for Air Conditoning System to be provided
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Air Conditioning System shall be provided in UPS room, AV room, ELV room. Natural or Mechanical Ventilation in other room.
21	**LIFT WELL**	-
23	**LIFT MACHINE ROOM**	Air Conditioning System
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-
9	**STAIRCASE**	Normal or Mechanical Ventilation as per requirement.
19	**TOILETS**	Mechanical Ventilation System
	TERRACE	-
	OPD BUILDING	
1	**ENTRANCE LOBBY**	Air Conditioning System

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
2	**CORRIDOR & LOBBY**	Air Conditioning System
3	**LIFT LOBBY**	Normal or Mechanical Ventilation as per requirement.
4	**OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM**	Air Conditioning System with 100 % redundancy
5	**LABORATORY, SAMPLE COLLECTION ROOM**	Air Conditioning System
6	**TOILETS**	Mechanical Ventilation System
7	**SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM**	Air Conditioning System with 100 % redundancy
8	**RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION**	Air Conditioning System with 100 % redundancy
9	**PHARMACY**	Air Conditioning System with 100 % redundancy
10	**X-RAY ROOM**	Air Conditioning System with 100 % redundancy
11	**DARK ROOM**	Air Conditioning System with 100 % redundancy
12	**USG ROOM, MRI ROOM, CITY SCAN ROOM, ECO ROOM, EEG ROOM, ECG ROOM**	Air Conditioning System with 100 % redundancy
13	**STAIRCASE**	Air Conditioning System
14	**OT AREA**	Air Conditioning System with 100 % redundancy

ACMV SCHEDULE FOR MEDICAL COLLEGE OTHER BUILDINGS:		
SL. No.	**TYPE OF ROOM/AREA**	**SCOPE OF ACMV**
15	**RECOVERY ROOM**	Air Conditioning System with 100 % redundancy
16	**AUDIOMETRY ROOM**	Air Conditioning System with 100 % redundancy
17	**OFFICE**	Air Conditioning System
18	**DAY CARE WARD**	Air Conditioning System
19	**BABY CARE ROOM**	Air Conditioning System
20	**RECORDS & STORE ROOM**	Mechanical Ventilation System
21	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Air Conditioning System shall be provided in UPS room, AV room, ELV room. Natural or Mechanical Ventilation in other room.
	TERRACE	-

NOTE 2:	
1	Fresh air for Air Conditioned areas shall be considered as per ASHRAE std. 62.1 (2010) / ASHRAE std 170-2008.
2	All Air Conditioned Space Temperature to be maintained at 23 +/- 2 Deg. C without any specific control on Relative Humidity
3	Minimum Pre filters to be considered for all Air Conditioned areas.
4	Mechanical Ventilation systems shall be designed as per NBC - 2016 / Electro-Mechanical equipment heat dissipation limiting temp. rise to 5 Deg. C over prevailing ambient.

14.1 DESIGN CONSIDERATIONS:

a. The option proposed to be adopted for this project, will be planned and selected for:

b. Energy efficient throughout the varying load patterns.

c. Providing required Indoor air quality (IAQ) with reduced operating cost.

d. Maximum flexibility of operation.

14.2 Energy Efficiency

a. **Energy Efficiency**: All refrigeration equipment (Chiller Unit/ Ductable Split/Unitary AC machines) should comply with efficiency norms as per latest ECBC code.

14.3 Design Philosophy

a. The air conditioning systems operate between a minimum demand of 40% and up to a maximum demand of 95% for a major part of the year.
b. Hence, the selection proposed is such that the overall power requirement remains consistent with the demand, avoiding all possible waste.

14.4 INDOOR AIR QUALITY

a. ASHRAE (USA) standard call for maintaining a desirable Indoor Air quality (IAQ) in a tightly sealed building.

b. This is to prevent sickness syndrome in people who occupy these buildings for a long period. This will also help to control the concentration of harmful bacteria to provide a comfortable environment, to save energy, to prevent exhilaration / infiltration of pathogens etc.

14.5 FLEXIBILITY

a. Suitable zoning shall be done based on operating time and functional requirement and independent AHU / FCU shall be provided for each zone / room.

b. This will ensure that the equipment in operations is as per demand without any wastage of power.

14.6 SYSTEM REQUIREMENT

Suitable capacity of ACMV equipment shall be considered by bidder to satisfy the requirement.

14.7 AIR CONDITIONING SYSTEM TO BE CONSIDERED FOR VARIOUS BUILDINGS

Residential Qtrs / Buildings and Hostels:

Wherever applicable, shall be provided with Hi wall / Ductable Split A.C. machine.

- Compressor: Rotary / Scroll Type
- Air Cooled Condenser: Copper tube with aluminium fins duly coated for protection against atmospheric corrosion.
- Refrigerant: HFC / HCFC. R-32 is not acceptable.
- Energy Efficiency: 5 - Star for Hi Wall Split Units. As per ECBC for Ducted Split Units.
- BMS Integration: Not Required

Auditorium Building:

Air Conditioning to be provided by Chilled water plant consisting of Multi Circuit Air Cooled
Chillers and fixed speed pumping system.

- Compressor: Scroll/Screw Type.
- Refrigerant: HFC. R-32 is not acceptable
- Air Cooled Condenser: Copper tube with aluminium fins duly coated for protection against atmospheric corrosion.
- Energy Efficiency:As per ASHRAE std
- 90.1.

- Hi Side: 2 x 50% capacity module (without redundancy). However chilled water pumps shall have 3 x 50% modules.
- Air Side Equipment: Air Handling units shall be double skin type, custom built, to satisfy Air quantity delivery, static pressure and Heat removal capacity as per peak design. Small rooms however can have standard FCUs / IDUs.
- BMS Integration: Required

Main Academic Block:
A common Central Chilled water plant shall be considered for all the conditioned spaces of the building.

- Chilling Machine: Air Cooled Screw Chilling machines with minimum 2 independent refrigerant circuits per machine.
- Air Cooled Condenser: Copper tube with aluminium fins duly coated for protection against atmospheric corrosion.
- Energy Efficiency: As per ASHRAE std 90.1.
- Refrigerant: HFC. R-32 is not acceptable.
- Equipment Configuration: 2Working +1 Stand-by for Chillers, Fixed speed Primary chilled water pumps and Variable speed Secondary chilled water pumps.
- Secondary Variable Flow Pumping System: All pumps shall be VFD driven with by-pass starter arrangement working as a complete system under Pump Logic Controller.
- Air Side Equipment: Air Handling units shall be double skin type, custom built, to
- satisfy Air quantity delivery, static pressure and Heat removal capacity as per peak design. Small rooms/ chambers can have FCU.
- BMS Integration: Required for Hi Side Equipment & AHUs – facilitating operation and monitoring from a central work station.

a. Ventilation System

i. Axial Flow Fans

- Static Pressure shall be as per requirement.
- Type of Motor - TEFC

ii. Centrifugal Blowers

- Type - DIDW/SISW
- Static Pressure shall be as per requirement.
- Outlet velocity - Shall not exceed 2000 FPM(10.16 m/s)
- Inlet velocity - Shall be limited to 1000 FPM(5.08 m/s)

iii. Inline Fans

- Type -
Direct driven type
- Static pressure shall be as per requirement.
- Electric supply -
220V/1 PH/50 Hz

iv. Duct Work

- Air velocity in ducts - Shall Not exceed 1500 FPM (7.6 m/s)
- Aspect Ratio of duct - Generally up to 1:4
- Friction Rate - 0.0065 to 0.008m/100m

14.8 SMOKE MANAGEMENT SYSTEM

a. Shall be provided as per provisions of **NBC-2016** and Amendment No-2 Sept. 2015 to **NBC- 2016** Part 4 "Fire and Life Safety".

14.9 VENTILATION OF SERVICES AREAS LIKE, DG ROOM, SUBSTATION ETC.

a. Service areas include mechanical equipment room comprising of DG sets, LT Room, Transformer room, AC Plant room and pump room.

b. As per the National Building Code of India 2016 (NBC-2016) there shall be separate ventilation of services room i.e. DG sets, LT panel rooms, Transformer room, AC plant room, sewage plant (STP) room etc.

c. Separate mechanical fans shall be provided equivalent to 12 air changes per hour (ACPH) separately for DG room, LT panel room and Pump room as these rooms are placed inside the building. Similarly forced make up air will be provided for these areas. These fans shall be interlinked with main fire alarm and detection system of the building. The fans shall be automatically started in case of fire and there will be provision to run the fans manually as and when required. These areas shall have provided with normal exhaust fans as well to exhaust out the heat or gases equivalent to 10 - 12 air changes per hour.

d. Transformer rooms and other services areas shall be provided with exhaust fans capacity equivalent to 10 - 12 air changes per hour.

e. All type of mechanical fans proposed for smoke extraction shall be of class 'H' insulation or 2
hour fire rating.

f. Services areas shall be maintained at negative pressure to avoid / prevent heat or smoke leakages to the adjoining area.

g. There will be separate shaft air / ventilation shafts for each services area.

14.10 POWER REQUIREMENT

a. The ACMV system will require 3 Ph, 50 Hz, 415 V / 1 Ph, 50Hz 230V A.C. as per specific requirement of the various equipment.

14.11 REFERENCE STANDARD FOR HVAC SYSTEM Code & Standard The under mentioned Codes & Standard will be followed:

- **ANSI / ASHRAE.** Standard 15-1994. Safety Code for mechanical refrigeration.
- **NFPA.** National Fire Protection Association.
- **ARI.** Air conditioning and Refrigeration Institute.
- **SMACNA.** Fix and Smoke damper installation guide.
- **SMACNA.** Standards for Duct Construction.
- **ASHRAE.** Standard 60.1.2007. Ventilation for Acceptable Indoor Air Quality.

15. Specification of Signage

All signs, Internal, External and Road Signs shall be as per specifications given hereinafter:

15.1 INTERNAL SIGNS

1) **Directory (Main)**
Exterior Grade 3mm ACP Router cut and fixed on iron sq pipe with anti rust coating with cut vinyl should be 3M/ Avery. ACP should be PU painted. ACP edge should not be open. Size should be 1800 x1200 mm x 3 nos.

2) **Directory (Floor)**
Exterior Grade 3mm ACP Router cut and fixed on iron sq pipe with anti rust coating with cut vinyl should be 3M/ Avery. ACP should be PU painted. ACP edge should not be open. Size should be 900 x 1200 mm.

3) **Directional**
Made of Aluminum Extrusion 75x25 mm Each section with internal connector and side cap, Vinyl used 3M/Avery hanging with s.s fittings
Size should be 1200 x 300 mm.

4) **Departmental**
Exterior Grade 3mm ACP Router cut with cut vinyl should be 3M/ Avery make. ACP should be PU painted. ACP edge should not be open. Size should be 1200 x 200 mm.

5) **Room Identification**
Exterior Grade 3mm ACP Router cut with cut vinyl should be 3M/ Avery make. ACP should be PU painted. ACP edge should not be open. Size should be 450 x 100 mm.

6) **Service Signage**
Exterior Grade 3mm ACP Router cut with cut vinyl should be 3M/ Avery make . ACP should be PU painted. ACP edge should not be open. Size should be 450 x100 mm.

7) **Washroom**
Exterior Grade 3mm ACP Router cut with cut vinyl should be 3M/ Avery make. ACP should be PU painted. ACP edge should not be open. Size should be 200 x 200 mm.

8) **Floor No (Staircase)**
Exterior Grade 3mm ACP Router cut with Auto glow cut vinyl should be 3M/ Avery make. ACP should be PU painted. ACP edge should not be open. Size should be 200 x 200 mm.

9) **Floor No (Lift Lobby)**
Exterior Grade 3mm white ACP Router cut with cut vinyl should be 3M/ Avery make. ACP should be PU painted. ACP edge should not be open. Size should be 200 x 200 mm

10) **Evacuation Plan/ with design create**
Exterior Grade 3mm ACP Router cut with Auto glow cut vinyl should be 3M/ Avery make . ACP should be PU painted. ACP edge should not be open. Size should be 450 x 300 mm

11) **Fire Exit**
Exterior Grade 3mm ACP Router cut with Auto glow cut vinyl should be 3M/ Avery make . ACP should be PU painted. ACP edge should not be open. Size should be 450 x 150 mm

12) **Fire Exit directional**
Exterior Grade 3mm ACP Router cut with Auto glow cut vinyl should be 3M/ Avery make hanging with s.s. Fittings. ACP should be PU painted. ACP edge should not be open. Size should be 450 x 150 mm.

15.2 External Signage

1) **Signage on Rooftop or Mupty level**
Chanellium Signage letter: Made of Aluminum Chanel with Acrylic face and back ACP. All ACP cuts and channel bending through CNC operated. Side profile paint and outside paint as per recommendation. ACP Should be 3mm outdoor quality and 6 mm A cast imported Acrylic with 3M/Avery Cut vinyl. LED Light used for

Module with outdoor Power supply and proper Electricals Wiring. Size should be 18900 x 900 mm. Structure cost extra if it is required. Cost depends on structural drawing as per individual Location.

2) **Building Signage on façade**
Exterior Grade 3mm white ACP Router cut and fixed on iron sq pipe with anti rust coating with 8 mm A cast Imported Acrylic and cut vinyl should be 3m/ Avery. LED Light Used along with wiring. Size should be 6360 x 3360 mm.

3) **Directional**
40mm X 40mm Ms pipe and 2mm Thick Ms Plate with powder coated, autoglow, cut vinyl 3M/Avery pest ,Stand should be grouts on floor with fastener size should be 900 x 1500 mm.

4) **Pylon**
Made of 150x75, 75x75, 50x50, and 25x25 Ms section with proper welding and epoxy base paint as per drawing. Top surface made of ACP cladding and partly painted duco, and litted area made of acrylic. Main logo made of channelium letter. All light provision use LED module, power supply use outdoor quality... foundation as per requirement. Size should be 6mtrx 2.5mtr.

5) **Parking**
Exterior Grade 4mm white ACP Router cut round shape fixed on Ms Structure 25x25 mm and 50x50 mm Ms Stand with Foundation, vinyl should be used Honeycomb Retro reflective 3M/ Avery Make. Size should be 600 x 1800 mm.

15.3 Location:

a. Type 1: Guide Map & Information Sign:

Non-illuminated and illuminated (LED) types, to be mounted on Walls inside the building, at strategic locations, to help public to locate the exit points in case of emergency and also to orient themselves on the respective floor.

b. Type 2: Location Identification Signs:

c. Type 3: Room Numbers:

All rooms will have a unique number. The Room Nos. will be mounted on or above the door frame.

d. Type 4: Statutory Signs:

i) Illuminated type with battery back-up mounted on Doors/Walls or suspended from the ceiling. These will be used for Fire Exit at various locations as required.

ii) Photo-Luminescent types, glow in dark: - to be mounted on Walls/suspended from ceiling inside the building. These will be required to provide Statutory messages inside the building at various locations.

e. Type 5: Warning/Prohibitory Signs:

Non-illuminated types, to be mounted on Walls/suspended from ceiling inside the building. These will be required to provide Statutory messages inside the building at various locations.

f. Type 6: Way Finding Signs: Wall Mounted/Ceiling suspended/Wall projected

Non-illuminated types, these will be mounted on Wall/suspended from the ceiling inside the building. These will require guiding the public to locate the direction towards the various facilities & areas inside the building.

g. Type 7: Doctor Directory Signs

h. Type 8: Evacuation Plan

Photo-Luminescent types, glow in dark: - to be mounted on Walls/suspended from ceiling inside the building. These will be required to provide Statutory messages inside the building at various locations

i. Type 9: Information Display Panel

Medical College will require poster and other information to be displayed which is frequently changed. The displayed frame will be provided mounted on walls to hold frequently changed information/poster.

Specification of illuminated & non- illuminated signage (including external and internal) may vary as per site condition and Employers Requirement. As many numbers of illuminated (LED) & Non-illuminated signage of different types and sizes as decided by the Employer.

16. Specification of Lift

Supply, erection, testing and commissioning of Bed cum passenger lift and other passenger lifts travelling from ground floor to top floors, stopping at all floors with AC variable voltage variable frequency micro-processor control, gear less and equipped with duplex full collective with attendant and ARD complete The scope includes liaison with lift inspector for submission of necessary Form and obtaining license to erect & operate the lift from the Lift Inspectorate & all cost to be included in quoted rate. The lift car will be stainless steel mirror finish, centre opening stainless steel mirror finish sliding doors (size: as per design). CCTV (for Academic Building) should be provided inside the lift cars.

16.1 Building wise quantity/number of Lift:

Sl. No.	Building	Minimum quantity of lift shall be installed	Provision
1	Academic Building	**4 (four)** nos. Bed cum passenger (20	

Sl. No.	Building	Minimum quantity of lift shall be installed	Provision
		passenger capacity).	
2	Composite Hostel Building for **Boys** (Resident Doctors, Interns, Students)	**4 (two) Lifts**. **2 (two)** no. bed cum passenger (15 passenger capacity) and **2 (two)** no. passenger (10 passenger) required.	1. **1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) lifts **for Resident Doctors and Interns Hostel Part** 2. **1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) lifts **for Student Hostel Part**
3	Composite Hostel Building for **Girls** (Resident Doctors, Interns, Students)	**4 (two) Lifts**. **2 (two)** no. bed cum passenger (15 passenger capacity) and **2 (two)** no. passenger (10 passenger) required.	1. **1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) **for Resident Doctors and Interns Hostel Part** 2. **1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) lifts **for Student Hostel Part.**
4	Teaching Staff Quarter	**2 (two)** nos.	**1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) lifts.
5	Non-teaching Staff Quarter	**2 (two)** nos.	**1 (one)** no. bed cum passenger (15 passenger capacity) and **1 (one)** no. passenger (10 passenger) lifts.
6	OPD	**5 (five)** nos.	**1 (one)** no. doctors lift (6 passenger capacity), **4 (four)** nos. bed cum passenger (20 passenger capacity) lifts.

16.2 <u>Design of ELEVATOR components, their installation and operation shall meet with:</u>

IS: 14665-2000 - Electric traction lifts.	
Part-I	Guidelines for outline dimensions of passenger, goods, service and hospital lifts.
Part-II	Code of practice for installation, operation and maintenance. Section 1 - Passenger and goods lifts. Section 2 - Service lifts.
Part-III	Safety rules. Section 1 Passenger and goods lifts. Section 2 Service lifts.

Part-IV	Components. Section 1 Lift buffers.
IS: 15785-2007	Code of practice for Installation and maintenance of lift without conventional machine rooms.

TABLE 16.3:

DETAILS OF LIFT SPECIFICATION		
Sl no	Item	Details
1	Load – Kgs	a. 1020 (15 bed cum passenger lift) for Academic Building b. 680 (10 Passenger Lift) for Hostel Building c. 408 (6 Passenger Lift) for Quarter Building
2	Speed – mps	1 mps
3	Travel – mtrs	As per Bldg requirement
4	Stops & Openings	As per Bldg Requirement
5	Power Supply	400 Volts 3 Phase 50 Hertz. Alternating Current
6	Control	A.C. Variable Voltage Variable Frequency (with close loop) micro-processor control, gear less.
7	Operation	Duplex Full Collective (with/without Attendant)
8	Machine	Gearless.
9	Car Size (W x D x H) – mm	As per Requirement
10	Hoistway Reqd (W x D) - mm	As per Requirement
11	Overhead Reqd – mm	As per Requirement
12	Pit Depth Reqd – mm	As per Requirement
13	Car Enclosure	IND-160
14	Car Panels	Stainless steel car panels in hairline finish
15	Handrails on three sides	Stainless steel mirror finish

16	Flooring	20 mm recess (Flooring -Granite)
17	Car Entrance	Protected by two speed stainless steel door in hairline finish
18	Size (W x H) – mm	As per requirement.
19	Hoist way Entrances	Protected by two speed stainless steel doors in hairline finish
20	Door Operation	Automatic & Multi-Ray Electronic Door Detector System
21	Details	Fireman's switch at main lobby
22	Signal	Overload Warning Device
23	ARD	Automatic Rescue Device with battery back up
24	Signal	Combined luminous, Hall Button and digital hall position indicator at all floors with up/down arrows
		Digital Car position Indicator in cars with up/down arrows
		Overload warning indicator in car
		Battery Operated Alarm Bell and emergency light in car with rechargeable dry maintenance free battery and battery charger (Battery back-up for 2 hours operation). Alarm bell to be located Main Lobby in Ground floor with all cable work for each lift
		Hall lanterns at all floors
25	Other equipments	Battery operated alarm bell to be located in the lift lobby in ground floor with floor announcements in car and facility playing pre-recorded music within the cars during travel and between the period of floor announcements for lifts
		Voice Announcement System with provision for playing music etc for passenger each lift
26	Fireman's switch	On ground floor main lobby for each lift
27	Communication system	Intercommunication system – One hand set in each car and one master hand set in main landing with necessary flexible cabling system and accessories for each lift. In the Lift supplier has to provide back net/ mod bus get way for integration with BMS.

16.4 COMPLETION TESTS

A Load test

A contract load test under the supervision of the local authorities and in presence of the Owner's representative shall be carried out before the lift is put into commission. During the test the brakes, limit switches, buffers and car safety devices shall be caused to function with the contract load in the lift. The lift shall be tested for accuracy of levels at all loads in either direction and for smooth vibration less travel. The lift shall be accepted upon satisfactory completion of the contract load test and after the same are certified by the appropriate local authorities/Lift Inspector and Owner's representative

B. Other Completion Tests

Insulation resistance tests to earth of the entire electrical equipment and wiring installation are to be carried out by means of a constant pressure 500 volts testing meggar set and the test result shall not be less than 1 mega ohm.

Result of continuity test of the conduit installation and any other metal work to earth shall not be more than one ohm

The temperature of motors and associated control equipments shall be checked after a continuous run of at least one hour duration to ensure that temperature rises are within the limit.

Test for speed shall be carried out and the speed shall not vary more than 10% of the specified speed under any conditions of load during ascending or descending

16.5 FEES & LICENSES

The Lift Contractor shall submit requisite application forms with necessary fees to the State Lift Inspector/Authority for permission to erect and for operation after getting the requisite forms (to be furnished by him) duly filled in and signed by the Owner. He will also liaison with the lift inspector and arrange for the provisional approval, inspection and issue of the licence by the Lift Inspector for regular use of the lifts.

The lift supplier will bring all his tools and tackles, testing apparatus at the time of inspection of Government Inspector/ Authority and he will be solely responsible for getting the lift installation approved/passed by the lift inspector/Authority

Statutory fees will be paid by the employer

The Contractor shall warrant the performance of the equipments installed under this contract for a period of 36 months from the date of Taking Over of the Works or Sections thereof, as may be applicable.

17. Specification of Pump Motor for Water Supply & Sewerage

The bidder should design a efficient water supply system showing exact position of each component like type & size of pump, pump room, pump motor, electrical panel, service line etc. Provision of Electrical GEYSER at HOD rooms toilet , Principal's rooms toilet , MSVP's rooms toilet, Staff quarters toilet and Interns Hostels toilet.

17.1 MOTOR DRIVEN DRY PIT PUMPS [FOR CLEAR WATER]:

End suction type, horizontally mounted centrifugal pump each capable to deliver the rated discharge of clear water. The pump should be coupled to a suitably TEFC electric motor mounted on a common base frame and anti-vibration pads/sheets, coupling, coupling guard and fixing stainless steel bolts etc. Motor HP to be suitably selected to suit discharge at duty point. The characteristic should have a wide range so that the pump does not fail at lower heads. Pump is to be selected with a minimum

efficiency of 65%. The vendor has to select the best efficiency pump from the vendor list

The material of construction of pump shall be all stainless steel [minimum AISI 304] complete with body, housing, impeller & shaft of stainless steel. The base frame also shall be fabricated stainless steel **(nickel alloy bars)** with minimum 5 mm thickness of angle/channel sections & 4 mm thickness of sheets. All nuts / bolts / washers shall be of stainless steel. Gland packing shall be graphite asbestos

The material of construction of motor shall be cast iron housing, pressed stamped internals, copper windings. The motor shall be TEFC, squirrel cage induction type, IP55 rated with Class 'F' insulation & Class 'B' temperature rise, continuous rated for ambient of 50˚ C. motor efficiency should not be less than 87%. This motor will be mounted on the common stainless steel base frame. The motor will be coupled to the pump with a love joy flexible coupling

Arrangement to drain off gland packing leakage shall be provided with suitable funnel & PVC pipe of 32 mm Ø.

For close coupled mono block pump sets, the material of construction will remain the same as for dry pit pumps mentioned above but instead of gland packing there should be a mechanical seal as per manufacturers' standard. The efficiencies of pump & motor should be minimum as mentioned before

In both cases of pumps the rpm should not be more than 3000 [syn]. These pumps should be suitable for clear water operation of sp.gr = 1

17.2 SUBMERSIBLE CLEAR WATER PUMPS:

The material construction of pump & motor shall be all stainless steel #AISI 304 or superior as per manufacturer. The motor protection shall be IP:68 and there should be a single mechanical seal. All other specifications shall be the same as mentioned in dry pit pumps. The pump must have all internal sensing devices as well as level sensing for automatic start & stops at required levels. Arrangement must be made for lifting the pumps with guide pipe or chain or wire as per manufacturers' standard. However such lifting arrangements will have to be of AISI 304.

17.3 SEWAGE SUBMERSIBLE WET PIT PUMPS.

Submersible sump pumps for sewage & waste water applications shall be all cast iron with double mechanical seals. Motor protection shall be IP:68. The motor shall be close coupled vertical motor, squirrel cage induction type with class 'F' insulation. Cooling will be with the liquid surrounding the motor frame outside. The pump set must have all monitoring devices for auto control & tripping, viz. winding temperature, moisture control, & level sensing to prevent any failure in operation. Arrangement must be made for lifting the pumps with guide pipe or chain or wire as per manufacturers' standard. However such lifting arrangements will have to be of AISI 304.

17.4 PUMPSET DATA SHEETS:

Pump set data sheets complete with data as per manufacturer, material of construction, characteristic curves, efficiency curves, power consumption curves etc have to be provided for at least 3 manufacturers. Architect/Owner will chose the best available pump set from the data provided and this pump set will have to be provided by the contractor who is awarded the work.

The rates quoted by contractor will take this into account

Please note that AISI 304 is slightly magnetic but AISI 316 is non magnetic.

18. Specification of Solar System:

Deliverable of 2×50 KWp Grid Connected Roof Top Solar PV Power Plant:

A. Outline of the scheme of the project :

A.1 The array capacity of the proposed grid connected PV Power plants shall be **50kWp** for the entire Medical College campus.

A.2 The PV array shall be installed on the available space of the Roof of the Building.

A.3 The power plant shall be connected with grid with five numbers grid tie string inverters each of capacity 10 KVA, 3Ø 415 V 50Hz AC.

A.4 The inverters shall be installed in a suitable kiosk(s) with proper security protection close to the Array Terminal Box with arrangement of proper shed.

A.5 Outputs of the grid tie string inverter shall be terminated to an Inverter Combiner Panel to be located close to the inverters.

A.6 The output of the Inverter Combiner Panel shall be terminated and connected with supply mains through Grid interfacing Panel

A.7 An Export Import Energy Meter to be installed nearer to the Grid interfacing Panel before connected to the mains to measure the energy produce from the PV Power Plant **A.8** The SPV power plant to be installed should be Robust, Economic, Efficient and Time tested.

B. Solar PV Modules

The Cell of the Modules shall be poly crystalline. The capacity shall be consider as per declared capacity in the published technical brochures of the proposed PV Module Manufacturer.

Minimum number of PV Modules:

Sl No:	PV Module capacity type	No of PV Cell
01	240 Wp/250 Wp	60 Nos.
02	290 Wp / 300 Wp	72 Nos.

The PV modules must qualify the relevant **IEC 61215 or IS 14286 and IEC 61730.** The proposed PV Module must have the Test Certificate issued from accredited test laboratories of MNRE Government of India under JNNSM Programme. The test certificates issued from IEC accredited laboratories shall also be acceptable.

Proposed PV Module must be manufactured in India.

Each PV module used in this solar power project must use an RF identification tag. The information must be mentioned in the RFID used on each module as per guideline of MNRE Government of India (This can be inside or outside the laminate, but must be able to withstand harsh environmental condition

Manufacturer of proposed PV modules must have the ISO 9001:2008 or ISO 14001 Certification for their manufacturing unit for their said manufacturing item.

Desired specification of the PV Module shall include but not limited to the following:

Sl No	Item	Description
1.0	Certification	i) IEC 61215 or IS 14286 ii) IEC 61730
1.1	Test certificate issuing authority.	NABL/ IEC Accredited Testing Laboratories or MNRE accredited test centers.
2.0	PV Cell	
2.1	Type	poly crystalline
2.2	Size	156mmX156mm
3.0	PV Module	
3.1	Rating at STC	i)240 Wp/ 250Wp, 60 cells (without any negative tolerance) ii)290 Wp / 300Wp, 72 cells (without any negative tolerance)
3.2	Efficiency	minimum14%
3.3	Fill factor	Minimum 70%
3.4	Withstanding voltage	1000V DC
3.5	Glass	
3.5.1	Thickness	3.2 mm (minimum)
3.5.2	Type	High transmission, low iron, tampered & textured glass with anti reflective coating.
3.6	PV Module Junction Box	
3.6.1	Protection level	IP 65 or above
3.7	Bypass Diode	
3.7.1	System Voltage (Vsys)	1000 V dc
3.7.2	Number	3 numbers
3.8	Module Frame	
3.8.1	Type	Anodized aluminum frame

C. PV Array

Desired specification of the PV Array shall include but not limited to the following:

Sl No	Item	Description
1.0	Nominal Capacity	1x50 KWp
2.0	PV Module interconnection connector	MC-4 / Tyco
3.0	PV Module interconnection cable and array cable	PV 1-F standard /NEC standard "USE-2 or RHW-2" type (double insulated)
4.0	PV array String Voltage	Compatible with the MPPT Channel of the inverter
5.0	Number of Parallel String against each MPPT Channel	02 Nos (Maximum)

D. Array Structure

i) The solar PV system capacity minimum 100 KWp have to install at shadow free multiple locations as per availability of free roof top space of the buildings.

ii) PV Array structures shall be of Mild Steel with combination of either of I, C , L sections MS flat as per structure design requirement. The structure should be capable of withstanding **a wind load of 150 km/hr after grouting & installation**.

iii) Weight of the Metallic part of PV Array structure excluding nuts and bolt must be minimum same as the Weight of the total PV Module**.**

iv) Structural shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts.

v) The array structure shall be made of hot dip galvanized MS structure of minimum galvanizing thickness **70 to 80 micron**

vi) Structures shall be supplied complete with all members to be compatible for allowing easy installation.

vii) The module mounting structure shall have to be designed and fabricated with optimum tilting angle considering the site conditions.

viii) The structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground.

ix) All fasteners for supporting conduits , nut & bolts shall be made with stainless steel , very good quality stainless steel **except foundation bolts and the nuts and bolts to be used for connection of earthing strip with module mounting structure which will be of MS (GI Coated)**

x) Supporting structures including module Mounting structure shall have to be adequately protected against all climatic condition. The array structure shall support SPV modules at a given orientation and absorb and transfer the mechanical loads to the columns properly.

xi) The structures shall be designed for simple mechanical and electrical installation. There shall be no requirement of welding or complex machinery at the installation site. Required civil work or support platform is absolutely essential to install the structures, detailed engineering drawings and instructions for civil and other works shall got approved from the competent authority before carried out at the site.

xii) The Specification of the MS sections, flats must be as per **IS 808**

xiii) The supplier shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings.

E. <u>PV Array Junction Box (AJB)</u>

Array Junction Box (AJB) shall have to be used for termination of string prior connecting array with each inverter. There shall be two Arrays Junction Box incase, the inverter is located elsewhere away from PV Array. The minimum number of PV Array Junction Box shall be **five (05) numbers**. The

desired specification of the PV Array Junction Box and accessories shall include but not limited to the following:

Sl No	Item Description	Desired Data
1.0	Enclosure	
1.1	Degree of Protection	IP65 with UV Protected
1.2	Material	Polycarbonate.
1.3	Withstanding voltage	1000V DC
1.4	Withstanding Temperature	100 ^{0}C
1.5	Accessories mounting arrangement	DIN Rail
1.6	Number of Strings entry	As may be required
1.7	Approved Make	Hensel/ Spelsberg /ABB /*Ensto or* or equivalent make ***(as per acceptability of*** authority ***)***
2.0	Cable Entry and Exit	
2.1	Position	Bottom at cable entry and exit
2.2	Cable Entry and Exit connector type	MC 4 Connector (PV Array String cable)
2.3	Cable gland	Earthing cable entry
3.0	Surge Protecting Device (SPD)	
3.1	Type	DC
3.2	Approved Make	OBO Betterman / Dehn / Citel /ABB or equivalent make ***(as per acceptability of*** authority ***)***
3.3	Protection class	Type B+C
3.4	Number of set	As may be required as per string Design
3.5	System Voltage	Matched with System Voltage 1000 V DC
4.0	Fuse with fuse holder	
4.1	Position	Positive and negative terminal for each series string
4.2	Type	Glass fuse, for PV Use only
4.3	Rating	Current: Minimum **1.25** times the rated short circuit current of the string Voltage: Minimum **1000 V DC**
5.0	Earthing Provision	Terminal blocks will have to be provided for Earthing
6.0	Terminals, lugs and bus bar	Tinned copper

F. <u>Grid Connected Inverter</u>

The inverters shall be of string inverter. The proposed 50 KWp grid connected solar PV power plant shall be connected with grid. As such, the inverters shall be compatible to operate with existing utility supply. The PV system shall comprise of **five (05) numbers** of grid tie inverters each of nominal capacity 10 KVA.

Desired specification of each 10 KVA inverter shall include but not limited to the following:

Sl. No.	Operating Parameter	Desired specification
1.0	Type	Grid connected String Inverter
2.0	Usage	Specially used for PV system
3.0	Standards	
3.1	Efficiency Measurement	IEC 61683/ Equivalent BIS Std.
3.2	Environmental testing	IEC 60068-2 (1,2,14,30) / Equivalent BIS Std.
3.3	Interfacing with utility grid	IEC 61727
3.4	Islanding Prevention Measurement	IEC 62116
3.5	Type Test certificate issuing authority **(for item no 3.1 , 3.2,3.3 and 3.4)**	NABL/ IEC Accredited Testing Laboratories or MNRE approved test centers.
4.0	**Input (DC)**	
4.1	PV array connectivity capacity	12 KWp (minimum)
4.2	MPPT Voltage range	Compatible with the array voltage
4.3	Number of MPPT Channel	2 nos (Minimum)
5.0	**Output (AC)**	
5.1	Nominal AC Power output	10 KVA
5.2	Number of Grid Ph	3Ø
5.3	Adjustable AC voltage range	Programmable as per grid condition 360V-455V
5.4	Frequency range	47-53 Hz
5.5	AC wave form	Sine wave
5.6	THD	Less than 3%
5.7	Switching	High frequency transformer / transformer less
6.0	General Electrical data	
6.1	Efficiency (Maximum)	95 %
6.2	Sleep mode consumption	Less than 5 W
7.0	**Protection**	
7.1	DC Side	1. Reverse-polarity protection 2. Reverse current to PV array protection, over voltage, Under voltage protection 3. Over current
7.2	AC side	1. DC inject protection to grid less than1% 2. Over voltage and Under voltage 3. Over current 4. Over and under grid frequency protection, 5. Anti Islanding protection
7.3	Isolation Switch	1. PV array Isolation switch (DC)

7.4	Ground fault detection device (RCD) which can detect changes in ground current. Rating shall be as suitable for inverter	To be provided for transformer less inverter.
8.0	Display	
8.1	Display type	LCD Display
8.2	Display parameter	
8.2.1	DC	Voltage Current Power
8.2.2	On grid connected mode	Line status Grid voltage Grid frequency Export Power Cumulative Export Energy
9.0	Interface (Communication protocol)	Suitable port must be provided in the inverter for i) On site upgrade of Software, ii) On site dumping data from the memory, iii) Web based remote monitoring system
10.0	Web monitoring	Matched with the monitoring and data logging system
11.0	Mechanical Data	
11.1	Protection Class	IP 65 or higher
11.2	Operating ambient temperature	0 ^{0}C to 60^{0}C
11.3	Cooling	Natural / forced cooling

G.

H. **<u>Web enable on line data logger and Remote Monitoring Unit :</u>**

Web enable data logging system may be an integrated part of the inverter or a separate unit. The data logging system includes **MPPT wise PV array monitoring** system also. The data Logger should have the provision of recording **the data of solar insulation, PV cell temperature and ambient temperature and associated electrical parameters** at different stages to study performance of system as well as to study status of the system at a particular instant. The data logger should have required transducer to monitor and record the required system data. **The data logger should be provided with an insulation sensor and a module temperature sensor, ambient temperature sensor matched with the system**.

The data logger shall have reliable battery backup and data storage capacity (minimum two days data) to record all sorts of data simultaneously round the clock.

Web based Remote Monitoring system must be compatible with data logger. The system shall be provided **with GSM Modem with required SIM card**. The modem must be compatible to GSM and /or GPRS system. The other required accessories, hardware and compatible software shall have to be provided as an integrated part of the system to monitor the real time data (maximum 20 minutes delay) through web server. The Data logger shall continuously send data to the server. The system can be monitored from anywhere through internet without installing any special software. The server

shall not be provided by authority or end user. **The price of the remote monitoring system includes all the rental and other costs of the SIM cards, IP address for a period of five (05) years**.

The Web based monitoring system should have the provision of graphical representation of the data shall include but not limited to the following:

Sl. No.	Operating Parameter	Desired specification
1.0	Input data	PV Power PV Energy
2.0	Meteorological data	Insolation Module Temperature Ambient Temperature
3.0	Output data	
3.1	Inverter	Export Power Export energy

All data shall be recorded chronologically date wise. The data file should be MS Excel/XML/or any readable form compatible and should have the facility of easy download

H. Inverter Combiner Panel

Each of the output of the five (05) Nos Inverters shall be terminated in a Combiner Panel through 32A 415V 4 pole MCB at the in incoming side (Inverter side). The outgoing side (Grid side) shall be connected through a 125A 415V 50 kA TPN MCCB and a 150A 415 V 4 pole Load Break Switch. The set of AC surge suppressor (SPD) shall be connected at the outgoing bus. The Grid Sync Panel shall be outdoor type having double door metal enclosure with a front. **The protection level Grid Sync Panel must be IP 54.** All the equipments and meter display can only be accessed after opening of front doors. The front door must have locking arrangement.

Desired specification of **Grid Sink Panel** shall include but not limited to the following:

Sl No	Parameter	Desired Specification
1	In coming MCB (Inverters side)	
1.1	Approved make	ABB / L & T / Schneider / Siemens/Havell's orequivalent make (as per acceptability of authority)
1.2	Number	06 (one) number. 01(one) number against each inverter and one number spare.
1.3	Type	4 pole
1.4	Rating	415V, 32 Amps, 10 kA
2	Outgoing MCCB (Grid Side)	
2.1	Approved Make	ABB / L&T / Siemens/ Schneider or equivalent ***(as per acceptability of*** authority***)***
2.2	Type	4 pole

2.3	Rating	125A 415VAC 50kA
3	Surge protection device	
3.1	Position	Outgoing side (Grid side)
3.2	Approved Make	OBO Betterman / Dehn / Citel /ABB or equivalent make(as per acceptability of authority)
3.3	Usage as declare by Manufacturer	For AC use only
3.4	Protection class	Type B+C
3.5	Number of set	01 Set
3.6	Rating	600 V 100 kA (minimum)
4	AC load break switch	
4.1	Make	ABB / L&T / Siemens/ Schnider /Havell's or equivalent make ***(as per acceptability of*** authority***)***
4.2	Rating	150A 415 V TPN
4.3	Operating facility	Handle with Padlock.
5	Indicator	Incoming side and outgoing side (R,Y,B)
6	Metering Arrangement	
6.1	Instantaneous Measuring parameter	i. Voltage, ii. currentiii. Frequency
6.2	CT/ PT Make	KAPPA/ SERVO/AE/ KALPA or equivalent make ***(as per acceptability of*** authority***).***
6.3	Type of meter	Electronics
6.4	Display type of meter	LED/LCD
6.5	Display of the meter	From outside without opening of front cover
6.6	Meter Make	L&T / Siemens/ Schneider/ Secure or equivalent ***(as per acceptability of*** authority***)***
7	Bus Bar	
7.1	Material	Copper
7.2	Type	TPN
7.3	Rating	200 A
7.4	Position	Incoming and Out Going Bus
8	Earthing Provision	Terminal Blocks will have to be provided for Earthing
9	Mechanical	
9.1	Type	Metallic, double door, Outdoor Type
9.2	Protection level	IP 54 (minimum)
9.3	Housing	Floor Mounted/ Wall Mounted
9.4	Enclosed	Double Door Metal Enclosure dust and vermin proof
9.5	Cable Entry	Bottom
9.6	Glands Position	At cable entry and exit
9.7	Cooling	Natural/ forced

I. <u>Kiosk (for installation of Array Junction Box, Inverter, Grid Sync Panel) :</u>

(i) All the Array Junction Boxes, Inverters and Grid Sync Panel shall be installed at the same place and at the rare side of the PV Array in a suitable location in a Kiosk.

(ii) The kiosk of must be of a suitable design, covered with a door and locking arrangement with good air circulation. The Kiosk must have security arrangement against theft, manhandling etc. Above the kiosk there should have a suitable shade.

(iii)The equipment / structure of the equipment fixed on the array structure then suitable insulation must be provided between Array structure and the equipment and equipment structure.

(iv)The minimum clearance of the lower edge of the equipments from the developed ground level should be **1m**

(v) The kiosk of must be of a suitable design covered with a cage with door and locking arrangement for protection and to prevent mishandling.

(vi)The cable laid in the kiosk through cable tray with front cover.

(vii) The Kiosk structure must have sufficient strength to bare the load of the equipments.

J. Grid interfacing LT Panel

Output of each of the two Inverter combiner panel shall be terminated to a **Grid Interfacing LT Panel.** The Inverter Combiner Panel shall be outdoor type Poly Carbonate of protection level IP 65**.** All the equipments and meter display can only be accessed after opening of front doors. The front door must have locking arrangement.

Desired specification of each **Grid interfacing LT Panel**shall include but not limited to the following:

Sl No	Parameter	Desired Specification
1.0	MCCB (Grid Side)	
1.1	Number	02 (two) numbers. 01(one) number to be used + 01 Number spare
1.2	Approved Make	ABB / L&T / Siemens/ Schneider or equivalent ***(as per acceptability of*** authority***)***
1.3	Type	4 pole with handle
1.4	Rating	125A 415VAC 50 kA
2.0	Surge protection device	
2.1	Position	Outgoing side (Grid side)
2.2	Approved Make	OBO Betterman / Dehn / Citel /ABB or equivalent make (as per acceptability of authority)
2.3	Usage as declare by Manufacturer	For AC use only
2.4	Protection class	Type B+C
2.5	Number of set	01 Set
Sl No	Parameter	Desired Specification 102

2.6	Rating	600 V 100 kA (minimum)
3.0	Metering Arrangement	
3.1	Instantaneous Measuring parameter	i. Voltage, ii. current iii. frequency iv. Power
3.2	CT/ PT Make	KAPPA/ SERVO/AE/ KALPA or equivalent make ***(as per acceptability of*** authority***).***
3.3	Type of meter	Electronics
3.4	Display type of meter	LED/LCD
3.5	Display of the meter	From outside without opening of front cover
3.6	Meter Make	L&T / Siemens/ Schneider/ Secure or equivalent ***(as per acceptability of*** authority***)***
4.0	Earthing Provision	Terminal Blocks will have to be provided for Earthing
5.0	Enclosure	
5.1	Degree of Protection	IP65 with UV Protected
5.2	Material	Polycarbonate.
5.3	Withstanding voltage	1000V DC
5.4	Withstanding Temperature	100 ^{0}C
5.5	Number of Strings entry	As may be required
5.6	Approved Make	Hensel/ Spelsberg /ABB /*Ensto or* or equivalent make ***(as per acceptability of*** authority***)***
5.7	Cable Entry	Bottom

K. <u>Export Import Energy Meter :</u>

One number 3 Ø 4 wire 415V AC 3X(20A-100A) whole current **Export Import Energy Meter of L&T / Genus or Equivalent** ***per acceptability of*** authority **.** The Meter to be supplied must be tested from any of the NABL/ BIS Accredited Testing-Calibration Laboratories. The export Import Energy meter shall be installed at the separate housing within an enclosure. The Export Import Energy meter shall be installed at a suitable location before Point of Common Coupling (PCC) with grid side.

L. <u>Cables & Wirings :</u>

The Specification of wiring material of PV Power plant shall include but not limited to the following:

Sl No	Item	Description
A	DC Cable	
1.1	Conductor	Tinned annealed stranded flexible copper according to IEC 60228 class 5
1.2	Standard	PV-1F / 2 PfG 1169/08.2007 / VDE Standard E PV 01:2008-02 /Equivalent

1.3	Mke	LAPP/Top Solar/Nexans/ Schneider or equivalent ***(as per acceptability of*** authority***)***
B	AC Cable	
2.1	Rated Voltage	1.1kV
2.2	Construction	
2.2.1	Type	Armored or unarmored as per requirement
2.2.2	Conductor	Stranded flexible copper
2.2.3	Insulation	PVC
Sl No	Item	Description
2.2.4	Standard	IS : 1554 -1
2.3	Make	RR Cable/ Polycab/LAPP/ Havell's or equivalent ***(as per acceptability of*** authority***)***
C	PVC Conduit tees, bends etc (Hard & flexible)	
3.0	Standard	ASTM D 1785 u PVC
3.1	Ambient Temperature	0 ^{0}C to 50 ^{0}C
3.2	Type	UV stabilized , temperatures, Shock proof chemical resistant
3.3	Make	Oriplast /Supreme
D	GI Pipe	
4.0	Make	TATA

(i) All the Array Junction Boxes, Inverters **Inverter Combiner Panel** shall be installed at the rare side of the PV Array in suitable locations in Kiosks. **Grid Inter facing panel** also to be put in a Kiosk

(ii) The panels must be installed in suitable kiosks protected from theft and mishandling with sheds so that rain water and direct sun exposure can be avoided.

(iii)The kiosks of must be of a suitable design, covered with a door and locking arrangement with good air circulation. The Kiosks must have security arrangement against theft, manhandling etc.

(iv) The kiosks must have suitable sheds so that rain water and direct sun exposure can be avoided.

(v) The equipment / structure of the equipment fixed on the array structure then suitable insulation must be provided between Array structure and the equipment and equipment structure.

(vi) The minimum clearance of the lower edge of the equipments from the developed ground level should be **1m**

(vii)The kiosk of must be of a suitable design covered with a cage with door and locking arrangement for protection and to prevent mishandling.

(viii)The cable laid in the kiosk through cable tray with front cover.

(ix) The Kiosk structure must have sufficient strength to bare the load of the equipments.

M. <u>System , Equipment, Array structure Earthing:</u>

i. Equipment grounding (Earthing) shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV panel mounting

structures in one long run. The grounding wire should not be switched, fused or interrupted.

ii. Array Structure must be earthed with GI Strip

iii. The complete earthing system shall be electrically connected to provide return to earth from all equipment independent of mechanical connection.

iv. The equipment grounding wire shall be connected to one grounding electrode per PV power plant.

v. Test point shall be provided for each earth pit.

vi. An earth bus and a test point shall be provided inside control room. vii. Earthing system design should be as per the standard practices.

viii. The Earthing pit must be of Chemical gel type with Chem-Rod as grounding rod.

ix. The Code of Practice Earthing shall be IS 3043:1987

x. Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.

xi. Minimum six (06) numbers of earth pit. Earthing Pit Cover Needs to be provided

xii. Earth Grid must be made by inter connection of earth pit through GI Strip. The size of the GI earth strip must be minimum **25X3 mm**. The thickness of the galvanization should be

N. Lightning Protection

(i) The Code of Practice of lightning protection system shall be IS 2309: 1987

(ii) Suitable number of Lightning Protection Unit comprises of GI Air Terminal with G.I.
pipe of suitable height for mounting the terminal & adaptor must be provided to cover the complete PV Array yard.

(iii) Minimum four (04) numbers lightning arrestor must be provided

(iv)Earth pit used for lightning arrestor shall be separate from the system/equipment earthing.

(v) Chemical gel type of earthing must be used for earth pit.

(vi)The two pits shall be inter connected at a suitable location outside the of the building by a earth bus with test jumper.

(vii) Lightning arrestors shall be interconnected connected and earthed to the lightning protection system through the GI strip

(viii) The size of the GI earth strip used for Lightning Protection system must be minimum **50X5 mm**.

(ix)Minimum five (05) numbers of earth pit for lightning arrestor.

(x) The number of air terminal must be such so that it can cover the total PV array.

O. Signage:

Safety Signage: Safety Signage must be provided mentioning the level and type of voltage and symbols as per IE Rule at different position as may be required.

P. Provision for Module Cleaning

Module Cleaning: Necessary arrangement and equipment is to be provided to facilitate easy cleaning of the PV Modules

Q. Fire Buckets and Fire Bucket Holding stand

Fire Bucket of minimum quantity eight (08) numbers and Fire Bucket Stand of minimum quantity two (02) shall be provided at Array field. Each fire Bucket holding stand (Triangular type) shall have the arrangement to hold four (04) numbers of fire buckets. The

Fire Bucket stand must be as per IS 2546. The stand shall be installed at the rare side of the PV Array. The minimum technical specification is a follows:

Bis Specification	IS 2546
Fire Bucket Capacity	10 Litres
Fire Bucket Body Material	Galvanized Mild Steel Sheet
Body Thickness	1 mm

R. Spares ,Tools and Measuring Instruments:

The minimum number and different type of spares, tools and measuring instruments must be supplied under this project within the contract value. Also any special tools, spares, measuring instruments if required as may be shall be provided by the contractor.

Special Terms and Condition

A. Field Proven Inverter

The propose string inverter must be field proven in Indian atmosphere. The string inverter of the proposed manufacturer must be used in any project of minimum **capacity 50 KWp** anywhere in India and in operation on or before **31th December 2012.** Also there must be a good maintenance setup of the proposed inverter manufacturer with having sufficient numbers of qualified service engineers (Degree/ Diploma engineers) and well equipped set up with instruments, tools and tackles at anywhere in West Bengal. The maintenance setup of the proposed inverter manufacturer may be inspected by authority, if required.

B. Equipment and Material

Equipment and material shall comply with description, rating, type and size as detailed in this specification. Equipment and materials furnished shall be complete and operative in all respect. All accessories, which are necessary for safe and satisfactory installation and operation of the equipment, shall be furnished. All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable. Contractor shall carefully check the available space and the environmental conditions for installation of all equipments available at site and shall design the system accordingly.

C. Mode of Execution

The PV power plant shall be procured as a complete package. The entire work shall have to be executed on turnkey basis. Any minor item(s) not included in the schedule or specification but required for completion of the work shall have to be carried out/supplied without any extra cost. While submitting the offer the bidder shall consider cost of those items and may indicate separately as additional deliverable items

D. Materials and Workmanship

Qualified, experienced people should be deployed to install the **PV Power Plant**. All materials shall be of the best quality and workmanship capable of satisfactory operation under the operating and

prevailing climatic conditions of respective. Unless otherwise specified, they shall conform in all respect to the latest edition of the relevant code and standards.. The project must be supervised by a qualified Structural Engineer/ Engineering firm and Electrical /Electronics Engineer so that the work shall be as per drawing and related IS/IEC Code. The work shall be performed confirming safety precaution of all level of worker execute the project. The name and the qualification of the project engineers must be submitted to authority after placement of order. **The qualification of the supervising engineers must be minimum degree or diploma in respective stream.**

E. Testing and Inspection

Material Inspection will be carried out after submission of all test reports /certificates and after completion of the manufacturing work, against formal intimation from the contractor. The contractor shall, give notice of any material being ready for testing and the authority, if desired, shall attend at the contractor's premises and may proceed with the routine tests. The material shall have to be dispatched at site after inspection and clearance from the purchaser. The inspection setup and instruments must be provided by the contractor within the contract value.

F. Commissioning

After the erection and testing of the equipment/works as per above, commissioning of the plant and works shall be carried out and here the term "Commissioning" shall mean the activities of functional testing of the complete system after erection and

testing, including tuning or adjustment of the equipment for optimum performance and demonstrating to the Purchaser that the equipment performance meets the requirements of the specifications.

G. Insurance:

Execution Insurance:

It is desired that the contractor shall arrange for insurance coverage for the equipment, accessories, materials etc. to be delivered at site upto handing over of the complete installation. As such the bidder shall include the cost of such insurance in their price bid.

Insurance after commissioning of PV Power Plant:
Insurance against Fire, natural calamities shall be arranged by the Contractor for entire period of contract (i.e three years from the date of handover of the power plant)."

H. Comprehensive Warrantee and Maintenance

The Contractor must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The warrantee period of the complete PV Systems will be 36 (Thirty six) calendar months from the date of handover. The Contractor shall remain liable to replace any defective parts that may develop in the plant of his own manufacture or that of his sub-contractors under the conditions provided for by the contract under proper use, and arising solely from faulty design, materials or workmanship, provided always that such defective parts as are not, repairable at site and are not essential in the meantime to the maintenance in commercial use of the plant are promptly returned to the contractor's works at the expense of the contractor unless otherwise arranged.

The maintenance includes Routine, Preventive, Breakdown & Capital Maintenance the details are as follows but not limited:

Routine, Preventive, Breakdown & Capital Maintenance:

Routine and preventive maintenance:

Routine and preventive maintenance shall include cleaning of PV Module on regular basis, checks and maintenance activities such as tightening of all electrical connections, daily, weekly, fortnightly, monthly, quarterly, half yearly, and yearly basis which are required to be carried out on all the components of the power plant to minimize breakdowns and to ensure smooth and trouble free running of the power plant. The supplier shall be responsible to carry out routine and preventive maintenance and replacement of each and every component / equipment of the power plant and he shall provide all labour, material, consumables etc. for routine and preventive maintenance at his own cost.

Breakdown maintenance:

Breakdown maintenance shall mean the maintenance activity including repairs and replacement of any component or equipment of the power plant which is not covered by routine and preventive maintenance and which is required to be carried out as a result of sudden failure/breakdown of that particular component or equipment while the plant is running. The supplier shall be responsible to carry out breakdown maintenance of each and every component of the power plant and he shall provide the required manpower, materials, consumables, components or equipment etc. for

breakdown maintenance at his own cost irrespective of the reasons of the breakdown/failure

Capital maintenance:

Capital Maintenance shall mean the major overhaul of any component or equipment of the power plant which is not covered by routine, preventive and breakdown maintenance which may become necessary on account of excessive wear & tear, aging, which needs repair/replacement. The capital maintenance of power plant and all civil structures shall normally be planned to be carried out on an annual basis. For this purpose a joint inspection by the supplier and purchaser shall be carried out of all the major components of the power plant, about two months in advance of the annual maintenance period, in order to ascertain as to which components of the power plant require capital maintenance. In this regard the decision of the purchaser will be final and binding. However, if the condition of any plant and component warrants its capital maintenance at any other time, a joint inspection of the purchaser and supplier shall be carried out immediately on occurrence of such situation and capital maintenance shall be carried out by arranging the shutdown of the plant/part of the plant, if required, in consultation with concerned authorities. The decision of the purchaser shall be final and binding. Capital maintenance also includes replacement of defective lights fans under the project supplied by the contractor. The capital maintenance includes painting, of mechanical structure, civil structure.

The contractor shall under take necessary maintenance/troubleshooting work of the Solar PV Power Systems. Down time shall not be more than 72 working hours from time of occurrence. Adequate measures should be taken for prevention of wear and tear of the machines. Solar PV Power System is to be designed to operate with a minimum of maintenance.

The scope of Support Service provides preventive maintenance as & when necessary within the contract period and break down maintenance in the event of malfunctions, which prevent the operation of the power system or part of it within the stipulated time period & free replacement of spares required for maintenance.
Party will provide the A list of Spare parts & measuring instruments are
The contractor will submit warrantee certificates of the work & spare parts and materials at the time of submission of completion report. If any defect is found within the warrantee period, contractor will be liable to repair or replace the same at his own cost and risk, within three (72 hours) days from the date of complaint lodged by the authority or by the user himself.

I. End Users Training

The Contractor shall arrange for training at site for the end users. The duration of training shall be minimum **five days**. The contractor shall provide training materials at least seven days before commencement of training programme. **The training shall be the part of contract and no extra cost shall be provided for organizing the training programme**.

J. Handing Over

The work shall be taken over by authority upon successful completion of all tasks to be performed at site(s) on equipment supplied, installed, erected, commissioned AND RUN SUCCESSFULLY FOR CONSECUTIVE 60 DAYS AT A STRETCH by the contractor in accordance with provision of this order. During handing over complete project work, the contractor shall submit the followings for considering final payment.

i. All As-Built Drawings & Design ii.
ii. Detailed Engineering Document with detailed specification, schematic drawing, and test results, manuals for all deliverable major items, Operation, Maintenance & Safety Instruction Manual and other information about the project
iii. Certificate issued by the structural & civil engineer/firm having engineer with minimum LBS/ESE/EBA License for structural design of PV Array.
iv. Bill of material
v. Inventory of spares at projects site
vi. Completion certificate as per prescribed format provided by authority.

19. A) Scope of Backup power source

BACKUP POWER SOURCE (DG):

Apart from the normal power supply alternative source of power supply is required as emergency supply for the following electrical loads, which are to be marked as emergency/ critical loads.

1. Lighting & power in Research Lab, Auditorium, Lecture Theatre, Building Management System, Dissection Hall etc.- 100%
2. Light in service area like LT panel room, AHU room, A.C. Plant Room, Substation, lift M/C room, staircase etc.- 100%
3. Corridors, Toilets, Administrative Blocks, HOD Rooms, Autopsy Block, Laboratories, OPD area and other areas.
4. EPABX,Fire panel, BMS
5. Sump pumps
6. Water pump
7. Jockey pump and Booster pump
8. Fire hydrant pump
9. Elevator
10. UPS
11. 50% of HVAC load including 50% of total Chiller capacity load and all Air Handling Unit (AHU) of Academic Bulidng.

19. B) Scope of UPS System

UPS of required KVA capacity is to be installed in the UPS room/electrical room. Supply shall be given from UPS panels at ground floor to various floor DBs .UPS panel shall be connected to LT panel through PVC armoured /flexible cables and the UPS DBs shall be connected to UPS panel through PVC armoured /flexible cables. Dedicated ON LINE/OFF LINE UPS shall be provided with at least 30 minutes back up time. Apart from the normal power in some place like Auditorium hall, EPABX, BMS, Fire Panel, Lecture hall, Dissection hall etc. UPS power supply required as per MCI Guideline as well as employer requirements.

19. C) Specification of U.P.S System

19.C.1 SPECIFICATION FOR THE UPS.

i) **Quality power Supply:**

The UPS shall be ON-LINE double conversion with filter, stabilized and reliable voltage that is free from all mains interference (Over voltage, frequency variations, voltage drops).

ii) The battery cabinets used in the UPS shall be for longer runtime, The UPS shall have Optional filters, Isolation transformer module, LCD-based remote control panel, LED-based remote control panel & Communication software "professional" version.

iii) **The Operating mode of UPS:**

It should operate in on-line operating mode as follows.

- **Economy Mode**: The UPS should use Line Interactive technology, i.e. the load is powered from the mains; the energy consumption is reduced with a subsequent improvement in efficiency (98%).
- **Smart active mode:** The UPS should automatically selects On Line or Line Interactive operating mode according to the quality of the mains supply, by monitoring the number, frequency and type of disturbances at the mains power input.
- **Stand-by-off mode:** With the mains available the UPS should normally not powered and consequently the power consumption is almost nil. Only when the mains fails or falls outside a preset range, does the inverter take over in 200ms using power from the batteries. This mode shall be suitable for Emergency escape lighting as pr standard **EN 50171.**

iv) **The UPS shall have Expandable feature**.

The units can be connected in parallel up to 8 units to increase power availability or redundancy. The system can be expanded at any time. For the expandability there shall be "Hot System Expansion" feature, the additional unit can be connected in parallel while the other units are on-line and supplying regular power to the load. The new UPS is on-line and will receive the updated information automatically.

v) **High Reliability.**

The UPS should be connected in parallel up to 8 units to exponentially increase the reliability of the system.

vi) **Maximum battery care**

In the UPS there shall be an automatic battery test which shall be able to periodically check the efficiency of the batteries. The batteries should not be used during micro-interruption (40ms), as the required energy is drawn from a group of capacitor. (Battery saving). vii) **Maximum safety for personal**

There should be a feedback protection device in the UPS to prevent any voltage back feed in the upstream distribution board, thus ensuring the maintenance personal. viii) For Advanced communication there shall be software system which displays the most important information such as the input and output Voltage, the load applied, the remaining back-up time, etc. It should also be able to provide information even in the event of a failure, to support the fault diagnostics.

It should also contain the following hardware interfaces:

- RS232 serial port
- Dry contacts
- EPO (Emergency Power Off)
- Contact for UPS shutdown using the remote emergency button.

- To allow easy and intuitive operation of the UPS there should be Mimic Panel. This helps in accessing the most important parameters: status and alarm, control and commands, input, output, battery measurements (power, current, voltage, frequency and temperature) and settings.

vii) **Low Input Harmonic Distortion,** The UPS shall have The Power Factor Correction (PFC), standard on all modules, so that the input power factor level to 0.95 for any load percentages so that it is ideal in conjunction with motor generator or in installation with other sensitive loads. There shall be built in Active Filter designed to reduce the level of THDi to less than 4% and to increase the input power factor up to 0.99.

This Active filter shall be based on the IGBT's Technologies controlled by the Digital Signal Processor (DSP). This DSP instantly monitors and controls the inputs current absorbed by the UPS in order to eliminate the unlike harmonics and maintain the THDi less then 4%. With the effect of Active Filter the UPS can also be connected to the low loads. These active filters shall be fitted inside the UPS so that no additional footprint is required.

Less harmonics in the UPS input reduces the neutral cable size and consequently the installation cost. Also it gives maximum reliability as any failure of the optional Active Filter has no influence on the power supplied to the load; the only consequence is the increase of current harmonics level rejected to the mains, which gives maximum reliability for the load.

viii) **The input requirement of the UPS is as follows:**
Voltage: 380/400/415V
Voltage tolerance: 320-480V at rated load & 240- 480V at 50% load
Frequency: 50-60 Hz
Current distortion: <4% with active filter

ix) **The Bypass of the UPS is as follows:**
Rated voltage: 380/400/415V
Phases number: 3 + N
Voltage tolerance: ± 15%
Rated frequency: 50 Hz
By-pass: Static and manual for maintenance
Transfer time: nil

x) **The Battery for the UPS is as follows:**
Type of battery: maintenance-free sealed lead-acid
Battery Blocks: 12 V SMF
Recharge time minimum: 6 Hr.

19.C.2 Table:

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
1	**Capacity (in kVA / kW) (*as per requirement*)**	**3-Phase Input / Three Phase Output (Bidder to specify, the UPS should be output Power Factor 0.9 lag to unity within kVA & kW rating.**

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
2	**Technology and Capability**	True **Online** configuration with **double conversion** UPS b)DSP based control, using **IGBT based retifier& Inverter** c) Input Power Factor**>** **0.99** d) Possibility of enhancing UPS capacity / redundancy by operating UPS in **Parallel Redundant Configuration(PRS) maximum upto 4 Units for future.** e)UPS should be designed at **Rated PF of 0.9 lag to unity within kVA & kW rating**
	Construction	UPS system should be of modular construction with separate isolated PCB tray for better protection against dust to sensitive electronics and to reduce the down time and increase reliability of system
	Component Used	IGBT should be of latest with temperature sensor so that availability of IGBT become longer and minimum damage to surrounding components in case of IGBT failure. Capacitor used should be PEC AC.
	Temperature Monitoring	Each IGBT chip of UPS system should have with temperature monitoring to give better protection to IGBTs.
	Fan Redundancy	System should have independent fans for rectifier and inverter and static switch in redundant mode
	Isolation Transformer	K- Rated isolation transformer inbuilt inside the UPS.
3	**Model Name & Number**	
		Make / Model / Part No to be specified by the vendor
4	**Input**	
4.1	Input facility -Phases / Wires	3- Phase / 4-Wire &Gnd
4.2	Input Voltage Range	300 - 477V AC (on Full Load)
4.3	Nominal Input Frequency	50 / 60 Hz (Auto selectable)
4.4	Input Frequency Range	45 to 55 Hz
4.5	Input Power Factor	> 0.9 on Full Load(ONLINE MODE)
4.6	Input Current Harmonic Distortion (THDi)	<5%
4.7	Generator Compatibility	Compatibility to genset supply required
4.8	Input Protection	Should be provided at the input of the UPS suitable for the full rated capacity of the UPS.
4.9	Phase Reversal Correction	Auto phase reversal correction should be present with UPS system

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
5	**Output**	
5.1	Nominal Output voltage	220/380V, 230/400V, 240/415V (3F4W)
5.2	Output Voltage Regulation	± 1%
5.3	Nominal Output Frequency	50/60Hz
5.4	Output Frequency Regulation	± 0.05Hz
5.5	Output Frequency Slew Rate	＜1Hz/sec
5.6	Output Wave Form	Pure sine wave
5.7	Output Voltage Distortion (THDu)	≤ 3% (linear load) & ≤ 5% (Non-linear load)
5.8	Crest Factor	3:1
6	**Transient Response / Recovery**	
6.1	Transient Response: Dynamic Regulation for 10% to 90% step linear load	+/- 7 %
7	**Transfer Time**	
7.1	Transfer Time (Mode of operation)	0 ms
7.2	Transfer Time (Inverter to Bypass / Bypass to Inverter)	< 1 ms
7.3	**Automatic & Bi-directional static by-pass (In-built)**	Should be provided to take care of uninterrupted transfer of load from Inverter to bypass (under overload / fault conditions) & automatic retransfer from bypass to inverter (on removal of overload / fault conditions)
7.4	**Maintenance Bypass**	1. UPS should have option for manual maintenance bypass 2. The maintenance bypass should provide for Hot-swap of the faulty UPS for repairs / service
8	**Efficiency (At Nominal Voltage & Resistive Load up to kW rating of UPS)**	
8.1	Overall Efficiency (AC to AC) - Online (Double Conversion)	Up to 95 % (Full Resistive Load)
8.2	Overall Efficiency (AC to AC) - ECO Mode (Bypass feeding the load under normal conditions)	Up to 99 %
9	**Overload**	
9.1	Inverter Overload capacity	111% to ≦ 125% : 10 Minutes≦ 150% : 1 Minutes＞150% : 1 sec
10	**Display Panel (In-build LC Display & LED)**	

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
10.1	**Measurements** (On LCD)	**Input:** Voltage / Frequency **Bypass:** Voltage / Frequency **INV Output:** Voltage / frequency / Current **UPS Output:** Voltage / frequency / Loading % / Current / KVA / KW **Battery**: Voltage / Remaining Capacity / Status **Temperature:** Bypass STS / PM INV & PFC
10.2	**Fault Indication** (On LCD)	
		OVERLOAD
		FAN FAIL
		OUTPUT FUSE FAIL
		BATTERY REVERSED
		INVERTER DC FAIL
		INVERTER SOFT START FAIL
		PFC SOFT START FAIL
		BYPASS PHASE SEQUENCE FAIL
		MANUAL BYPASS ON
		PARALLEL INCOMPATIBLE
		BYPASS ABNORMAL
		INPUT ABNORMAL
		OVERLOAD ALARM
		CHARGER OCP
		EPO ON
		EPO OFF
		MANUAL BYPASS OFF
		PARALLEL COMMUNICATION OK
		LOAD ON INVERTER
		LOAD ON BYPASS
		NO OUTPUT

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
10.3	**Indications** (LED)	Normal (online mode of operation) / Battery Mode of Operation / Bypass feeding the load / UPS Fault
11	**Battery Backup / Battery Bank & Charger**	
11.1	Backup Required	Minimum 30 Minutes at 0.8 Load Power Factor with 12 V SMF Battery (As per Minimum VAH list provided)
11.2	Battery Bank Voltage	Min ±240 VDC
11.3	Battery Bank VAh (Vendor to include battery sizing calculations with tender)	Battery backup to be calculated at 0.8 Load Power Factor (The minimum VAH to be followed as per the below list
11.4	Batteries Type	Sealed Maintenance Free (SMF) - 12V Cells
11.5	Battery Makes	Amara Raja / Hipower/Exide/Quanta
11.6	Number of Battery Banks	Maximum Two Banks in parallel
11.7	Battery recharge time (After complete discharge) to 90% capacity	10-12 hours
11.08	Battery Housing (Vendor to provide the GA drawings of the offered Battery Rack)	Should be compact and space saving **MS steel open racks** complete with interconnectors
11.09	**VAH Details for 30 Minutes backup for various capacity from 20 KVA to 100 KVA at 0.8 Load Power Factor**	**20 KVA at 0.8 Load PF (Min 20160 VAH)/30 KVA at 0.8 Load PF (Min 31200 VAH)/40 KVA at 0.8 Load PF (Min 40320 VAH)/60 KVA at 0.8 Load PF (Min 57600 VAH)/80 KVA at 0.8 Load PF (Min 72000 VAH)/100 KVA at 0.8 Load PF (Min 96000 VAH) (BATTERY SIZING SHEET MUST BE SUBMITTED)**
11.10	No of Battery	Bidder to Specify
11.11	AH of Each Battery	Bidder to Specify
11.12	Make of the Battery Offered	Bidder to Specify
12	**Interfaces**	
12.1	Serial Communication RS232 Port	RS232 Port should be provided as standard in the UPS.
12.2	REPO(Remote Emergency Power OFF)	Should be provided as standard in the UPS
13	**Restart / Testing Capability**	
13.1	Cold Start	UPS should start up On AC Supply (Mains) without DC Supply (Batteries) On DC Supply (Batteries) without AC Supply (Mains)
13.2	Automatic Restart	UPS should start up automatically on mains resumption after battery low shutdown
13.3	Self-Diagnosis	UPS should be capable to carry out self-test of Rectifier / Charger /Battery & Inverter module during start-up

Technical Data Sheet for UPS System of required capacity/quantity:		
Sr. No.	**Description**	**Specification**
13.4	Diagnostic Facility	UPS System to have fault diagnostic facility functional on real time basis, giving the nature of faults and the action to be taken by the user.
13.5	Data Storage	Record minimum 500 events on first in first out basis of any faults with the UPS system.
14	**Physical**	
14.1	Operating Temperature	0 to 40 deg C
14.2	Storage Temperature	-20 ~ 40 Deg C
14.3	Operating Humidity	< 95 %
14.5	Type of Cooling	Forced Air
14.6	Noise Level	＜55dBA at 1 Meter (@Load ≧70%)
14.7	Form Factor	Tower
15	**Certifications**	
16.1	Manufacturer	**QMS:** As per ISO 9001: 2008 **EMS:** As per ISO 14001: 2004 **OSHAS:** As per ISO 18001: 2007
15.2	Product Safety Certifications (Mandatory)	Safety : EN62040-1-2 EMC : EN62040-2 ESD : IEC 61000-4-2 Level 4 RF Electromagnetic Fields : IEC 61000-4-3 Level 3 Fast Transient / Burst : IEC 61000-4-4 Level 4 Surges : IEC 61000-4-5 Level 4 Conduction Immunity: IEC 61000-4-6

20. Building Management System (BMS)

Detailed Specifications for Building Management System

GENERAL

Furnish all labor, materials, equipment, and service necessary for a complete and operating Building Management System, utilization of Direct Digital Controls as shown on the drawings, as in attached Input/Output Summary and as described herein. Drawings are schematic only. The BMS should integrate inputs from HVAC (Optional), Electrical Panel, STP, Fire detection system & PHE pump, Lift. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Employer. Employer shall be the named license holder of all software associated with any and all incremental work on the project(s).

SYSTEM DESCRIPTION

The entire Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark/ LonTalk

communication protocols to a Network Area Controller (NAC) / Router. Building Management System products shall be manufactured as per LonWorks products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the execution.

The entire Integrated Control and Monitor Management System (IBMS) shall be comprise of a network of interoperable, stand-alone digital controllers communicating on an open protocol communication network to a host computer within the facility (when specified) and communicating via the Internet to a host computer in a remote location. The IBMS shall communicate to third party systems such as Chillers, Boilers, Air-Handling Systems, Energy metering systems, Lighting Management System & other energy management systems, Fire-Life safety systems and other building management related devices with open, interoperable communication capabilities.

The IBMS framework shall utilize JAVA based automation products and services with built-in Internet connectivity to a broad range of distribution partners in the building automation, energy services, power/utility, and industrial sectors. The Framework shall bring together the computerization of control applications under the umbrella of single integrated system architecture. The suite of component software applications shall support true plug-and-play, multi-vendor interoperability, resulting in lower automation and information infrastructure costs. The Network Area Controllers (NAC's) shall run a JAVA Virtual Machine (JVM) platform and use a common set of tools for accessing and integrating multiple protocols.

The Building Management System (BMS) shall be comprised of TCP/ IP enabled Network Area Controller or Controllers (NAC) / Routers. The NAC / Router shall connect to the local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk and/or BACnet Direct Digital Controllers (DDC) and other open protocol systems/devices.

The following software packages shall be loaded into the system as minimum standard :-

a. Complete system operational software

b. Site specific data manipulation software

c. Active graphics software

d. Alarm indication software

e. Data Visualization Package

f. Internet Enabled Remote Monitoring Package.

SPECIFICATION NOMENCLATURE

Acronyms used in this specification are as follows:

FMCS	Facility Management and Control System
BMS	Building Management System
NAC	Network Area Controller
DDC	Direct Digital Controller
IBC	Interoperable BACnet Controller

GUI	Graphical User Interface
WBI	Web Browser Interface
PMI	Power Measurement Interface
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

AGENCY AND CODE APPROVALS

All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

UL-916; Energy Management Systems

CE

FCC, Part 15, Subpart J, Class A Computing Devices

SOFTWARE LICENSE AGREEMENT

The employer shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

The EMPLOYER shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, EMPLOYER shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, BMS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID (“orgid”) of all software licenses. Owner shall be free to direct the modification of the “orgid” in any software license, regardless of supplier.

DELIVERY, STORAGE AND HANDLING

Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

JOB CONDITIONS

Cooperation with Other Contractors: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

MATERIALS

GENERAL

The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within BMS shall be latest version compliant and shall be supported by compliance documentation from the manufacturer.The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.

OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable. Maximum acceptable response time from any alarm occurrence (at the point of

origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

NETWORKS

The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

Local area network minimum physical and media access requirements:

Ethernet; IEEE standard 802.3

Cable; 100 Base-T, UTP-8 wire, category 5

Minimum throughput; 100 Mbps.

TCP/ IP enabled NETWORK AREA CONTROLLER (NAC) / ROUTER

The BMS contractor shall supply one or more TCP/IP enabled Network Area Controllers (NAC) / Router as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided in IO Summary.

The TCP/ IP enabled Network Area Controller (NAC) / Router shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC / Router. It shall be capable of executing application control programs to provide:

Calendar functions

Scheduling

Trending

Alarm monitoring and routing

Time synchronization

Integration of LonWorks controller data and BACnet controller data

Network Management functions for all LonWorks based devices

The TCP/ IP enabled Network Area Controller must provide the following hardware features as a minimum:

One Ethernet Port – 10/100 Mbps

One RS-232 port

One Lon Works Interface Port – 78KB FTT-10A

One RS-485 ports

Battery Backup

Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

The NAC / Router must be capable of operation over a temperature range of 32 to 122°F

The NAC / Router must be capable of withstanding storage temperatures of between 0 and 158°F

The NAC / Router must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

The TCP/ IP NAC / Router shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC / Router shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

The NAC / Router shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

Event Alarm Notification and actions

The NAC / Router shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

The NAC / Router shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.

Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:

To alarm

Return to normal

To fault

Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: Electricals, HVAC(Optional) , Fire, lift, PHE pump, STP etc. Provide timed (schedule) routing of alarms by class, object, group, or node. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

Control equipment and network failures shall be treated as alarms and annunciated.

Alarms shall be annunciated in any of the following manners as defined by the user:

Screen message text

Email of the complete alarm message to multiple recipients.

Provide the ability to route and email alarms based on:

Day of week

Time of day

Recipient

Pagers via paging services that initiate a page on receipt of email message

Graphic with flashing alarm object(s)

Printed message, routed directly to a dedicated alarm printer

The following shall be recorded by the NAC / Router for each alarm (at a minimum):

Time and date

Location (building, floor, zone, office number, etc.)

Equipment (air handler #, accessway, etc.)

Acknowledge time, date, and user who issued acknowledgement.

Number of occurrences since last acknowledgement.

Alarm actions may be initiated by user defined programmable objects created for that purpose.

Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

A log of all alarms shall be maintained by the NAC / Router and/or a server (if configured in the system) and shall be available for review by the user.

Provide a "query" feature to allow review of specific alarms by user defined parameters.

A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

Data Collection and Storage

The NAC / Router shall have the ability to collect data for any property of any object and store this data for future use.

The data collection shall be performed by log objects, resident in the NAC / Router that shall have, at a minimum, the following configurable properties:

Designating the log as interval or deviation.

For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.

Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

All log data shall be stored in a relational database in the NAC / Router and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

All log data shall be available to the user in the following data formats:

HTML

XML

Plain Text

Comma or tab separated values

Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

The NAC / Router shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC / Router on the network. Provide the ability to configure the following archiving properties, at a minimum:

Archive on time of day

Archive on user-defined number of data stores in the log (buffer size)

Archive when log has reached it's user-defined capacity of data stores

Provide ability to clear logs once archived

AUDIT LOG

Provide and maintain an Audit Log that tracks all activities performed on the NAC / Router. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC / Router), to another NAC / Router on the network, or to a server. For each log entry, provide the following data:

Time and date

User ID

Change or activity: i.e., Change set point, add or delete objects, commands, etc.

DATABASE BACKUP AND STORAGE

The NAC / Router shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and, at the most recently saved database shall be stored in the NAC / Router. The age of the most recently saved database is dependent on the user-defined database save interval.

The NAC / Router database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

OTHER CONTROL SYSTEM HARDWARE

FIELD DEVICES

7.1 ELECTRIC AND ELECTRONIC CONTROLS RELATED EQUIPMENT

General Requirements

All controls shall be capable of operating in ambient conditions varying between 0-55 deg. C and 90% R.H. non-condensing.

All Control devices shall have a 20 mm conduit knockout. Alternatively, they shall be supplied with adaptors for 20 mm conduit.

Ancillary Items

When items of equipment are installed in the situations listed below, the BAS contractor shall include the following ancillary items :

(i) Weather Protection

All devices required to be weatherproofed are detailed in the Schedule of Quantities. IP ratings for the equipment is mentioned in the respective section.

(ii) Pipework Immersion

Corrosion resisting pockets of a length suitable for the complete active length of the device, screwed ½" (13 mm) or ¾" (20 mm) NPT suitable for the temperature, pressure and medium.

(iii) Duct Mounting (Metal or Builders Work)

Mounting flanges, clamping bushes, couplings, locknuts, gaskets, brackets, sealing glands and any special fittings necessitated by the device.

Additional features

(i) Concealed Adjustment: All two position switching devices shall have concealed adjustment unless detailed otherwise in the Schedule of Quantities.

(ii) Operating Voltage : All two position switching devices shall operate on 230 v a.c and all accessible live parts shall be shrouded. An earth terminal shall be provided.

LEVEL SWITCH

The level switches shall have to meet the following requirement:

Type	:	Float Type/Capacitance type/Conductivity type
Mounting	:	To suit application.
Connection	:	Flanged ANSI 150 lbs RF Carbon steel
Float material	:	316 SS
Stem Material	:	316 SS
Output		2 NO, 2 NC potential free
Switch Enclosure	:	IP 55

SOFTWARE LICENSE

EMPLOYER shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the "**orgid**" of all software licenses.

EMPLOYER, or his appointed agent, shall be free to direct the modification of the "**orgid**" in any software license, regardless of supplier.

The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

ACCEPTANCE TESTING

Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of EMPLOYER's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the EMPLOYER's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

System Acceptance: Satisfactory completion is when BMS contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of EMPLOYER Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

OPERATOR INSTRUCTION, TRAINING

During system commissioning and at such time acceptable performance of the BMS hardware and software has been established this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

This contractor shall provide 40 hours of instruction to the EMPLOYER's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

21. Specification of Earthing

The entire earthing system shall be provided as per **IS: 3043**. The earthing system will be made extensively available throughout the building with each electrical panel and equipment earthed securely. Copper earthing ie. Copper plate earth electrodes and copper conductors shall be used for Medical equipment, O.T grid and neutral earthing of Transformers and DG sets. Each neutral will be connected to 2 different copper plate earthing stations. GI plate Electrodes will be used for body earthing of transformers/ D.G.Sets / electrical panels and general earthing.

- Pipe earthing shall be provided for street light poles/Feeder Pillar.
- Chemical Earthing shall be considered if required according to the soil condition.

22. Specification for External & Internal Lighting

Areas like portico, waiting areas shall be well-illuminated and the illumination level should be as per the latest Indian and /or IEC standard. LED type Light fixtures such as bollard, post top lanterns, path/road lights with MS tubular pole etc. shall be used to illuminate landscaped areas according to the availability.

The external lighting system consist a main feeder pillar and required numbers of sub feeder pillars in which adequate number of outlets shall be provided for further distribution to street light poles and landscape lighting.

Area illumination (External lighting) System shall be proposed with Automatic Timer based Power control supplied from normal power supply from main panel. At road crossings, underground XLPE / PVC armoured cable shall run in RCC Pipe/PCC Trench of suitable sizes, to feed power to various poles.

Special LED type light fixtures such as bollard, post top lanterns, path lights etc. shall be used to illuminate total campus areas like internal path way, around the buildings, boundary walls, garden areas, landscaping areas etc and external connecting roads upto State Highway/National Highway/ Major District Road as per requirement of the Employer.

23. Specification of Street Light

Octagonal Pole:

Supply of 7 Mtr. height dip galvanised octagonal pole made of HT steel of grade S355 of BSEN 10025 with 130mm bottom A/F & 70mm top A/F made up of 3mm thick G.I. sheet along with base plate of size 200x200x12mm thick within built terminal for connection of 4 Core cable as required . Price should be inclusive of accessories like 4 nos. 600 mm J type foundation bolt / nut / template & 1.5 mtr single/double arm bracket. Bakelite sheet should be provided with two 6A SP MCB and 16sqmm stub type connector.

24. Specification of Visual Display System

Visual display units shall be installed at strategic locations especially in entry area, reception, Waiting Lounge, Parking Zone, Main Entrance etc as per requirement of approval authority. Specification for VDU system: Professional LED display, Screen size diagonal 32" minimum, Resolution full HD, Connectivity: HDMI, USB, VGA with inbuilt media player.

25. Illumination

25.1 ILLUMINATION:

- **Illumination design shall be done with relevant guidelines laid down in National Building Code 2016 & IS: 4347 - 1967.**
- **The turnkey agency will submit a detailed room wise list of final illumination level with electrical layout drawings.**

Generally the light fixtures shall be with energy efficient LED lamps with daylight or warm daylight ambience and decorative LED fittings in the special areas taking into account the aesthetic part as well.

a) Offices, Professor's room, Staff & Doctor's room, small halls, library, laboratories, Practical class room etc. shall be provided with surface/ recess mounted mirror optics / box type general purpose LED fittings/ Decorative type LED fittings.

b) All wash basins shall be provided with LED mirror lights.

c) Staircases, storerooms, Animals Room, Service Room, and Toilets etc. shall be provided with general box type LED fittings.

d) Lighting in Auditorium shall be provided with Ceiling Mounted recessed type dimmable fancy LED spot fittings, wall mounted fancy fittings with metallic finish special type incandescent lamp, figlow sign EXIT LED type with battery backup and charger, Foot/ Chair light fittings, Decorative light and decorative emergency light with automatic charging facility etc.

Stage lighting system shall be provided with plano convex spot light fittings, parabolic aluminized reflector light fittings, cyclorama halogen flood light fittings, halogen flood light fittings, LED par light, LED ribbon and Electronic Dimmer with power pack etc. (Make will be decided as per design and approval of the Employer).

e) All Lecture Theatre, Cafeteria, Common Room, Gym room shall be provided with surface/recess mounted LED fittings.

f) Internal road areas, Courtyard, Roof top and Boundary area shall be provided with post top lantern / street light poles with LED fittings.

g) Entrance, Corridor, lobby etc. shall be provided with circular / square type LED fittings.

h) Student's room, Living Room, Family Room shall be provided with wall mounted type LED fittings.

(i) **UPS lighting:** Emergency lighting shall be provided to the following areas i)Exit ii) corridors used by the public, serving classrooms iii) Auditorium iv) Lecture theatre v) dissection hall vi) library vii) Exam hall viii) Electrical room & Substation ix) Server room x) Principal & MSVP chambers xi) Accounts room xii) Reception & cash receiving counter xiii) Lift Machine Room xiv) Stair xv) Lift Lobby etc. as per NBC and relevant Indian codes.

25.2 <u>TABLE:</u>

Illumination Levels	
Location	**Recommended Avg. Lux**
Principal office	300
College Council room	300

Office	300
Record room	200
Common room - Boys & Girls	200
Cafeteria	200
Examination room	300
Central Library	300
Lecture Theatres	300
Auditorium	300
Central Research Laboratory	300
Central Photographic Section	300
Medical Education Unit	300
Demonstration room	300
Dissection Hall	300
Museum	300
Embalming room	300
Cold Storage room	200
Histology Lab	300
Preparation room	200
Research Lab	300
Museum - Preparation rooms	300
Department Library	300
Amphibian Lab	300
Mammalian lab	300
Human Lab - Haematology	300
Clinical Physiology Lab	300
Practical Class room	300
Ante room	300
Practical Labs	300
Service Laboratory	300
Balance room	200
Store room	100
Special room for High Centrifuge	300
Media Preparation & Storage	300

Autoclaving	300
Washing & Drying	200
Professor & Head / Lecturer	200
Lobby	150
Change/ Lockers	150
Toilet	100
Staff room/ Doctors room	200
Animal rooms	150
Feed Room	150
Instruments repair area/ Workshop area	300
Carrom/ Chess room	300
Gym room (Tread Mill, Cycling, Work area)	300
Office / Staff room/ Doctors room	300
Demonstration room	300
Autopsy room	300
Student room	200
Visitor room/ Care taker room	150
Study room (With Computer & Internet)	300
Recreation room	200
Corridor	100
Living room/ Family room	200
Kitchen	200
Bed room	150
UG Sump & Pump Room, Electrical Sub station, Transformer Yard, HVAC Plant room	200
Area Lighting	50
Service Road Lighting	50
Main Access road/Street Lighting	50

- **Illumination Level may be changed as per Employer requirement**

25.3 <u>TABLE:</u>

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT			
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**	**UPS**

		CEILING / BRAKET FAN	SWITCH/ POWER SOCKET	LIGHT FITTINGS/FIXTURES	LIGHT FITTINGS/FIXTURES
	ACADEMIC BUILDING & OTHER BUILDINGS				
1	**ENTRANCE LOBBY**	Ceiling Fan / Bracket Fan	Modular Type 5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Ceiling suspended Type / Recessed Type Decorative LED	Minimum 1 LED light or 20 percentage which is higher.
2	**RECORDS & STORE ROOM**	Ceiling Fan / Bracket Fan	DO	Bulk Head Type LED	DO
3	**COMMON ROOM (Boys and Girls)**	Ceiling Fan / Bracket Fan	DO	Ceiling suspended Type LED	DO
4	**KITCHEN BLOCK**		DO	Wall mounted type LED	DO
5	**OTHER ROOMS**	Ceiling Fan / Bracket Fan	DO	Wall mounted type LED	DO
6	**CORRIDOR & LOBBY**	Ceiling Fan / Bracket Fan	DO	Ceiling suspended Type / Recessed Type LED	DO
16	**LIFT LOBBY**	Ceiling Fan.	DO	Ceiling suspended Type LED	DO
7	**BODY STORAGE**	-	DO	Bulk Head Type LED	DO
8	**RECEPTION/ WAITING**	Ceiling Fan / Bracket Fan	DO	600× 600 square type LED	DO
9	**STAIRCASE**			Wall mounted type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	TYPE OF ROOM	ELECTRICAL			UPS
		CEILING / BRAKET FAN	SWITCH/ POWER SOCKET	LIGHT FITTINGS/FIXTURES	LIGHT FITTINGS/FIXTURES
10	ACCOUNT OFFICER,TUTOR / DEMONSTRATOR	Bracket Fan	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Ceiling suspended Type LED	DO
11	PRINCIPAL, MSVP , HOD, ALL PROFESSOR ASST. PROFESSOR / LECTURER, DEAN OF STUDENT'S AFFAIR ,DOCTOR'S ROOM	Bracket Fan	DO	600× 600 square type LED	DO
12	COLLEGE COUNCIL ROOM	Bracket Fan	DO	600× 600 square type LED	DO
13	All LABS, ANTE, AUTOCLAVING, AUTOPSY, PREPARATION, CENTRIFUGE, EMBALMING, MUSEUM ROOM	Ceiling Fan / Bracket Fan	DO	Ceiling suspended Type LED	DO
14	ALL LIBRARY AREA	-	DO	Ceiling suspended Type LED	DO
15	LECTURE HALL/THEATRE	-	DO	600× 600 square type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
17	**AUDITORIUM**	-	DO	Recessed Type Circular LED and decorative wall mounted LED	DO
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	DO	Ceiling suspended Type high bay LED	-
19	**TOILETS**	-	DO	Circular type LED in true/false ceiling	Minimum 1 LED light or 20 percentage which is higher.
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Ceiling / Bracket Fan	DO	Ceiling suspended Type LED	DO
21	**LIFT WELL**	-	DO	Bulk Head Type LED	-
22	**STRONG ROOM**	Bracket Fan	DO	Bulk Head Type LED	Minimum 1 LED light or 20 percentage which is higher.
23	**LIFT MACHINE ROOM**	Bracket Fan	DO	Wall mounted type LED	DO
	TERRACE	-	-	-	Peripheral light at parapet and mumpty romm. Flood light in other area
	BOYS & GIRLS HOSTEL BUILDING				
1	**ENTRANCE LOBBY**	Ceiling Fan	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and	Ceiling suspended Type Decorative LED	Minimum 1 LED light or 20 percentage which is higher.

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
			Normal Power		
2	**CORRIDOR & LOBBY**	-	DO	Ceiling suspended Type LED	DO
16	**LIFT LOBBY**	Ceiling Fan.	DO	Ceiling suspended Type LED	DO
3	**ROOMS**	Ceiling Fan for each occupants	DO	Wall mounted type LED	DO
4	**KITCHEN BLOCK**	Ceiling Fan	DO	Wall mounted type LED	DO
5	**DINING HALL**	Ceiling Fan	DO	Ceiling suspended Type LED	DO
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Ceiling / Bracket Fan	DO	Ceiling suspended Type LED	DO
21	**LIFT WELL**	-	DO	Bulk Head Type LED	-
23	**LIFT MACHINE ROOM**	Bracket Fan	DO	Wall mounted type LED	DO
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	Ceiling suspended Type high bay LED	-
9	**STAIRCASE**	-	-	Wall mounted type LED	Minimum 1 LED light or 20 percentage which is higher.

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
19	**TOILETS**	-	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Circular type LED in true/false ceiling	DO
	TERRACE	-	-	-	Peripheral light at parapet and mumpty romm. Flood light in other area
	INTERNS & RESIDENT DOCTOR'S HOSTEL BUILDING				
1	**ENTRANCE LOBBY**	Ceiling Fan	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Ceiling suspended Type / Recessed Type Decorative LED	Minimum 1 LED light or 20 percentage which is higher.
2	**CORRIDOR & LOBBY**	-	DO	Ceiling suspended Type LED	DO
16	**LIFT LOBBY**	Ceiling Fan	DO	Ceiling suspended Type LED	DO
3	**ROOMS**	Ceiling Fan for each occupant	DO	Wall mounted type LED	DO
4	**KITCHEN BLOCK**	-	DO	Wall mounted type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
5	**DINING HALL**	Ceiling Fan	DO	Ceiling suspended Type LED	DO
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Ceiling / Bracket Fan	DO	Ceiling suspended Type LED	DO
21	**LIFT WELL**		DO	Bulk Head Type LED	DO
23	**LIFT MACHINE ROOM**	Bracket Fan	DO	Wall mounted type LED	Minimum 1 LED light or 20 percentage which is higher.
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	Ceiling suspended Type high bay LED	-
9	**STAIRCASE**	-	-	Wall mounted type LED	Minimum 1 LED light or 20 percentage which is higher.
19	**TOILETS**	-	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Circular type LED in true/false ceiling	DO
	TERRACE	-	-	-	Peripheral light at parapet and mumpty romm. Flood light in other area

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	TYPE OF ROOM	ELECTRICAL			UPS
		CEILING / BRAKET FAN	SWITCH/ POWER SOCKET	LIGHT FITTINGS/FIXTURES	LIGHT FITTINGS/FIXTURES
	TEACHING STAFF QUARTER, NON TEACHING STAFF QUARTER & NURSES QUARTER BUILDING				
1	**ENTRANCE LOBBY**	Ceiling Fan	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Ceiling suspended Type / Recessed Type Decorative LED	Minimum 1 LED light or 20 percentage which is higher.
2	**CORRIDOR & LOBBY**	-	DO	Ceiling suspended Type LED	DO
16	**LIFT LOBBY**	Ceiling Fan	DO	Ceiling suspended Type LED	DO
3	**DRAWING ROOM**	Ceiling Fan	DO	Wall mounted type LED	DO
3	**BED ROOMS**	Ceiling Fan	DO	Wall mounted type LED and twin wall bracket	DO
4	**KITCHEN**	-	DO	Wall mounted type LED	DO
5	**DINING ROOM**	Ceiling Fan	DO	Wall mounted type LED	DO
20	**ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM**	Ceiling / Bracket Fan	DO	Ceiling suspended Type LED	DO
21	**LIFT WELL**	-	DO	Bulk Head Type LED	-

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
23	**LIFT MACHINE ROOM**	Bracket Fan	DO	Wall mounted type LED	Minimum 1 LED light or 20 percentage which is higher.
18	**MAIN ENTRANCE ENTRY STEPS & RAMP**	-	-	Ceiling suspended Type high bay LED	-
9	**STAIRCASE**	-	-	Wall mounted type LED	Minimum 1 LED light or 20 percentage which is higher.
19	**TOILETS**	-	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Circular type LED in true/false ceiling	DO
20	**TERRACE**	-	-	-	Peripheral light at parapet and mumpty romm. Flood light in other area
	OPD BUILDING				
1	**ENTRANCE LOBBY**	Bracket Fan	5 Pin or 6 Pin, 6A or 6/ 16 A. Seperate colour scheme for Emergenct and Normal Power	Ceiling suspended Type / Recessed Type LED	Minimum 1 LED light or 20 percentage which is higher.
2	**CORRIDOR & LOBBY**	Bracket Fan	DO	Recessed Type LED	DO
3	**LIFT LOBBY**	Ceiling Fan	DO	Ceiling suspended Type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	TYPE OF ROOM	ELECTRICAL			UPS
		CEILING / BRAKET FAN	SWITCH/ POWER SOCKET	LIGHT FITTINGS/FIXTURES	LIGHT FITTINGS/FIXTURES
4	OPD CHAMBER, COUNSELING ROOM, PPU, FAMILY WELFARE ROOM, IMMUNIZATION ROOM, PHYSIOTHERAPY ROOM, PROCEDURE & TREATMENT ROOM, DOCTOR'S ROOM, NURSE'S ROOM, SPEECH THERAPY ROOM & OTHER ROOM	Bracket Fan	DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
5	LABORATORY, SAMPLE COLLECTION ROOM	Bracket Fan	DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
6	TOILETS	-	DO	Circular type LED in true/false ceiling	DO
7	SEMINAR ROOM, TEACHING CORNER, ANTENATAL ROOM	Bracket Fan	DO	Ceiling suspended Type LED	DO
8	RECEPTION, WAITING AREA, ENQUIRY COUNTER, NURSES STATION	Bracket Fan	DO	Recessed Type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	**TYPE OF ROOM**	**ELECTRICAL**			**UPS**
		CEILING / BRAKET FAN	**SWITCH/ POWER SOCKET**	**LIGHT FITTINGS/FIXTURES**	**LIGHT FITTINGS/FIXTURES**
9	**PHARMACY**	Bracket Fan	DO	Ceiling suspended Type LED	DO
10	**X-RAY ROOM**	Bracket Fan	DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
11	**DARK ROOM**	Bracket Fan	DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
12	**USG ROOM, MRI ROOM, CITY SCAN ROOM, ECO ROOM, EEG ROOM, ECG ROOM**	Bracket Fan	DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
13	**STAIRCASE**	-	DO	Wall mounted type LED	DO
14	**OT AREA**	-	DO	600 × 600 Recessed Type LED	DO
15	**RECOVERY ROOM**	Bracket Fan	DO	Ceiling suspended Type LED	DO
16	**AUDIOMETRY ROOM**		DO	Ceiling suspended/ wall mounted Type LED as per clients requirement	DO
17	**OFFICE**	Bracket Fan	DO	Ceiling suspended Type LED	DO
18	**DAY CARE WARD**	Bracket Fan	DO	Ceiling suspended Type LED	DO
19	**BABY CARE ROOM**	Bracket Fan	DO	Ceiling suspended Type LED	DO

MEP FINISHING SCHEDULE FOR MEDICAL COLLEGE PROJECT					
SL. No.	TYPE OF ROOM	ELECTRICAL			UPS
		CEILING / BRAKET FAN	SWITCH/ POWER SOCKET	LIGHT FITTINGS/FIXTURES	LIGHT FITTINGS/FIXTURES
20	RECORDS & STORE ROOM	Ceiling Fan/Bracket Fan	DO	Bulk Head Type LED	DO
21	ELECTRICAL , ELV, AHU , AV , UPS Etc. ROOM	Ceiling / Bracket Fan	DO	Ceiling suspended Type LED	DO
22	TERRACE	-	-	-	Peripheral light at parapet and mumpty romm. Flood light in other area

26. Specification of Digital Classroom

Class Room Interactive Digitization:

Specialized Elements

1. **Interactive White Board**
   - Allows teacher to directly write on the Interactive surface and the contents are recorded back on computer.
   - Teacher can engage with the board naturally.
2. **Audio System**
   - Amplifier.
   - Speaker (30X4) based on classroom size.
   - Lapel Mic, Handheld Mic.
   - Mixer.
   - Acoustic Echo cancellation.
3. **Document Camera DC-2300**
   - Magnify and project actual 3D Objects in real time.
   - Simply need to place the object below the camera – Hand Note, Book, Fruit, Flower, Leaf, Machine Component or any other object required to be shown to the class.
4. **Projector – Short Throw. Branded 3400 lumens**
   - To project the Screen.
   - Short Throw recommended for lesser shadow, important in interactive scenario.

5. Digital Classroom Software

- Fully loaded Software acting as a teaching aid. Helps teacher select multiple pen, easily create various geometrical objects, highlight and scores of such functionalities.
- Almost Infinite long board for those long questions in math, science, accounts etc.
- Screen Recording and Replay for review.

Many more such functions to reduce teacher's efforts and improve quality.

6. Pointers [Combination of Laser Pointer, Pen &Telescopic Pen Pointer]

- To the teacher point to the right components in the right manner and easily use the interactive board.
- Use Laser for remote, Short Pen Pointer for Black Board Feel, Telescopic one to point out the contents in traditional style.

Computing Backbone

7. Desktop Computer. Branded. (core i5 /4GB/500GB/Kb & mouse)

Organizer, Connectors & Support System

8. Digital Podium

- Professional Housing for Desktop, UPS, Pen, Remote and other Accessories.
- Professional Termination of Network & Power lines.
- Professional Housing of Audio Components.

9. Projector Mounting Kit with Extended Power & VGA Cables.

- Specially designed for heavy duty use.
- Professional Grade cables for consistent performance.

10. Power Backup

- 600VA UPS sufficient to offer 10 minute backup inside class.

Enabling Institute

11. Internet Connectivity (Part of Infrastructure provided by the Institute)

SL	Components	Specification
1	Interactive White Board	1. Size: 95 Inch. 2. Physical Ratio:-16:9 and 4:3 4. Technology: infrared Touch/Optical. 5.Touch Resolution :-32768X32769 6. System Calibration: Manual. 7.Interactivity: Using Stylus/pen/finger 8. Battery FREE Pen. 9. Power requirement: No external power. Should take power from USB. 10.Compatibility platform: Windows / Linux 11. Power consumption: Less than 1 watt. 12. Interactivity parts inside the board only. No external device. 13. Accessories: Cd, 3 Pens. Software::Plug &

		Play software, Option of Auto Replaying page without prior recording, Pen, Magic pen, Math tools etc.
2	Short Throw Projector with 3200 Lumens	Projection System :-DLP® Native Resolution :-WXGA, 1280x800(450 type) Brightness:- 3400AL Contrast Ratio:-12000:1 Display Colour :-1.07 Billion Colours Lens:- F/#=2.6 ; f=6.9 mm Aspect Ratio Native :-16:10 (5 aspect ratio selectable) Throw Ratio :- 0.49 Clear Image Size / Maximum Image Size :- 70"~120" / 120" Zoom Ratio :- Fixed Lamp Type :-200W Resolution Support :- VGA(640 x 480) to WUXGA_RB(1920 x 1200) *RB-Reduced Blanking" Horizontal Frequency :-15K~102KHz Vertical Scan Rate :-23~120Hz HDTV Compatibility :- 480i, 480p, 576i, 567p, 720p, 1080i, 1080p
3	Wall Mount Projector Kit, Cable etc.	1. Adjustable Bracket Extendable up to 4 ft. 2.15 Meter VGA Cable, PowerCablecastingetc.
4	Desktop Computer	Intel i5, HD Graphics 4600, HDD Sata 6 Gb/s 500 GB 7.2k RPM, 4 GB DDR3 RAM,), Monitor, Keyboard and Mouse.
5	Offline UPS.	1KVA UPS with 10 min backup , Tamper proof UPS Ventilation for Cooling
6	Public Address System	1. 4 pcs Speaker @ 30 Watts. 2. Amplifiers 250 watt for communication for multiple sound device ie.Laple or collar mike. 3. Mixture for mixing a multiple audio.
7	Document Camera	1. 5 MP CMOS Active Pixels Main Camera 2. Optical Format:1/3 inch 3. Active Pixels Max: 2592H X1944V 4. Image Resolution: 2592H X1944V 5. Shooting area: A3 6. Responsivity:1.0 V/Lux-sec 7. Operating temperature:-30 to +70 º C 8. Power supply : USB POWER CABLE 9. Power Consumption:<220mW 10. Suspend Current : <5 mA 11. Two LED Light 12. Communication Interface : USB2.0 With UVC 13. AGC/AEC/ White Balance : Auto
8	Digital Classroom Software.	1. Should support Gesture Recognition like zoom, pan, tilt, flicks etc. (on Win

		platform) 2. Should have the following interactive tools/features like Pen, Magic Pen, Eraser, spot light, curtain, shape recognition, shape editing, infinite colour options for annotation, lines & arrows, screen capture tools (freehand capture is must), import / export files, unlimited pages, page navigation, save page(s), Undo/Redo, Geometric Tools like Math, protractor, compass, ruler etc. 3. Should capable to annotate on any 3rd party applications 4. Annotation Capability & integration with MS office application (for Win platform only): a. MS Word: handwriting recognition & draw object b. MS Excel: Should draw graph w/o touching KB & Mouse c. MS Power point: Should Create, Edit, Save, delete & annotate slides 5. Software should support & compatible with document camera solution 6. Capability of taking Snapshot from running video (Win platform) 7. Should support & operational with MS Touch Pack (Free Multi Touch application on Win platform) Auto replaying page without prior recording also have Audio-Video recording without internet.
9	Digital Podium	1) Advance digital podium which can be integrated with all Smart/Virtual Classroom. 2) Customizable as per customer requirement. 3) Elegant design and all in one compact solution with clutter free design. 4) Single touch start and shutdown. 5) Easy to use controller. 6) Best suited for college class room, Conference room etc. 7) Type of make MS fabricated Sheet with wooden sliding top and Lock. 8) Hydraulic with Up-down switch and power supply. 9) Display:-21" or above touch display. 10) Console panel port RGB X 1, USB, RJ45, Power, Input selection. 11) In-build processing system: - CPU, PA System and other accessories.

10	Installation And Delivery and Training.	Installation and Delivery Charges and Training per class room.

27. Special Condition

27.1. GENERAL

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The requirement offered by the contractor shall be complete in all respects. Any materials or accessories which may not have been specifically mentioned, but which are usual and necessary for the satisfactory and trouble free operation and maintenance of the equipment shall be provided without any extra cost of the purchaser. This shall also include spares for commissioning of the equipment.

The contractor shall obtain all sanctions (electrical loads, approval of drawing/ESS/D.G.'s estimator/approval of meter room etc. from the concerned authorities and permits required for the electrical installation work. All actual fee payable in this regard will be reimbursed against receipt/documentary evidence. On completion of work, the contractor shall obtain NOC from Director of Electricity Government of west Bengal .And a copy of the same shall be delivered to the Owner. The Owner shall have full power regarding the materials or work got tested by independent agency at the electrical authority expenses in order to prove their soundness and adequacy. The contractor will rectify the defects/suggestions pointed out by independent agency through Owner at his own expenses. The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations (for F.F. etc.) as amended up to date, there under and special requirements, if any, of the WBSEDCL etc. The bidder is liable to furnish the list of authorized licensed persons/ employed/deputed to carry out the works/perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

27.2 DRAWINGS

i) Shop Drawings

The contractor shall prepare detailed coordinated electrical shop and working drawing indicating lighting/lighting fixtures, convenience outlets, D.G.'s, H.T., Transformer, M.V. Panel Boards/Relay Panel, PCC, DB's, Rising Mains, Cable Schedule with other relevant services and submit to the Owner for approval or the Engineer-in-Charge before commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. 11 KV Panel Board, Control and Relay Panel Package Substation, D.G.'s, PCC's, MCC's, cable schedule and routes, manhole trap and fixing details as well as for conduit indicating run and size of wire/cables, outlet/pull/junction boxes etc. with fixing details etc. for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and fool proof system including any missing component/accessories to meet with the intent of the specifications. Contractor will submit 2 prints for preliminary approval and finally six prints for distribution.

ii) Completion Drawings/As Built Drawings

On completion of the work and before issue of certificate of virtual completion, the contractor shall submit to the employer 4 sets along with soft copy of 'As Built' drawings of the work along with 01 Nos. cloth tracing originals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution along with warrantee & guarantee certificates from manufacturers.

These drawings must provide:

- Run and size of conduit, inspection and pull boxes including routing and locations.

- Number and size of conductor in each conduit.
- Locations and rating of sockets and switches controlling the light and power outlet.
- A complete wiring diagram as installed and schematic drawings showing all connections in the complete electrical system.
- Location of outlets of various services, junction boxes, light fixtures.
- Location of all earthing stations route and size of all earthing conductors.
- Layout and particulars of all cables.
- Location and details of PCC's, MCC's, Feeder Pillars, capacitor control panels, PLC D.G. set panel, UPS panel, and relay panels with description detailed control wiring diagram.
- Location of transformer and its details and control wiring diagram.
- Location of Hume pipe/pcc ducting and manhole including HT/LT cable layout and scheduling.
- Location of D.G.'s, exhaust and auxiliary equipments with schematic drawings.
- Layout of cable trays with support and their fixing details/vertical rising.
- Location of all earthing station, route and size of all earthing conductor.
- Layout and particulars of rising mains with fixing details.

iii) Position of HT/LT Switch Boards/Transformer & D.G.'S

The recommended position of the switch boards transformer & D.G.'s as will be shown on the layout drawings will be adhered to as far as practicable.

The contractor shall submit 2 sets of samples of each type of accessories and apparatus, proposed to be used in the installation at site for approval (drawings or samples) as required shall be submitted by contractor and the choice of selection out of the approved list lies with the Owner. For all non-specified items, approval of the Owner shall be obtained prior to procurement of the same. Owner shall in no way be liable for rejection of the any material due to poor quality, poor workmanship, poor material etc.

27.3. MANUFACTURER'S INSTRUCTIONS

Where manufacturers have furnished specific instructions, relating to the material/equipments to be used on this job, covering points not specifically mentioned in this document, manufacturers' instructions should be followed.

27.4. MATERIALS AND EQUIPMENTS

All the materials and equipments shall be of the approved make and design. Unless otherwise called for any approval by Owner's Engineer-in-Charge, only the best quality materials and equipment shall be used.

27.5. GENERAL DETAILS

a. Space Heaters & Lighting.

One of more adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in any panel compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation. CFL lamp shall be provided in any panel compartment.

b. Fungistatic Varnish

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

c. Ventilation Opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a

minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

d. Degree of Protection

The enclosures of the Control Cabinets, Junction Boxes and Marshalling Boxes, Panels etc. to be installed shall provide degree of protection shall be as given below.

- Installed Outdoor: IP-55.
- Installed Indoor: IP-42.

27.6. Building Management System:

Building Management system should have to be provided for controlling and monitoring the following networks:

a. Temperature control and on/off operation of AHU units in ACMV systems.
b. Controlling and Monitoring of Fire Pumps, PHE Pumps, STP Monitoring of H.T panel, Main L.T Panel and D.G Set, Lift etc.

PART C: APPROVED MAKE:

C.1: Contractors have to take approval from Engineer in charge before placing of order of any required materials from the above mentioned approved makes. If any required materials not available in above list Engineer in charge can add the make / Brand in list at any stage with the approval of the Employer, decision will be final and binding on contractors. If any doubts about listed make / Brand Engineer in charge may amend the list at any stage, decision will be final and binding on contractors.

C.2: TABLE: List of Approved List:

Sl. No.	Item	Manufacturer's Name
1.HT Switchboard & Cable:		
1.1	11kV VCB & VCB Panel	L&T / Schneider/ ABB / Siemens (In-House or through Authorized System Integrator only)
1.2.	HT XLPE Cable	Polycab/ Gloster /Havells
1.3.	HT Cable End Termination	Birla/ Raychem /Frontec / Denson/3M
2. CSS , Transformer, DG set, Lift:		
2.1.	Unitised / Compact Sub-Station	ABB/Schneider/Siemens/L&T /
2.2.	Transformer (Dry Type, Cast Rasin)	Crompton Greaves/ Areva/ ABB/ Voltamp/ Energypac
2.3	D.G. Set	Jackson/Sterling Wilson / Cummins
2.4	D.G. Synchronization Panel	Jackson / Sterling Wilson/Mahindra
2.5	Lift	Otis/ThyssenKrupp/Kone/Schindler
3. **LT Switchboard, Cable & Switchgear:**		
3.1	LT Switchboard (IEC61439 Compliant)	L&T(Ti) /Legrand (XLCube)/Schneider (Blockset) / Siemens (Sivacon)
3.2	Air Circuit Breaker (ACB)	Schneider (Masterpact NW)/ L&T (Omega)/ Siemens (3WL)/ABB (Emax/ Legrand (DMX3)
3.3	Moulded Case Circuit Breaker (MCCB)	Siemens (3VL)/L&T (dsine)/ ABB (Tmax)/ Schneider (NSX)/ Legrand (DPX3)
3.4	Motor Protection Circuit Breaker (MPCB)	L&T / Siemens/ Schneider/ ABB
3.5	Power Contactor (AC3 duty)	Siemens (3TF)/ L&T(MO)/ ABB(AF)/Schneider (LC1)
3.6	Overload Relay with Single Phase Preventer	Siemens/ L&T/ ABB/ Legrand
3.7	Changeover Switch	L&T/ACB/ Havells
3.8	HRC Fuse & Switch Disconnector Fuse	Legrand/Siemens/ABB/L&T
3.9	Rising Main /Bus-Duct (Sandwich type)	Siemens (Sivacon 8PS) / Legrand (Zucchini) / Schneider (I Line II)/ L&T (Henikwon S Line)/C&S (metabar)
3.10	Digital-Ammeter/ Voltmeter/Multifunction Meter/Tri-vector Meter	Secure/ L&T /Conzerve / AE
3.11	Protection Relays	Alstom / L&T / Siemens / Schneider
3.12	LT XLPE Cable	Gloster / Havells / Polycab/Crystal
4. LT Panel Components:		
4.1	Timer	Siemens/ L&T/ ABB/ Legrand/ Havells
4.2	Rotary Switch	L&T / Kaycee / BCH / Siemens

4.3	Indicator Lamp (LED Cluster Type), Actuater, Push Button	L&T / Kaycee / BCH / Siemens
4.4	Selector Switch	Siemens/ Schneider / L&T
4.5	Terminal Block	Elemex / Wago
4.6	Lugs	Dowells/ Commet
4.7	Brass Cable Glands	Commet/ Beliga
4.8	Current Transformer (Epoxy Coated, Metering Class 1.0, secondary -/5A)	AE/ Kappa/ L&T / Schneider
4.9	PT (Epoxy Coated, Metering Class 1.0)	AE/ Kappa/ L&T / Schneider
4.10	Control Cable/Wire (Copper flexible, 1.1kV PVC insulated FRLS upto 10sq.mm.)	Universal/Nicco/ Polycab/ Havells/ KEI/ Mescab/ RR Kable/
4.11	Wire Mesh Cable Tray	OBO/ COPE/ LEVITON / Legrand (cablofil)
4.12	Phenol Laminated Sheet	Hylam/ Formica
5. Power Factor Correction:		
5.1.	APFC Panel (IEC 61439 Compliant)	L&T(Ti) /Legrand (XLCube)/Schneider (Blockset) / Siemens (Sivacon)
5.2.	APFC Relays	EPCOS/ L&T/ Legrand / Beluk/ Schneider
5.3.	LT Power Capacitor	L&T (Heavy Duty) / EPCOS (SquareCap)/Schneider (Varplus)
5.4.	Detuned Reactor (Copper)	L&T / EPCOS / Legrand / Schneider
5.5.	Capacitor Duty Contactor (AC6b)	L&T / Siemens /Schneider/ Legrand
5.6	Thyrister Switch	Electronicon/ Consul Neowatt/ Beluk
6. Internal Power Distribution:		
6.1	MCB/RCCB/RCBO/ Isolators	Legrand / Siemens / L&T/ ABB / Schneider
6.2	SPD	Legrand / Siemens / L&T/ ABB / Schneider/ Havells
6.3	Distribution Board (IEC 61439 Compliant)	L&T (Exora)/ Siemens (Beta-Guard)/ Schneider (Acti-9)/ Legrand (Ekinoxe3)
6.4	Metal Clad Socket	Legrand / Siemens / L&T/ Schneider / Hager
7. Auxiliary Power Source:		
7.1.	Solar Power Panel	KL Solar / Vikram Solar/ Surana / TATABP/AVO
7.2.	UPS System	APC/ Emerson/ Socomac / Delta/ AVO/ Numeric/ Schneider / Consul Neowatt
7.3	Invertor	Luminous /Mictotek/ Consul Neowatt
7.4.	Rechargeable Batteries	Exide/ Amaron/ Quanta/ Standard
7.5.	Battery Charger	Keltron/ Nelco/ Exide/ HBL Nife
8. Internal Wiring Accessories:		
8.1.	Modular Switch (Switch/Socket/LAN, TV & Telephone Socket) with ISI Mark	L&T (Entice)/ Legrand (Mylinc)/ Schenider (Zencelo)/ North West (Norisys)/ Anchor (Woods)
8.2	Ceiling Fan Regulator	L&T (Entice)/ Legrand (Mylinc)/ Schenider (Zencelo)/ North West (Norisys)/ Anchor (Woods)/
8.3	Modular AC Starter	L&T/ Legrand/ Schneider/ North West/ Hager
8.4	PVC Conduit (ISI Marked)	BEC/ Polycab/ AKG/ VIP/ Anchor

8.5	MS / GI Conduit (ISI Marked)	BEC/ AKG/ Atul/ RMCON
8.6	PVC Insulation Tape	Steel Grip / Anchor
8.7	Accessories for Metalic/GI Conduit (ISI Marked)	BEC/ RMCON/ AKG/ RMCON
8.8	Junction Box	Hensel/ ABB/ Schneider
9. Lighting & other Fixtures:		
9.1	LED Light's	Phillips /Bajaj/ Wipro/ Havells/ Crompton
9.2	Lighting Fixtures	Bajaj/ Crompton/ Wipro/ Havells
9.3	Bulk Head Fittings	Crompton/ Phillips /Bajaj/ Wipro/ Havells
9.4	LED Street Light	Bajaj/ Crompton/ Havells
9.5	LED Bollard & Post Top Light	Crompton/ IB LED/ Vinay Electrical
9.6	Lighting Control System	Phillips / Lutron/ Schneider/ Havells
9.7	External Street Light Pole	Bajaj/ Transtel/ Utkarsh
9.8	Lightning Arrestor and Chemical Earthing	ABB/ERICO/DUVAL MESSAIN
9.9	Ceiling Fan/ Wall Mounted Fan/ Exhaust Fan	CGL/ USHA/ Havells
9.10	Electric Motor	Kirloskar/ Crompton Greaves/ ABB/ Siemens
10. Fire Alarm& Detection Systems:		
10.1	Addressable Fire Alarm System (Detectors- Smoke, Heat, Manual Call Box, Response Indicator, Hooter/Sounder)	Honeywell (Notifier)/Siemens/ GST / Bosch/ Ravel
10.2	Gas Fire Suppression System	Fire Line/ Tyco Fire/ Siemens
11. Security, Access Control and Calling/Announcement / Audio Video System:		
11.1	CCTV System (along with accessories)	Honeywell/ PELCO/ Bosch/
11.2	Monitor	LG/ Samsung
11.3	VCR	BPL/ Panasonic
11.4	Access Control System	Bosch/ HID / Honeywell
11.5	Card Reader	Sensormatic-USA/ Motorola/ Honeywell
11.6	PA Amplifier/ PA Speakers	Bose/ Honeywell X-618/ ATEIS
11.7	Goose Neck MIC	Bose/ Honeywell X-618/ ATEIS
11.8	PA Rack	APW/ Net Rack / VAL Rack
11.9	MICs	Bosch/ Shure / Sennheiser
11.10	Signal/ Control Cable	Finolex/ Havells/ Gloster/ Polycab/ KEI
11.11	Line Matching Transformer	Bose/ Phillips/ Bosch
11.12	Road Barrier	NICE/ Magnetics / Godrej/ GE
11.13	Digital Classroom	SMART/ EKIN/ PROMETHEAN/ CISCO
11.14	PROJECTOR	BENQ/ EPSON/ SONY/Panasonic
11.15	Desktop as Server	HP/ DELL/ IBM
11.16	Video Conference	Honeywell/ Polycom/ EIKIN/ Cisco/
12. Communication System:		
12.1.	EPABX	Alkatel/ Nortel/ Panasonic
12.2.	Telelphone Tag Block	Krone/TVS R&M/ Systimax/ Schneider/ Panduit
12.3.	Proximity Card	Motorola/ Hughes/ Hoyenwell/ GE/ Siemens
12.4.	Telephone Cable	Delton/ Skytone/ Clipsal
12.5.	Co-axial Cable	Finolex/ Delton/ Skytone
12.6.	Multiplexer	Sensormatic or equivalent
12.7.	Sequencer	Alba/ Vantage
12.8.	IT System	Systimax/ Panduit/ Schneider

12.9.	Jack Panels	Amp/ Tyco/ Legrand/ Schneider
12.10.	IP Switches	HP/ CISCO/ Juniper
12.11.	Fibre & Cat6 Cables	Molex/ Tyco
12.12.	Active Server	HP/ Dell/ CISCO
13. HVAC System & Air Conditioning:		
13.1.	HVAC Control System (along with feedback system)	Honeywell/ Siemens/ Johnson Control
13.2.	Scroll / Screw Chilling Machine	Voltas / Blue Star/ LG/ Carrier/Daikin
13.3	Hi wall split	Blue Star/ Hitachi/ Carrier/Daikin
13.4	M.S. Pipe	Tata/ Jindal/ Bansal
13.5	Filters – Pre/Fine/Hepa	Clean Filters/ Dyna Filters/Pyramid Filters/ Spectrum
13.6	Air Handling Unit	EdgeTech/Waves/ Zeco/ Systamaire
13.7	2 way Valve with Controls	Advance/ Honeywell/ Johnson
13.8	Split/ Window Type – 5 Star rated Air Conditioner	Daikin/ Hitachi/ Bluestar/ Carrier
13.9	Ductable Split AC Unit	Daikin/ Hitachi/ Bluestar/ Carrier
13.10	Fixed Speed Pump	Grundfoss / M&P /Kirloskar / Wilo/ Armstrong/ ITT
13.11	Vaiable Flow Pump	Grundfoss / Armstrong/ ITT/ M&P /Kirloskar/ Wilo
13.12	3 WAY VALVE WITH CONTROLS	ADVANCE/HONEYWELL/JOHNSON/SIEMENS
13.13	G.I.SHEETS	SAIL/TATA/JINDAL/ESSAR
13.14	ALUMINIUM SHEETS	BALCO/JINDAL/NALCO
13.15	Pre fabricated Ducts	Radiant/ZECO/Camduct
13.16	Centrifugal Fan	Kruger/Nicotra/Flaktwoods/Wolter/SYSTEMAIRE
13.17	Axial flow fan	Kruger/Nicotra/Flaktwoods/Wolter/SYSTEMAIRE
13.18	Propeller fan	Almonard/GEC Alsthom/Khaitan/HAVELLS/MARATHON
13.19	BUTTERFLY VALVES	CASTLE/ADVANCE/Honeywell/L&T/ ZOLOTO
13.20	BALANCING VALVES	ADVANCE/ZOLOTO/ Honeywell
13.21	MOTORIZED VALVE	L&T/ADVANCE/ZOLOTO/HONEYWELL/SIEMENS
13.22	NON RETURN VALVE	ADVANCE/L&T/ HONEYWELL /ZOLOTO
13.23	Y Strainer	Emerald/ ADVANCE/ZOLOTO
13.24	THERMOMETER/PRESSURE GAUGE	H.GURU/Warree
13.25	Gate/Globe/Ball Valve	ADVANCE/L&T /ZOLOTO
13.26	Chilled Water Pipes	Tata/Jindal/Sail
13.27	Diffusers/Grilles	Ravister/Air Master/Air Flow
13.28	Fire Damper	Ravister/Air Master/Air Flow
13.29	Duct Insulation (Fibre Glass)	UP Twiga
13.30	Flexible Duct	Atco/Sevenstar/Rolastar
13.31	Pipe Fittings	HEAVY/ Local repute make
13.32	Sluice Valve	Koley/ Kalpana/ Karter/ C&R
13.33	Foot Valve	Koley/ Kalpana/ Karter/ C&R
13.34	Anti-corrosive wrapping material	IWL/ Indolit
14. Fire Fighting System:		
14.1	BATTERIES	EXIDE / STANDARD / AMARON
14.2	BATTERY CHARGER	KELTRON/ NELCO/ EXITE/ HBL NIFE

14.3	DIESEL ENGINE FOR FIRE PUMPS	CUMMINS / CATERPILLAR / KIRLOSKAR / ASHOK LEYLAND
14.4	FIRE PUMPS	KIRLOSKAR / MATHER &PLATT / KSB/ CROMPTON GREAVES
14.5	ELECTRIC MOTORS	KIRLOSKAR / SIEMENS / CROMPTON GREAVES / ABB / MARATHON
14.6	GI PIPES (Heavy Duty)	TATA / JINDAL / SURYA ROSHNI / ZENITH /BANSAL
14.7	SUPPORTS	HITECH / SAKTHI
14.8	PIPE FITTINGS – BUTT WELDED	REPUTED MAKE (AS PER IS 1239, Part 2 , Heavy grade)
14.9	PIPE FITTINGS – SOCKET WELDED	REPUTED MAKE / VENUS / BHARAT FORGE / RAJENDRA FORGE / ASIAN VALVES & TUBES / VS (VIJAY CYCLE AND STEEL INDUSTRIES) / BM (B.M. METER PRIVATE LIMITED) / HP (HINDUSTAN PIPES & FITTINGS)
14.10	PRIMER, COATING & WRAPPING	IWL (PYPKOTE) / INDOLIT / RUSTEC / EQUIVALENT
14.11	PAINT	BERGER / ICI / ASIAN PAINTS / NERROLAC / NIPPON / J & N
14.12	SLUICE VALVE	KOLEY / KALPANA / KARTER / C&P / H.SARKAR / DURGA / KIRLOSKAR / SANT / VENUS / UPADHAYA
14.13	NON RETURN VALVE	KOLEY / KALPANA / KARTER / C&P / H.SARKAR / DURGA / KIRLOSKAR / SANT / VENUS / UPADHAYA
14.14	BUTTERFLY VALVE	KOLEY / KALPANA / KARTER / C&P / AUDCO / INTERVALVE / BDK /ADVANCE / H.SARKAR / CRAWL & RAY
14.15	BALL VALVE	LEADER / SANT / ZOLOTO/ ITAP / NETO / HAWA / RB
14.16	RUBBER EXPANSION BELLOWS	CORI / KANWAL / RESISTOFLEX
14.17	STRAINER	PROCEDYNE / SANT / EMERALD /H.SARKAR / VENUS / UPADHAYA / ZOLOTO
14.18	HYDRANT VALVE, BRANCH PIPE & NOZZLE	ASCO / GEI / FIRE SHIELD / GUARDS / NEWAGE / SUKAN / WINCO / SHAH BHOGILAL / MINIMAX / GHOSH / SAFEX / SAFE FIRE / FIRESHIELD / SEALFIRE / SAFEGUARD
14.19	FIRE HOSE	CRC / BRG / FIRE SHIELD / NEWAGE / PADMINI / SAFEGUARD
17.20	HOSE REEL DRUM	ZENITH ENGINEERS / NEWAGE / EVER SAFE / SHAH BHOGILAL / SAFE FIRE / SAFEX / USHA FIRE / SAFEX / EQUI / SAFEGUARD
14.21	HOSE BOX	ZENITH ENGINEERS / NEWAGE / EVER SAFE / SHAH BHOGILAL / SAFE FIRE / SAFEX / USHA FIRE / SAFEX / EQUI / SAFEGUARD
14.22	PRESSURE GAUGE	H.GURU / FIEBIG / WAREE / WIKA / GENERAL INSTRUMENTS
14.23	PRESSURE SWITCH	INDFOSS / DANFOSS / SWITZER / VERMA

		TRAFAG
14.24	SPRINKLERS	TYCO / VIKING / RELIABLE / FIRESAFE / HD FIRE /BEST/GRINELL
14.25	SPRINKLER FLEXIBLE DROPS	EASYFLEX / DONGA FLEX / RAPIDROP / DEIJIN / HD FIRE
14.26	ALARM VALVE	HD FIRE / TYCO / VIKING / RELIABLE / FIRESAFE (UL APPROVED)
14.27	FLOW SWITCH	SWITZER / SYSTEM SENSOR
14.28	FIRE BRIGADE INLET	ASCO / GEI / FIRE SHIELD / GUARDS / NEWAGE / SUKAN / WINCO / SHAH BHOGILAL / MINIMAX / GHOSH / SAFEX / SAFE FIRE / SAFEGUARD
14.29	AIR RELEASE VALVES	LEADER / NEWAGE / SHAH BHOGILAL / EQUIVALENT/WINCO
14.30	FIRE EXTINGUISHER	FIRE SHIELD / MINIMAX / ZENITH/ KANEX/ CEASEFIRE
14.31	PHOTOLUMINESCENT SAFETY SIGNAGES	GLO-LITE / AUTO GLO / BIJOLI STUDIO/ KLIK
14.32	SWITCH GEAR	L & T / SIEMENS/SCHNEIDER
14.33	CABLE END TERMINATION	DOWELL / COMET
14.34	FIRE SEALANT MATERIAL	PROMAT / FIRE MASTER (MMTCL) / 3M / HILTI / VIJAY SYSTEM ENGINEERS (VSE) / NELSON FIRE STOP
14.35	FIRE PUMP ENGINE	KOEL/Greaves
14.36	FIRE CHECK DOOR	AGNI/ PACIFIC/ NAVAIR/ SHAKTI

15. ELV SYSTEMS:		
Sl. No.	**Description**	**Preferred Brands**
A	**Public Address System**	
1	Voice alarm controller, Amplifier, Speaker	BOSCH/BOSE/HARMAN
2	PA / ELV Rack	APW/Rittal/Net rack/Val rack
3	Signal Cables	Delton/ Teleflex/ Finolex/ Thermo cables/ Varsha
B	**CCTV System**	
1	CCTV Camera, NVR &Software	HONEYWELL/ BOSCH /PELCO/AXIS
2	Monitors	LG/ SAMSUNG
C	**IT & Telecom System**	
1	All Passive Items	SCHNEIDER/ SYSTIMAX/ PANDUIT/MOLEX/LEGRAND/COMMSCOPE
2	GI/PVC Back Box	HEVELLS/ANCHOR
D	**DATA & VOICE**	
1	Server Based IP PABX System	CISCO/ALCATEL/NEC/MITEL/AVAYA
2	IP/SIP Phones	CISCO/ALCATEL/NEC/MITEL/AVAYA
3	EPABX Server	CISCO/HP/DELL
4	Network Switch	CISCO/HP/JUNIPER/EXTREME

5	Wireless System (with hardware controller)	CISCO/HP/ALCATEL/Dlink
6	Active Server	CISCO/ HP/DELL
	CONTAINMENT	
E	**MS Conduit / GI Conduit (ISI Marked)**	
1	PVC Conduit (ISI Marked)	BEC/ AKG / ATUL
2	Perforated Cable Tray	BEC/ POLYPACK/ AKG /ATUL/ PROFAB
F	**VIDEO CONFERENCE SYSTEM / AV system**	
1	VIDEO CONFERENCE SYSTEM	POLYCOM/CISCO/AVAYA/YEALINK
2	All Type of Display	LG/SAMSUNG/ PANASONIC
3	All types Speaker	JBL/LACOUSTICS/BOSE/TANNOY
4	Screen	ELITE/DREPPER/DALITE
5	Amplifier ,Mixture ,DSP & Controller	HARMAN/BOSE/EXTRON/LABGRUPEN
6	Cables and connector for AV Integration	BELDON/KRAMER/EXTRON/ CRESTON
7	Projector	SONY/NEC/EPSON/BARCO/ CHRISTIE
G	**Active Servers**	
1	Server	HP/Dell/CISCO
H	**UPS (for ELV /BMS System)**	
1	Online UPS	APC/EMERSON/ DELTA/ NUMERIC

16. Building Management System:		
S.No.	**Details of Materials / Equipment**	**Manufacturer's Name**
1.	Standalone TCP/ IP enabled DDCs, Software, Router/ System Integrator	Honeywell / Siemens / Schneider / Delta controls
2.	Immersion Temperature Sensor, Duct temperature sensor, Outside air temperature sensor, Room temperature sensor, Duct humidity sensor, Room Humidity sensor, Duct static Pressure sensor	Honeywell / Siemens / Schneider / Delta controls
3.	Flow Meter	Schenitech / Honeywell / Kampstrup
4.	Water Level Switch, DP Switch (Water & Air), CO2 sensor, Water flow switch,	Veksler / Filpro / Sontay
5.	Current Relay	Veris / Seto / Mamac/Omron / ABB
6.	Voltage / Current / Power Factor Transducer	SETO / ABB / L&T / Enercon / SETCO
7.	Flame Proof Level Switch / Level Transmitter	Veksler / Filpro / Sontay / Techtrol

8.	PH Sensor / TDS Sensor	Honeywell / Hach / Greisinger
9.	Personal Computer	HP / DELL / LENOVO
10.	Colour Monitor	DELL/ HP/ LENOVO
11.	Printer	HP / EPSON / CANON
12.	Copper Conductor Control Cable	Finolex / Skytone / Delton / Polycab
13.	Communication Cables / Signal Cable	Finolex / Skytone / Delton / Polycab
14.	LAN cables for BMS Network	Molex/LEGRAND/ Commscope/SCHENEIDER

SECTION 5.7

Payment schedule

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
1	On approval of Concept Plan, Architectural Plan, Elevation, Structural Details including Soil Investigation Report	0.20%	0.20%	0.20%	0.20%	0.20%
2	On approval of Working Drawings (Architectural) as required.	0.20%	0.20%	0.20%	0.20%	0.20%
3	On approval of Working Drawings (Structural) as required.	0.20%	0.20%	0.20%	0.20%	0.20%
4	On approval of DBR for other Services, Design Details. (e.g. S & P Works, Water Supply, Fire, Power, Electrical facilities, Waste Water Disposal, Bio-Medical Waste Treatment & Disposal, Roads, Pavement, Drains, Landscaping etc.) including approval of the drawing & procurement of clearence from statutory bodies like Municipality, Panchayat, Fire, Pollution control Board etc.	0.15%	0.15%	0.15%	0.15%	0.15%
5	On approval of Working drawing for other Services, Design Details. (e.g. S & P Works, Water Supply, Fire, Power, Electrical facilities, Waste Water Disposal, Bio-Medical Waste Treatment & Disposal, Roads, Pavement, Drains, Landscaping etc.) including approval of the drawing & procurement of clearence from statutory bodies like Municipality, Panchayat, Fire, Pollution control Board etc.	0.25%	0.25%	0.25%	0.25%	0.25%
6	On completion of "As Built Drawing".	0.50%	0.50%	0.50%	0.50%	0.50%
7	RCC Pile Foundation/RCC shallow foundation, strip footing, isolated/raft foundation etc. (including dismantling of existing structures where required.)					
	a) On completion of first 25% in all respect.	4.00%	4.00%		3.50%	-
	b) On completion of next 25% (total upto 50%) in all respect.	4.00%	4.00%	8.00%	3.50%	-
	c) On completion of next 25% (Total upto 75%) in all respect.	4.00%	4.00%		3.50%	-
	d) On completion of next 25% (Total upto 100%) in all respect.	4.00%	4.00%	8.00%	3.50%	16.50%
8	Pile Cap/ Tie-Beam (as applicable) up to Plinth level including earth/sand, Brickwork and floor Grade slab (PCC/RCC) as required					
	a) On completion of first 50% Pile Cap in all respect.	2.50%	3.00%		2.50%	-
	b) On completion of balance 50% (Upto 100%) Pile Cap in all respect.	2.50%	3.00%	6.00%	2.50%	6.00%
	c) On completion of plinth beam including brickwork as required.	1.00%	1.00%	1.00%	1.00%	1.00%
	d) On completion of 70% grade slab in all respect including sand/earth filling as required.	0.70%	0.70%	0.70%	0.70%	-
	e) On completion of 30% grade slab in all respect including sand/earth filling as required.	0.30%	0.30%	0.30%	0.30%	1.00%

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
9	RCC frame superstructure of the entire building except above roof structure.					
	a) On completion of first 15% in all respect.	2.50%	3.00%	3.00%	2.75%	-
	b) On completion of next 15% (total upto 30%) in all respect.	2.50%	3.00%	3.00%	2.75%	-
	c) On completion of next 15% (total upto 45%) in all respect.	2.50%	3.00%	3.00%	2.75%	-
	d) On completion of next 15% (total upto 60%) in all respect.	2.50%	3.00%	3.00%	2.75%	-
	e) On completion of next 15% (total upto 75%) in all respect.	2.50%	3.00%	3.00%	2.75%	-
	f) On completion of next 15% (total upto 90%) in all respect.	2.50%	3.00%	3.00%	2.75%	-
	g) On completion of next 10% (total upto 100%) in all respect.	2.00%	2.50%	2.50%	2.50%	19.00%
10	RCC frame superstructure of above roof structure like overhead tanks, LMR, & staircase head rooms etc. in all respect.	1.00%	1.00%	1.00%	1.00%	1.88%
11	On completion of Brick/AAC Block work of the entire building from ground floor to top floor including mumty.					
	a) On completion of first 25.0%	1.25%	2.00%	2.00%	2.00%	-
	b) On completion of next 25.0% (Up to 50.0%)	1.25%	2.00%	2.00%	2.00%	-
	c) On completion of next 25.0% (Up to 75.0%)	1.25%	2.00%	2.00%	2.00%	-
	d) On completion of balance 25.0% (Up to 100%)	1.25%	2.00%	2.00%	2.00%	10.00%
12	Plastering (inside & outside) of the entire building from ground floor to top floor including mumty, external façade complete in all respect.					
	a) On completion of first 25.0% inside plaster.	0.25%	0.50%	0.50%	0.40%	-
	b) On completion of next 25.0% (Up to 50.0%) inside plaster.	0.25%	0.50%	0.50%	0.40%	-
	c) On completion of next 25.0% (Up to 75.0%) inside plaster.	0.25%	0.50%	0.50%	0.40%	-
	d) On completion of balance 25.0% (Up to 100%) inside plaster.	0.25%	0.50%	0.50%	0.40%	2.50%
	e) On completion of outside Plaster first 50.0%	0.20%	0.40%	0.40%	0.40%	-
	f) On completion of outside Plaster next 50.0% (Up to 100%) including external façade complete in all respect.	0.80%	1.60%	1.60%	1.20%	2.00%
13	Flooring & Cladding work in all respect of the building from ground floor to top floor.					
	a) On completion of first 25.0%	1.25%	1.75%	1.75%	2.00%	-
	b) On completion of next 25.0% (Up to 50.0%)	1.25%	1.75%	1.75%	2.00%	-
	c) On completion of next 25.0% (Up to 75.0%)	1.25%	1.75%	1.75%	2.00%	-
	d) On completion of balance 25.0% (Up to 100%)	1.25%	1.75%	1.75%	2.00%	5.00%
	d) On completion of Staircase	0.50%	1.75%	1.75%	2.00%	1.00%

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
14	Supply and fixing of Doors (Wooden flush door, Panel door, Solid PVC door, Fire Resistant door & Metal door) and Windows with glass and grills etc.					
	a) On completion of Supply and fixing of Door frame in all respect first 50%	0.25%	0.30%	0.30%	0.30%	-
	b) On completion of Supply and fixing of Door frame in all respect next 50%(upto 100%)	0.25%	0.30%	0.30%	0.30%	0.60%
	c) On completion of Supply and fixing of Door Shutter in all respect first 50%	0.75%	0.60%	0.60%	0.60%	-
	d) On completion of Supply and fixing of Door Shutter in all respect next 50%(upto 100%)	0.75%	0.60%	0.60%	0.60%	1.20%
	e) On completion of Supply and fixing of Windows with glass in all respect first 50%	0.25%	0.30%	0.30%	0.30%	-
	f) On completion of Supply and fixing of Windows with glass in all respect next 50%(upto 100%)	0.25%	0.30%	0.30%	0.30%	0.60%
	g) On completion of Supply and fixing of Windows grill, collapsible gate, Rolling grill etc. in all respect next 50%(upto 100%)	0.25%	0.30%	0.30%	0.30%	0.30%
15	Supply and fixing of false ceiling (Metallic and Non-Metallic), stage craft, Acoustic treatment etc					
	a) On completion of first 50% false ceiling.	0.70%	-	-	2.00%	-
	b) On completion of balance 50% (Upto 100%) false ceiling.	0.70%	0.50%	0.50%	2.00%	0.50%
	c) On completion of Accoustic Wall paneling and Stage Craft as required complete in all respect.	0.60%	-	-	-	-
16	Putty & Painting works from ground floor to top floor including Staircase.					
	a) On completion of first 50% putty as required	0.25%	0.40%	0.40%	0.30%	-
	b) On completion of balance 50% putty (Upto 100%) as required	0.25%	0.40%	0.40%	0.30%	0.80%
	c) On completion of first 50% internal painting.	0.50%	0.75%	0.75%	0.65%	-
	d) On completion of balance 50% internal painting (Upto 100%)	0.50%	0.75%	0.75%	0.65%	1.50%
	c) On completion of external painting (Up to 100%)	0.75%	1.00%	1.00%	0.90%	1.00%
17	Staircase hand railing & other railing etc. of the entire building.					
	a) On completion of first 50% as required	0.12%	0.25%	0.25%	0.25%	-
	b) On completion of balance 50% (Upto 100%) as required	0.13%	0.25%	0.25%	0.25%	0.50%

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
18	External Pipeline for treated water etc. of the entire building.					
	a) On completion of external water distribution line from OHT complete in all respect.	0.30%	0.50%	0.50%	0.50%	0.50%
	b) On completion of external water supply line from UGR to OHT & STP to OHT complete in all respect.	0.10%	0.15%	0.15%	0.15%	0.15%
	c) On completion of all other external water distribution line including water feeding for landscape gardening from STP or UGR etc. complete in all respect.	0.10%	0.15%	0.15%	0.15%	0.15%
19	External Pipeline for rain water, waste water & sewerage network system etc. of the entire project.					
	a) On completion of external rain water, waster water pipe line of the entire building complete in all respect.	0.30%	0.30%	0.30%	0.30%	0.30%
	b) On completion of sewerage network system of the entire project complete in all respect.	0.20%	0.20%	0.20%	0.20%	0.20%
20	Rain water harvesting complete in all respect.	0.15%	0.25%	0.25%	0.25%	0.25%
21	External drainage network complete in all respect of the entire project.					
	a) On completion of external drainage network within the premises first 50% as required complete in all respect.	0.25%	-	-	-	-
	b) On completion of external drainage network within the premises balance 50% (Upto 100%)complete in all respect.	0.25%	-	-	-	-
	c) On completion of external drainage network outside the premises complete in all respect.	0.20%	-	-	-	-
	d) On completion of drainage lifting station including all electromechanical works complete in all respect.	0.40%	-	-	-	-
22	Internal Pipeline (for water supply) of the entire building.					
	a) On completion of first 50.0%	0.40%	0.75%	0.75%	0.40%	-
	b) On completion of next 50.0% (Up to 100.0%)	0.40%	0.75%	0.75%	0.40%	1.50%
23	Fixing of sanitary & Plumbing fittings/ fixtures for the entire building.	1.50%	3.50%	3.50%	1.50%	3.50%
24	Roof Water Proofing Treatment and other water proofing works complete in all respect.	1.00%	2.00%	2.00%	1.50%	2.00%

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
25	Civil work of Sub-Station building, DG foundation with shade etc. for the entire project.					
	a) On completion of structure upto plinth level except grade slab.	0.25%	-	-	-	-
	b) On completion of structural frame 100% except grade slab.	0.25%	-	-	-	-
	c) On completion of Block/Brick work & plastering work 100% including grade slab.	0.25%	-	-	-	-
	d) On completion of finishing work complete in all respect after installation of equipment.	0.25%	-	-	-	-
26	Underground Reservoir with water proofing including punp house (Fire fighting / Drinking water) for the entire project.	0.75%	-	-	-	-
27	Sewage Treatment Plant of the entire project.	0.40%	-	-	-	-
28	Road, Pathway, plinth protection etc. complete in all respect of the entire Project.					
	a) On completion of first 30.0% with M40 grade Concrete Road complete in all respect.	1.50%	-	-	-	-
	b) On completion of next 30.0% (Up to 60.0%) with M40 grade Concrete Road complete in all respect.	1.50%	-	-	-	-
	c) On completion of balance 40.0% (Up to 100%) with M40 grade Concrete Road complete in all respect.	2.00%	-	-	-	-
	d) On completion of pathway (covered as required) complete in all respect of the entire project.	0.50%	-	-	-	-
	e) On completion of plinth protection complete in all respect of the entire project.	0.15%	-	-	-	-
29	Boundary wall including barbed wire & Gate,	0.80%	-	-	-	-
30	Fire Fighting arrangement with Extinguisher, Yard Hydrant, Wet Riser, Down Comer, Sprinkler system etc. as required complete in all respect for both external and internal for the entire building including NOC from concerned authority.					
	a) On completion of first 50% internal.	0.10%	-	-	0.50%	-
	b) On completion of balance 50% (Upto 100%) internal and external including NOC from concerned authority.	0.15%	0.25%	0.25%	0.75%	0.25%
31	Bore-Well, Pump, WTP, water purification system etc. for the entire project.	1.25%	-	-	-	-

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
32	Internal electrical installation including Conduiting, Cabling, Wiring including all type of switch boards, proper electrical dressing with ferruling arrangement/tagging etc.					
	a) On completion of 50% Roof conduiting complete in all respect.	0.10%	0.15%	0.15%	0.10%	-
	b) On completion of 100% Roof conduiting complete in all respect.	0.10%	0.15%	0.15%	0.10%	0.60%
	c) On completion of 25% wall conduiting, chase chutting, back encloser fixing for switch board & DB complete in all respect.	0.10%	0.15%	0.15%	0.10%	-
	d) On completion of 50% wall conduiting, chase chutting, back encloser fixing for switch board & DB complete in all respect.	0.10%	0.15%	0.15%	0.10%	-
	e) On completion of 75% wall conduiting, chase chutting, back encloser fixing for switch board & DB complete in all respect.	0.10%	0.15%	0.15%	0.10%	-
	f) On completion of 100% wall conduiting, chase chutting, back encloser fixing for switch board & DB complete in all respect.	0.10%	0.15%	0.15%	0.10%	1.25%
	g) On completion of 50% electrical wire pulling complete in all respect.	0.35%	0.70%	0.70%	0.35%	-
	h) On completion of 100% electrical wire pulling complete in all respect.	0.35%	0.70%	0.70%	0.35%	3.00%
	i) On completion of 50% Switch Board & Accessories fixing complete in all respect.	0.10%	0.15%	0.15%	0.10%	-
	j) On completion of 100% Switch Board & Accessories fixing complete in all respect.	0.10%	0.15%	0.15%	0.10%	0.60%
	k) On completion of 50% laying of internal cable with cable tray complete in all respect.	0.20%	0.30%	0.30%	0.20%	-
	l) On completion of 100% laying of internal cable with cable tray complete in all respect.	0.20%	0.30%	0.30%	0.20%	1.20%
33	SITC of HT, LT, APFC Panels, Transformer, HT earthing and internal electrification etc. of Substation earthing & street light of entire project.					
	a) On completion of SITC of HT Panel	0.25%	-	-	-	-
	b) On completion of SITC of LT panel including APFC Panels	1.00%	-	-	-	-
	c) On completion of SITC of Transformer	0.40%	-	-	-	-
	d) On completion of SITC of HT cable, Internal electrification including earthing etc. of Substation.	0.10%	-	-	-	-
	e) On completion of SITC of Earthing & street light of entire project..	0.50%	-	-	-	-

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
34	Supply & installation of Building Electrical Panels with components, floor DBs with components, distribution of cables from Sub-Station to different buildings, UPS, all cable termination complete in all respect.					
	a) On completion of Supply & installation of Building Electrical Panels with components all cable termination complete in all respect.	0.60%	0.90%	0.90%	0.60%	0.90%
	b) On completion of Supply & installation of DBs, UPS with components all cable termination complete in all respect.	0.80%	1.20%	1.20%	0.80%	1.20%
	c) On completion of Supply & installation of Distribution of cables from Sub-Station to different buildings complete in all respect.	0.60%	0.90%	0.90%	0.60%	0.90%
35	SITC of AC system with all allied mechanical accessories complete in all respect.	3.00%	-	-	8.50%	-
36	SITC of AC system with all allied mechanical accessories at guest rooms attached with the teaching staff quarter complete in all respect.	0.15%	-	-	-	-
37	SITC of Lift including NOC from concerned authority for the entire project complete in all respect.	1.50%	5.00%	5.00%	1.50%	-
38	SITC of devices for Fire Detection System including all controlling system excluding hydrant complete in all respect.	0.30%	0.10%	0.10%	0.50%	0.10%
39	SITC of DG-set including AMF panel, earthing, cabling & NOC from concerned authority complete in all respect.	1.50%	-	-	-	-
41	P.A./ Sound System, CCTV, ELV system ie. LAN & Telephone network, Telecommunication equipment, Cable TV network, BMS & IT-systems complete in all respect.					
	a) On completion of first 50% complete in all respect.	1.00%	-	-	1.00%	-
	b) On completion of balance 50% (Upto 100%) complete in all respect.	1.00%	0.50%	0.50%	1.00%	0.50%
41	SITC of all electrical fittings & fixtures (all types of light & fan etc.), complete in all respect.					
	a) On completion of 25% SITC of electrical fittings & fixtures complete in all respect.	0.45%	0.77%	0.77%	0.35%	-
	b) On completion of next 25% (upto 50%) SITC of electrical fittings & fixtures complete in all respect.	0.45%	0.77%	0.77%	0.35%	-
	c) On completion of next 25% (upto 75%) SITC of electrical fittings & fixtures complete in all respect.	0.45%	0.77%	0.77%	0.35%	-
	d) On completion of next 25% (upto 100%) SITC of electrical fittings & fixtures complete in all respect.	0.45%	0.77%	0.77%	0.35%	5.00%
42	On completion of SITC of Solar Power System complete in all respect.	0.75%	-	-	-	-

Sec. 5.7 PAYMENT SCHEDULE

Sl.	Activity/ Milestone	% of Project Cost for Academic Building	% of Project Cost for Hostel Block	% of Project Cost for Staff Quarter	% of Project Cost for OPD Block	% of Project Cost for Other Building (Central Workshop, Maintenance Office, Garbage Store etc.)
43	SITC of Signage both internal and external of the buildings for the entire project.	0.25%	0.05%	0.05%	0.38%	0.05%
44	SITC of Lighting Conductor, Electrical Landscaping, Façade lighting of the buildings for the entire project.					
	a) On completion of SITC of Lighting Conductor for the entire project complete in all respect.	0.30%	-	-	-	-
	b) On completion of SITC of Electrical Landscaping, Façade lighting of the buildings for the entire project complete in all respect.	0.30%	-	-	-	-
45	Landscaping & Site clearance of the entire project.	2.28%	-	-	-	-
46	On completion of total electromechanical work for Sewage Treatment Plant including NOC from concerned authority of the entire project.	0.30%	-	-	-	-
47	Supply of consumables and maintenance including renuwal of all NOC from concerned authority during DLP for the entire project.					
	a) On completion of 1st quarter of 1st year.	0.08%	0.08%	0.08%	0.08%	0.08%
	b) On completion of 2nd quarter of 1st year.	0.08%	0.08%	0.08%	0.08%	0.08%
	c) On completion of 3rd quarter of 1st year.	0.08%	0.08%	0.08%	0.08%	0.08%
	d) On completion of 4th quarter of 1st year.	0.08%	0.08%	0.08%	0.08%	0.08%
	e) On completion of 1st quarter of 2nd year.	0.12%	0.12%	0.12%	0.12%	0.12%
	f) On completion of 2nd quarter of 2nd year.	0.12%	0.12%	0.12%	0.12%	0.12%
	g) On completion of 3rd quarter of 2nd year.	0.12%	0.12%	0.12%	0.12%	0.12%
	h) On completion of 4th quarter of 2nd year.	0.12%	0.12%	0.12%	0.12%	0.12%
	i) On completion of 1st quarter of 3rd year.	0.18%	0.18%	0.18%	0.18%	0.18%
	j) On completion of 2nd quarter of 3rd year.	0.18%	0.18%	0.18%	0.18%	0.18%
	k) On completion of 3rd quarter of 3rd year.	0.18%	0.18%	0.18%	0.18%	0.18%
	l) On completion of 4th quarter of 3rd year.	0.18%	0.18%	0.18%	0.18%	0.18%
	Total =	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*

Note (A): No additional area will be considered for services & utilities mentioned in Sl. No. 21, 25, 26, 27, 28, 29, 31, 33, 36, 39, 42, 44, 45, 46 in the Payment Schedule. Payment for these works will be disbursed as per provision made in the Payment Schedule for the Academic Building.

Note (B) for Sl. No. 47: - i) Supply, repair and maintenance of Sanitary and Plumbing system, door and windows along with its fittings and fixtures will be under the scope of bidder.

ii) Repair, Maintenance, renewing including supply of Consumables for all Electro-Mechanical equipments (except D.G fuel) will be under the scope of bidder.

NOTE III: SUPPLY OF ITEMS AGAINST WHICH PAYMENT TO BE RELEASED OF CORRESPONDING ACTIVITY/ MILESTONE

Sl. No.	Items of Supply	Corresponding Activity (Clause No: 14.4)	Percentage of Payment
1	LT Panels	**Activity Sl. No: 33** SITC of HT, LT, APFC Panels, Transformer, HT earthing and internal electrification etc. of Substation earthing & street light of entire project.	Payment to be released @ 20.00% of corresponding activity/ milestone, after civil work completion of Sub-station building.
2	HT Panels	**Activity Sl. No: 33** SITC of HT, LT, APFC Panels, Transformer, HT earthing and internal electrification etc. of Substation earthing & street light of entire project.	Payment to be released @ 15.00% of corresponding activity/ milestone, after civil work completion of Sub-station building.
3	Transformer	**Activity Sl. No: 33** SITC of HT, LT, APFC Panels, Transformer, HT earthing and internal electrification etc. of Substation earthing & street light of entire project.	Payment to be released @ 25.00% of corresponding activity/ milestone, after civil work completion of Sub-station building.
4	Chillers	**Activity Sl. No: 35** SITC of AC system with all allied mechanical accessories complete in all respect.	Payment to be released @ 35.00% of corresponding activity/ milestone, after 80% completion of structural work of respective building.
5	All AHUs	**Activity Sl. No: 35** SITC of AC system with all allied mechanical accessories complete in all respect.	Payment to be released @ 25.00% of corresponding activity/ milestone, after 80% completion of structural work of respective building.
6	Lift	**Activity Sl. No: 37** SITC of Lift including NOC from concerned authority for the entire project complete in all respect.	Payment to be released @ 60.00% of corresponding activity/ milestone
7	DG-Set	**Activity Sl. No: 41** SITC of DG-set including AMF panel, earthing, cabling & NOC from concerned authority complete in all respect.	Payment to be released @ 60.00% of corresponding activity/ milestone

SECTION 5.8

EMPLOYER'S REQUIREMENTS FOR PROCUREMENT OF MEDICAL EQUIPMENT

Section 5.8

EMPLOYER'S REQUIREMENTS FOR PROCUREMENT OF MEDICAL EQUIPMENT

1. Power input to the system should be single phase 220-240 Vac, 50 Hz single phase supply or 440 Vac, 50 Hz, 3 phase as applicable. Cables should be terminated in protected plug top or isolator of suitable capacity.

2. Suitable servo controlled stabilizer / CVT should be supplied if the unit is not supported by built-in stabilizer.

3. The unit supplied should function continuously in ambient temperature of 10º to 40º C and relative humidity of 15% to 90%.

4. The unit should be capable of being stored continuously in an ambient temperature from 0 to 50º C and relative humidity of 15% to 90%.

5. The manufacturing facility of the equipment, if situated in India, shall have ISO certification wherever applicable.

6. The Contractor shall provide all necessary cooperation to obtain statutory approvals like AERB / Explosive License/ running Blood bank approvals.

7. The Contractor shall ensurethat a local service facility is provided by the manufacturer or its authorized agent to carry out PM as per schedule and corrective maintenance at short notice.

8. Installation, commissioning, acceptance testing and validation shall be done by the Contractor as per manufacturer's protocol at site.

9. All test equipment, phantoms, kits, reagents; personnel for trial run of the equipment shall be the responsibility of the Contractor.

10. The Contractor shall provide end user training as many number as may be required after installation and commissioning of the equipment during Warranty and CMC of the equipment.

11. Acceptance of installation by the Contractor shall include training of personnel at site (users, technicians and engineers), which shall be undertaken by the Contractor.

12. All surgical instruments shall be made of high quality (SS-316 grade), with dull finish and CE / ISO certified.

SECTION 5.8A

List of Medical Equipment (Schedule – I)

Schedule - I

Name of the Discipline: ANATOMY			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Mortuary cooler with arrangement to keep 8 bodies	Temperature Range : 2°C to 8°C / -10°C to -20°C Temperature Control : Digital Micro-processor Temperature Display : LED / LCD Display Construction : G.I Sheet / M.S / 304 Stainless Steel Insulation : High Grade Poly Uretherane Doors : Made of Steel Sheets w/ Magnetic Gasket & External Lock Trolleys : Made of Steel and sliding on telescopic rails Compressor : ISI Marked & CFC Free Defrosting Type : Automatic Evaporator : Internal evaporator system Forced draught Internal drainage : Yes Integral temp gauge : Yes Refrigeration System : Air cooled Hermetically sealed Air Circulation : Forced Air Circulation Alarm : High / Low alarm system Internal Lighting : Waterproof fluorescent ceiling lamps Locking System : Standard Key Locks Power Supply : 220 Volts / 50 Hz Essentials : User & Technical Manual, Optional Accessories : Caters, Stabilizer, Loading Trolley, Instrument Trolley, Data Logger, Temperature Chart Recorder, Authorization Certificate	1
2	Embalming Machine	• The body of the Embalming Machine(Cadaverous Injector) machine is made of Stainless Steel. • For injecting formaldehyde solution in cadaverous at much higher speed than normal gravity process. • Unit is fully covered & mounted on a portable trolley having four castor wheels for easy movement. • Unit consists of one air compressor which is connected with a stainless steel tank of 10 liters capacity meant for storing and injecting the solution. • Incorporated with latest Reciprocatory pressuring unit for efficient performance. • The machine is Completely Noiseless and Vibration free which justifies the Superiority of our machine from the other brands available. • Tank is fitted with a safety valve, pressure gauge and rubber tubing having provision for injection. • Supplied complete with electric cord, plug and suitable to work on 220 volts, 1ph 50 hz. • Preferably 1HP motor. • **To be supplied with a manual device**	3
3	Microtomes, rotary	Section settings and adjustments for the Microtome: Section thickness indication: visual display Range of section thickness: 1 - 60μm Increments:from 1-10μm in 1μm steps from 10-20μm in 2μm steps from 20-60μm in 5μm steps	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
4	Incubators	1. Temperature range : 5° above ambient to Min. 75° C with + 1° C increments and accuracy. 2. Temperature stability : ± 0.5° C 3. Microprocessor based control with LED display Digital displays for time and temperature. 4. Natural and Forced air convection with selectable fan speed from 0-100%. 5. Minimum 200 litres chamber volume. 6. Programmable with adjustable timer. 7. Exterior corrosion resistant powder coated steel with rounded corners. 8. Interior Stainless steel with perforated SS shelves. 9. Double Doors with frame less inner fiber glass or glass door for sample observation without temperature drop. Doors should open 180° angle for easy loading of samples. Silicone gasket on main door to minimize heat loss. 10. Adjustable shelves (Flexible) with minimum 2 trays but provision for at least 5 more, shelves should be capable of carrying a load of min. 25 kg. 11. Should include mercury free thermometer. 12. Over temperature protection with visible and audible alarms. 13. The units should be stackable without the need for using tools. 14. Should be CE/US FDA/BIS approved 15. Should be of SS 304	1
Name of the Discipline: BIOCHEMISTRY			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Shaking Machine	Multipurpose Size of platform: 12''x12" Horizontal Motion for multipurpose use . Platform is to be provided with sliding steel rods and fly nuts to hold the beakers, bottles,racks etc. Number of oscillation 50 to 280 strokes per minute. Provided with a speed regulator,1/20H.P. AC/DC gear motor Power requirement: Electrically operated on 220/230V Should be CE/US FDA/BIS	2
2	Digital Colorimeters	1. Should have 8 no of filter covering OD range from 400 to 700 nm. 2. Should have a three digit display calibrated directly in optical density. 3. Detector should be encased in spill proof photocell. 4. Type of detector: high sensitivity silicon photocell. 5. Resolution: 0.01 in OD or Abs. 6. Should provide standard accessories a) 10 cuvettes b) test tube stand 7. Should have facilities for concentration calculation, percentage transmission and Optical density. 8. Should work on 200 – 240 Vac 50 Hz power supply. 9. Should have CE/US FDA/BIS	5

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
3	Thin Layer Chromatograph	Purpose: To introduce the principles of absorption chromatography using the thin layer technique. This mechanism is having moveable applicator with inbuilt thickness arrangement between 0 to 2mm (minimum div. 0.25mm) in further consists of the following components - a. Spreader (applicator) made of electroplated brass. b. Perspex base of 114x23 cm to support glass plates. c. Plate rack aluminium, anodised for ten 20 x 10 cm plates. d. Chromatography tank with lid. (20 x 20 cm) e. Spotting template made of perspex. f. TLC plates set of ten 20x10cm g. Glass sprayer with rubber bellow, cap. 100ml h. Micro-pipette i. Subscriber for marking lines made of stainless steel j.. Instruction manual.	2
4	Horizontal Electrophoresis Unit	1. Complete set – including base gel running unit, safety lid, at least two casting trays and combs. 2. Gel casting Tray: Standard form; 3. Combs size: 1.0mm – 4 wells, 8 wells & 12 wells 4. Buffer chamber capacity: 150 ml approx. 5. Buffer chamber must have safety lid 6. No. of platinum electrodes : positive &negative (each one) 7. Connecting Cord: Red and Black (each one) 8. Power supply: Suitable for constant voltage and constant current mode. Output voltage: adjustable from 0 to 500 with an increment of 1 volt Output current: upto 800 mA with an increment of 1mA. Output power: 300W or more (450) Input voltage: 230V + 10 VAC, 50Hz 9. Should have CE/US FDA/BIS	1
5	Vertical Slab Gel Electrophoresis Unit with Power supply	1. Dimensions: (l x b x h) cm :15x15x15 2. Gel size (cm): 8x7 3. No. of samples : 7 4. Upper buffer tank capacity (ml) :100ml 5. Lower buffer tank Capacity (ml0: 150 ml 6. No. of Combs: 7 well tooth comb 7. Teflon spacers: 0.5 mm Teflon spacers (2 in numbers) 1mm Teflon spacers (2 in numbers) 1.5mm Teflon Spacers (2 in numbers) 8. Connecting cords : Black & red 9. Platinum electrode : red & black : 1 each 10. lid: one 11. Glass plate : Notched &Rectangular : 2 sets Power Supply: Suitable for constant voltage and constant current mode. Output voltage: adjustable from 0 to 500 with an increment of 1 volt Output current: upto 800 mA with an increment of 1mA. Output power: 300W or more (450) Input voltage: 230V + 10 VAC, 50Hz 12. Should have CE/US FDA/BIS	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Analytical Balance	1. Range: 0.1mg-200g (at least) 2. Pan size: 125mm (approx) 3. Repeatability: 0.02 mg 4. Casing: Glass casing 5. Digital display 6. Automated Taring system. 7. Internal calibration 8. External calibration with weight from statutory body	2
7	Digital Spectrophotometer (UV vis Spectrophotometer)	1. UV Vis spectrophotometer can measure absorbance and transmission and perform screening. 2. Optical system: single beam 3. Light source: xenon flash lamp. 4. Wavelength range: 200-800 nm approx 5. Spectral band width: 4nm 6. Wavelength increment: 1 nm 7. Photometric measurement: 0 to 3 at 260 nm 8. Photometric accuracy: Δ = 0.001 9. Display system: LED 10. Cuvette: Round and square glass / hard plastic Cuvette 11. Should be supplied with branded PC and necessary software for analysis and system up-gradation 12. 1KV voltage stabiliser	1
Name of the Discipline: Community Medicine			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Haemoglobinometer	Should be digital, battery operated Code strips should be easily available Should operate at room temperature Package should come with disposable sterile lancet Should give results within 2-3 minutes Should not be affected by haemoglobin variation Cartridge should be self-contained Should be able to store data for at least last 3 tests Accessories free of cost: 1.Micro Pipette - 2.5 ml : 1 No. 2..Lancing device - 1 Unit 3 Lancettes : 25 Nos 4. 1-heme cuvettes with rubber cap Should be European CE approved	5

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
2	Centrifuge clinical	a) Capacity: At least 16 holes x15ml round bottom test tube (plastic & glass). b) Built in time and speed regulator (digital controlled) with suitable speed & time indicator (digital display) and lid lock system. c) RPM: 500 to 4000 rpm with full load with swing out rotor head. d) Power Supply: 220/240 volts, single phase, 50 Hz e) A line voltage corrector of appropriate rating will form part of standard configuration. The servo voltage corrector should be capable to correct input voltage range from 160 – 280 V AC to 220/240 VAC, 50Hz. f) Technical Literature: The firm shall submit printed illustrated technical literature/ leaflet indicating the model number. If quoted model is a modified version of their any standard product that also be indicated in the offer g) Product certification: CE / US FDA / BIS certified. h) Quality Certification: ISO certified.	1
3	Spirometer	1. FVE, SVC, MVV Tests. 2. Evaluation of all other parameters with Flow-Volume/Volume-Time graphs 3. Pre & Post medication tests 4. Store data for 2500 patients approx 5. Flow range – 10 l/s to 16 l/s 6. Built in printer to print graph and measurement values 7. Liquid crystal display for graphs and measurement values 8. Mains and battery operated 9. Result Table with Predicted, result achieved, %Predicted, %improvement 10. High resolution LCD (320x240 pixels) 11. Microsoft Windows-based PC 12. USB port 13. Color printer required for color printouts. 14. Software CD 15. Reusable Mouth pieces 16. Nose clip 17. Transducer bidirectional turbine cartridge 18. Turbine sensor-infrared interruption 19. Disposable mouth pieces 20. Handset	3
Name of the Discipline: Forensic Medicine			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Digital Spectrometer	1. UV Vis spectrophotometer can measure absorbance and transmission and perform screening. 2. Optical system: single beam 3. Light source: xenon flash lamp. 4. Wavelength range: 200-800 nm approx 5. Spectral band width: 4nm 6. Wavelength increment: 1 nm 7. Photometric measurement: 0 to 3 at 260 nm 8. Photometric accuracy: $\Delta = 0.001$ 9. Display system: LED 10. Cuvette: Round and square glass / hard plastic Cuvette 11. Should be supplied with branded PC and necessary software for analysis and system up-gradation 12. 1KVA voltage stabiliser	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
2	Automatic tissue processing machine	Carousel type with 12 stationsConfigurations: – Basic instrument with VacuumCapacity- 80-100 cassettesOption: 1 baskets loadingTissue baskets made of metal with varying capacities of up to 100 cassettesErgonomic control panel with foil-protected keyboard and LCDInfiltration time separately programmable for each stationDelayed start functions up to 9 daysPossibility of interrupting an automatic process for reloading or removing cassettes for special applications before the end of a runEasy editing and changing of programs, even during a processing runAudible alarms, error messages and warning codesAdvanced safety concept with Wide range of accessories should be availableNominal voltage:100 / 120 / 230 / 240 V AC ±10%Nominal frequency: 50 / 60 Hz Wax baths:Number: 2 Capacity: at least 1.8 litresTemperature range45 °C – 65 °CExcess temperature cutout: 75 °C ± 4 °CReagent containers:Number: 9 to 10Capacity: at least 1.8 litresStandard tissue basket:Number:1 Capacity: max. 100 cassettesPrograms:Number: 8 to 9, freely selectableProgrammable infiltration time per station: _ 99 h 59 minDelayed start: 9 daysDrain time: 60 sShould have min. 30 no of installations in East India in which --at least 7-10 nos. should be in Government Institutions in West Bengal stateShould have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquarted in Kolkata, having their office in Kolkata to support all districts of West Bengal timely. Should have European CE / USFDA certificate.	2
3	Microtome	Fully automated motorized rotary microtome along with manual operation having microprocessor controlled panel with provision for motorized cutting via operating panel or foot pedal control. Precise micrometer feed system via stepper motor permits precision sectioning selectable at least from 2.0-40/60 micron in 0.5 micron increments. Trimming section selectable from 2 micron onwards. The vertical specimen stroke length of 70mm, larger specimen can be sectioned. The specimen holder should be clamp type and hold 60mm size block. The specimen retraction should occur on return stroke. Cold light source. Precise specimen orientation with zero point indication, with an orientation 8º X-Y axis helps in marking perfect orientation of the sample for sectioning. Motorised coarse feed in two speeds 30 micron/sec and 90 micron/sec. Variable sectioning speed adjustable from 0.5 to 420 mm/sec. Disposable blade holder with lateral displacement feature that can hold both high and low profile blades Integrated section waste tray. Accessories Microtome disposable blades (high profile coated) - 1 packets (50 blades/pack). Microtome disposable blades (low profile coated) - 1packets (50 blades/pack). Should have European CE/US FDA/BIS	2
4	Cold storage for 6 dead bodies	Entire storage should be made of SS 304 Size of chamber (inside): 2100 – 2400 mm (length) × 500 – 600 mm (breadth) × 300 – 450 mm (height) 2 storied (3 column & 2 rows; i.e. maximum 2 bodies vertically) Temperature range: +1 to +5 C Must be equipped with Digital temperature display alongwith high or low temperature alarm or hooter Number of Refrigeration unit: 2 (1 working and 1 standby) Must be plug-in type for easy operation Refrigerant: Green gas (non CFC) Insulation: High density PUF panel (40 kg/cu. m) Insulation thickness: minimum 80 mm CFC free Green PUF panel Must be telescopic Trolley-mounted for easy shifting Door activated interior LED (2 sets) Individual lockable chamber Company or Product should be certified by ISO / appropriate authorities Automatic defrost Should be CE/BIS certified	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
5	Binocular Research type microscope with attachment for camera	Metal body with all critical movements based on ball bearing & wire guides thereby ensuring smooth & precise manipulation. Co-axial low drive mechanical stage (125mm x 145mm) (+/- 5 mm) with traverse area of 50 mm x 76 mm (+/-5mm) with single side holder. Co-axial coarse & fine controls with a focus adjustment and fine adjustment knobs, Coarse Focus range 20 mm. Fine focus range 0.2 mm. Rack & pinion mounted condenser holder. Centerable abbe condenser with aperture iris diaphragm (N.A. 1.25) focusable with rack & pinion through 20 mm and a continuously variable iris diaphragm with a removable blue filter for daylight observation. LED light source High brightness, longlife (30,000). Quintaple revolving nosepiece based on precision ball-bearing mechanism with positive click stop. Objectives: Plan 4X (N.A 0.10 W.D 25 mm), Plan 10X (N.A 0.25 W.D 5 mm), Plan 20x, Plan 40X. Infinity corrected plan optics, Uniformly centered, Interchangeable & Parfocal, Anti-fungus treated, Tropicalised anti fungus treatment ensures image excellence for long periods in conditions, favouring to fungus growth. Binocular (30 deg inclined seidentopf), 360 deg rotatable, dioptre adjustment WF 10X (F.N 18 mm Or better) paired eyepiece and left eyepiece should have eyepiece micrometer. The unique optical design of the compensating eyepiece provides relief from eye fatigue and renders color- compensated wide-field images of utmost clarity. Compatible with optionally available eyepiece micrometer. Certification: European CE/BIS (Certificates should be provided on the brand of microscope which the bidder mentioned in the tender).	4
6	Deep Freezer	(-) 20 ° FREEZER Parameter/ Feature THRESHOLD LIMIT / RANGE HOLD OVER TIME IN AMBIENT TEMPERATURE IN HOURS 2 or more Temperature range for machine in °C (-) 20 to (-) 15 Ability to work in ambient room temperature in °C (10 to 35) or more VOLUME in Litres 300 or more No. OF ADJUSTABLE STEEL RACKS IN INNER CHAMBER 3 or more THICKHNESS OF Powder coated CRCA steel sheet of OUTER BODY in mm 0.6 MUST HAVE SPECIFICATION Parameter/ Feature Yes/No Type: Vertical INNER CHAMBER WITH Stainless steel for insulation to minimize heat loss MICROPROCESSOR BASED TEMPERATURE CONTROL Solid state digital indicator cum controller with audio visual alarm ALARM FOR: HIGH LOW TEMPERATURE, POWER FAILURE Counter balanced door, Inside acrylic doors to avoid temperature loss CFC FREE REFRIGERANT Digital temperature display with 0.1°C graduation PUF INSULATION PANNEL FOR CASING AND DOOR-Thickness minimum 30 mm QUALITY STANDARD & SAFETY CERTIFICATION EUROPEAN CE / BIS /US FDA	1

Name of the Discipline: MICROBIOLOGY

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
1	Single pan digital balance	Capacity: 1000g Pan Size: 170x190 mm (approx) Transparant glass cover Power Connection: 220/230 V AC Calibration: Internal Linearity: 0.02g Repeatability: 0.01g Readability: 0.01g	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
2	Serum inspissators	Standard temperature: 85 degree C • Operating temp. range: ambient +5 to 90 degree C • Temperature display: LED; Display resolution: 0.1 degree C • Capacity for up to 156 test tubes (16mm diameter x 150mm long) or 162 universal containers • Heater power: (approx.) 1.4Kw, 230V; • Tank capacity: (approx.) 45 lit; • Working area: length/width: (approx.) 820/594mm; • Overall dimensions (approx).: L/W/H: 1040/600/380mm; • Over temperature protection: Fixed cut-out; • Electrical power: 220-240V 50/60 Hz, 1.5kW(approx.) • Approx.weight: 25-35 kgs. • Double walled Inner SS 304 and outer GI. • Full length inner glass or acrylic door for clean view. • Outer metal door with magnetic gasket and lock • Should bear CE • Company should have ISO certification • One year warranty and guarantee	1
3	Biosafety Cabinet Type - 2A	1. Vertical laminar flow air to create ISO-Class Ill work area 2. Single piece wall of SS, preferably SS- 304 3. Single piece work tray of SS, preferably SS-304. 4. Side walls are surrounded by negative pressure. 5. LUPA filter(efficacy 99.999% . Arrests particles S 0.3micron) — 2(both downflow and exhaust). 6. UV light arrangement with a UV meter. 7. Pressure gauge (dial type). 8. Size : WxDx H = 1000mm x 600 mm x 650 mm (approx) 9. Air flow velocity : Inflow 0.5 M/S , Outflow 0.3 M/S 1(). Heavy Duty Castor wheels Service facility in Kolkata. 5years guarantee of all parts. Thereafter AMC (please quote) Record of installation in reputed institutes in Kolkata and certificate from users	1
4	Biosafety Cabinet Type - 2B	1. Vertical laminar flow air to create ISO-Class Ill work area 2. Single piece wall of SS, preferably SS- 304 3. Single piece work tray of SS, preferably SS-304. 4. Side walls are surrounded by negative pressure. 5. HEPA filter(efficacy: 99.99 % at 0.3micron) 6. UV light arrangement with a UV meter. 7. Pressure gauge (dial type). 8. Size : Wx DxH = 1000mm x 600 mm x 650 mm (approx) 9. Air flow velocity : Inflow 0.5 M/S , Outflow 0.3 M/S 10. Heavy duty 'Castor Wheels'. Service facility in Kolkata. 5years guarantee of all parts. Thereafter AMC (please quote) Record of installation in reputed institutes in Kolkata and certificate from users ISO-2013 Compatible	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
5	BOD Incubator	PARAMETER / FEATURE THRESHOLD LIMIT / RANGE RANGE OF AMBIENT TEMPERATURE IN ◦ C 10 TO 35 OPERATING /PRODUCIBLE/ ACHIEBVABLE TEMPERATURE RANGE IN BOD INCUBATOR IN ◦ C 0-70 RANGE OF TEMPERATURE SENSITIVITY IN ◦ C ± 0.1 RANGE OF TEMPERATURE UNIFORMITY IN ◦ C ± 0.5 MAXIMUM HEATING RATE IN ◦ C/ MIN 5 OR LESS MINIMUM HEATING RATE IN ◦ C/ HOUR 2 OR MORE MAXIMUM COOLING RATE IN ◦ C/ MIN 5 OR LESS MINIMUM COOLING RATE IN ◦ C/ HOUR 2 OR MORE AIR CIRCULATION FORCED TYPE WITH FANS 2 OR MORE INNER CHAMBER VOLUME IN CUBIC FT 2 OR MORE INNER CHABER SHELVES 4 OR MORE SUPPLY VOLTAGE/ FREQUENCY 220 V/50 HZ MUST HAVE SPECIFICATION PARAMETER / FEATURE YES/NO DIGITAL TEMPERATURE CONTROLLER DEVICE PROFILE WITH DIFFERENT RAMP UP RAMP DOWN AND SOAK FEATURES PROFILE CONTAINING MORE THAN 8 FEED POINTS INDEPENDENT OVERHEAT PROTECTION SYSTEM INSTALLED WITH SEPERATE TEMPERATURE SENSOR AND BUZZER ALARM HUMIDITY CONTROL FOR CHAMBER, INSTALLED DEHUMIDIFIER FOR LESS THAN 50% REL HUMIDITY INNER CHAMBER WALL WITH INSULATED STAINLESS STEEL (SS 304) BOD OUTER WALL RUST AND CORROSION PROOF LOCK AND BUZZER ALARM FOR DOOR CALIBRATION AND OPERATING MANUAL CFC FREE REFRIGERATION SYSTEM QUALITY STANDARD AND SAFETY CERTIFICATION: EUROPEAN CE OR US FDA	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Elisa Reader	Parameter/ Feature THRESHOLD LIMIT / RANGE NO. OF WELLS RUN PER ASSAY (INCLUDING CONTROLS AND CALIBRATORS) 96 MINIMUM SAMPLES CAN BE RUN PER ASSAY (WITH CONTROLS AND CALIBRATORS) 1 ABSORBANCE Range (0.0-3.0) or more Wavelength of 6 Position filter wheel filters in nm 405- 690 READER ACCURACY in OD ± 0.010 READ TIME FOR SINGLE WAVELENGTH in Sec ≤10 READ TIME FOR DUAL WAVELENGTH in Sec ≤20 POWER SUPPLY 220 V±10% 50 HZ Range of ELISA WASHER Volume of solution dispense PROGRAMABLE in µl 50-1000 WASHER ACCURACY well to well (NOT EXCEEDING) in µl 300 ±10% WASHER PROCESSING TIME (350 µl x3 cycles x 8 port) in sec 180 or less RESIDUAL VOLUME in µl ≤2 NO. OF PROGRAM 30 or more POWER REQUIREMENT 230 V±10%; 50/60 Hz Range of Soak Time (In Strip Mode) in Sec 0-10 Range of Soak Time (In Plate Mode) in Min 0-30 WORKING CONDITION HUMIDITY in % 0-95 WORKING CONDITION TEMPERATURE in °C (10 to 35) or more MUST HAVE SPECIFICATION Parameter/ Feature Yes/No MACHINE IS COMPATIBLE WITH REAGENTS AND KITS OF OTHER MANUFACTURER DETECTOR- Silicon Photodiode MEASUREMENT MODE Monochromatic & Bi-chromatic LIGHT SOURCE - LED Lamp / Halogen KEYBOARD RUGGED , WATER PROOF , MEMBRANE TYPE ELISA WASHER : LIQUID CONTACT MATERIALS Glass, polypropylene, polyethylene, stainless steel, tygon, teflon, derlin & nylon HIGH RESOLUTION , FULL GRAPHIC THERMAL TYPE PRINTER ; SUPPLIED ACCESSORIES - COMPUTER AND PRINTER ; INTERFACE - RS-232 serial interface with computer ; READING MODE 6/12/24/48/96 WELL PLATES (ADJUSTABLE) ; USB 1.1/2.0 ; 8-12 CHANNEL OPTICAL SYSTEM ; VARIABLE SHAKING SPEED AND TIME ; WASHER WITH 8 / 12 WAY MANIFOLD CONFIGURATION ; ADAPT TO U, FLAT AND CURVED BOTTOM PLATES ; ALERT FOR WELL OVERFLOW AND WASTE BOTTLE ; QUALITY STANDARD & SAFETY CERTIFICATION ; EUROPEAN CE IVD / US FDA Note: In case the machine is offered with Halogen, free replacement of light source for next 10 years with free calibration at the time of changing of light source	1
Name of the Discipline: PATHOLOGY			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Automated Rotary Microtome****	Fully automated motorized rotary microtome along with manual operation having microprocessor controlled panel with provision for motorized cutting via operating panel or foot pedal control. Precise micrometer feed system via stepper motor permits precision sectioning selectable at least from 2.0-40/60 micron in 0.5 micron increments. Trimming section selectable from 2 micron onwards. The vertical specimen stroke length of 70mm, larger specimen can be sectioned. The specimen holder should be clamp type and hold 60mm size block. The specimen retraction should occur on return stroke. Cold light source. Precise specimen orientation with zero point indication, with an orientation 8º X-Y axis helps in marking perfect orientation of the sample for sectioning. Motorised coarse feed in two speeds 30 micron/sec and 90 micron/sec. Variable sectioning speed adjustable from 0.5 to 420 mm/sec. Disposable blade holder with lateral displacement feature that can hold both high and low profile blades Integrated section waste tray. Accessories Microtome disposable blades (high profile coated) - 1 packets (50 blades/pack). Microtome disposable blades (low profile coated) - 1 packets (50 blades/pack). Should be European CE/BIS/US FDA	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
2	Electrophoresis Set Up	1. Complete set – including base gel running unit, safety lid, at least two casting trays and combs. 2. Gel casting Tray: Standard form; 3. Combs size: 1.0mm – 4 wells, 8 wells & 12 wells 4. Buffer chamber capacity: 150 ml approx. 5. Buffer chamber must have safety lid 6. No. of platinum electrodes : positive &negative (each one) 7. Connecting Cord: Red and Black (each one) 8. Power supply: Suitable for constant voltage and constant current mode. Output voltage: adjustable from 0 to 500 with an increment of 1 volt Output current: upto 800 mA with an increment of 1mA. Output power: 300W or more (450) Input voltage: 230V + 10 VAC, 50Hz 9. Should have CE/US FDA/BIS	1
3	Five Part Hematology Analyzer***	RBC, WBC, PLT, HGB, HCT, MCV, MCHC, RDW, MPV, PCT, PDW, MCH, MCHC. 26 Parameters 5 different mode: RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV, PCT, PDW, WBC, LYM, MON, NEU, EOS, BASO, ALY (Atypical Lymphocytes), LIC (Large Immature Cells) in % & # RBC and BASO histograms Fully automated cell counter / hematology analyser providing 26 parameters including results for abnormal lymphocytes and Immature cells, absorbance-based cyto-chemical staining technology for reliability of the WBC differentials. System have option to turn off WBC Differential analysis, with resultant reagent saving. On-board monitoring of reagent levels and display the reagent level on screen whenever required. Sample processing speed of over 55 samples per hour. Whole-blood sample aspiration volume of less than 60uL for samples, quality control and calibration material. System does not have any external or internal pneumatic or compressor device. Should have barcode facility. Should be Europian CE IVD/US FDA certified. Should have demonstration prior to final price bid. Should have good service centre in Kolkata. Equipment Prints results on ordinary paper and on letter-heads.	1
4	Automatic Hematology Slide Stainers***	Compact, space saving H&E stainer for routine applications; High specimen throughput; Simultaneous realization of various different staining protocols; Exact incubation times; Continuous slide unload / reload function without having to interrupt a staining cycle or open the lid; Simple, menu-driven programming; Incubation times and sequence of use of reagent stations; freely programmable; Integrated oven for optimal slide drying; Reagent containers can be exchanged quickly and easily; Integrated fume extraction system with activated charcoal filter; Minimized user exposure to hazardous reagent fumes; Easy-to-clean and resistant surfaces made out of polyester epoxy resin and stainless steel; Specimen slide throughput: at least 200 specimen slides per hour; (depending on the selected program – up to 600 slides per hour); Loading capacity: at least 11 slide racks; Loading capacity per slide rack: at least 30 specimen slides; Total number of processing stations: 25-30; Reagent stations: at least 18; Reagent container volume: 400-450 ml; Number of wash stations: max. 5; Oven: 1; Oven chamber temperature: off or 30 °C to 65 °C; Incubation time setting: from 0 sec. up to 99 min, 59 sec.; Load / unload stations: 1 each; Permanent memory capacity: 15 programs, up to 25 program steps each; Should have at least 10 Installations in East India; Should have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquartered in Kolkata, having their office in Kolkata to support all districts of West Bengal timely; Should have European CE /US FDA/BIS certificate	1
5	Coagulometer (Fully automated)***	Fully automated random access Coagulation analyzer. Open System with random & STAT mode of operation. Viscosity based detection system for clotting test and optical system for Chromogenic & Immunoturbidimetric tests. Capable to run Clotting assay, Chromogenic assay & Immunoturbidimetric assays. Parameters – PT, APTT, TT, ATIII, Heparin. Fibrinogen, Fondaparinux, Rivaroxaban. UFH & LMWH, D-dimer, FM, FDP PC (clot & Chromogenic), PS. Free PS, APCR. Plasminogen, Antiplasmin, TAFI, VWF: Ag, Extrinsic & Intrinsic Pathway Factors & LA. Throughput – **150** PT/hour & **90 PT & APTT**/hour. **80** Assay Methodologist available. Reagent positions – **45** with **5** stirring positions. All are temperature controlled & and maintained from **15 to 19 deg C**. Each reagent can be placed in several positions and analyzer will detect automatically without manual intervention. Barcode identification for reagents with continues loading. Barcode identification for reagent name, Lot number, Expiry, on board stability. **96** samples positions, with **84** for primary tubes & **12** for pediatric tubes. Adaptors available for Microtainers. Barcode identification for samples. Continuous sample loading with all positions for **STAT** mode. **12** programmable tests for one sample. Three separate needles for Samples, Intermediate reagent & Starter reagents with LLD (Liquid level detection) **1000** unitary Cuvettes on board with continuous loading capability. Pre calibrated assays for PT, FIB & D.Dimer, and Free Pro S & VWF: Ag. Storage capable for Calibration curves. Automatic dilution for calibrations. **600 patients'** results & One year IQC results in memory. Re run & reflex facility. QC management with Levy Jennings chart & Westgard QC alarms. Alarm for QC out range capability. LIS capability with Bi directional transferring capacity. Auto validation for patient results & Calibrations. Auto rerun with operator's rules. Based on windows embedded operating systems with multitasking. Color LCD 22" Touch screen. The system is complied with CE (EC), US FDA certification.	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Penta Head Microscope with High end Optics with HDMI Multi output Photographic camera (> 5 MP) including Software	Focusing Systemis Co-axial coarse & Fine Focusing control on both sides. It should also have a focusing stopper. Objectives are Plan Achromat objectives of 4x ,10x, 20x, 40x (spring) and 100x (spring, oil) should be quoted. Nosepiece are Quintuple revolving nosepiece with inward tilt (facing away from the operator) Condenser- 1.25 with built in aperture iris diaphragm Illumination by Pre-centered LED illumination with consumption of 3 W or higher having lifetime of 30,000 working hours or higher. Eyepiece - Paired Widefield eyepiece of 10x having field of view of 20 mm or higher with diopter setting of +/- 5 should be available on one eyepiece position. Multi Viewing attachment Multi Viewing attachment for additional 4 observers. Binocular Observation tube inclined at 30 degrees with diopter setting - 4 units, Widefield paired eyepieces 10x having field of view of 20 mm - 4 pairs. All the co-observers should get the same orientation and view as main observer. It should have a arrow pointer attachment. Demonstration is a must for technical evaluation before price bid After Sales Service Support - The manufacturer should have their service engineer based in Kolkata so that after sales service is attended promptly. The Quoted Microscope should have European CE certification/USA-FDA (Certificates should be provided on the brand of microscope which the bidder mentioned in the tender	1
7	For every Tutor – Binocular Microscope with suitable high end lenses	Metal body with all critical movements based on ball bearing & wire guides thereby ensuring smooth & precise manipulation. Co-axial low drive mechanical stage (125mm x 145mm) (+/- 5 mm) with traverse area of 50 mm x 76 mm (+/-5mm) with single side holder. Co-axial coarse & fine controls with a focus adjustment and fine adjustment knobs, Coarse Focus range 20 mm. Fine focus range 0.2 mm. Rack & pinion mounted condenser holder. Centerable abbe condenser with aperture iris diaphragm (N.A. 1.25) focusable with rack & pinion through 20 mm and a continuously variable iris diaphragm with a removable blue filter for daylight observation. LED light source High brightness, longlife (30,000). Quintaple revolving nosepiece based on precision ball-bearing mechanism with positive click stop. Objectives: Plan 4X (N.A 0.10 W.D 25 mm), Plan 10X (N.A 0.25 W.D 5 mm), Plan 20x, Plan 40X. Infinity corrected plan optics, Uniformly centered, Interchangeable & Parfocal, Anti-fungus treated, Tropicalised anti fungus treatment ensures image excellence for long periods in conditions, favouring to fungus growth. Binocular (30 deg inclined seidentopf), 360 deg rotatable, dioptre adjustment WF 10X (F.N 18 mm Or better) paired eyepiece and left eyepiece should have eyepiece micrometer. The unique optical design of the compensating eyepiece provides relief from eye fatigue and renders color- compensated wide-field images of utmost clarity. Compatible with optionally available eyepiece micrometer. Certification: European CE/BIS (Certificates should be provided on the brand of microscope which the bidder mentioned in the tender).	4
8	For every Professor, Associate & Assistant Professor : Binocular Microscopes with High end Semiapochromatic Optics of international standard.	Metal body with all critical movements based on ball bearing & wire guides thereby ensuring smooth & precise manipulation. Co-axial low drive mechanical stage (125mm x 145mm) (+/- 5 mm) with traverse area of 50 mm x 76 mm (+/-5mm) with single side holder. Co-axial coarse & fine controls with a focus adjustment and fine adjustment knobs, Coarse Focus range 20 mm. Fine focus range 0.2 mm. Rack & pinion mounted condenser holder. Centerable abbe condenser with aperture iris diaphragm (N.A. 1.25) focusable with rack & pinion through 20 mm and a continuously variable iris diaphragm with a removable blue filter for daylight observation. LED light source High brightness, longlife (30,000). Quintaple revolving nosepiece based on precision ball-bearing mechanism with positive click stop. Objectives: Plan 4X (N.A 0.10 W.D 25 mm), Plan 10X (N.A 0.25 W.D 5 mm), Plan 20x, Plan 40X. Infinity corrected plan optics, Uniformly centered, Interchangeable & Parfocal, Anti-fungus treated, Tropicalised anti fungus treatment ensures image excellence for long periods in conditions, favouring to fungus growth. Binocular (30 deg inclined seidentopf), 360 deg rotatable, dioptre adjustment WF 10X (F.N 18 mm Or better) paired eyepiece and left eyepiece should have eyepiece micrometer. The unique optical design of the compensating eyepiece provides relief from eye fatigue and renders color- compensated wide-field images of utmost clarity. Compatible with optionally available eyepiece micrometer. Certification: European CE/BIS (Certificates should be provided on the brand of microscope which the bidder mentioned in the tender).	4
9	For Diagnostic & Research Work - Trinocular head Microscope with Bright field,	Metal body with all critical movements based on ball bearing & wire guides thereby ensuring smooth & precise manipulation.Co-axial low drive mechanical stage (125mm x 145mm) (+/- 5 mm) with traverse area of 50 mm x 76 mm (+/-5mm) with single side holder.Co-axial coarse & fine controls with a focus adjustment and fine adjustment knobs, Coarse Focus range 20 mm. Fine focus range 0.2 mmRack & pinion mounted condenser holderCenterable abbe condenser with aperture iris diaphragm (N.A. 1.25) focusable with rack & pinion through 20 mm and a continuously variable iris diaphragm with a removable blue filter for daylight observation. LED light source High brightness, longlife (30,000). Quintaple revolving nosepiece based on precision ball-bearing mechanism with positive click stop. Objectives: Plan 4X (N.A 0.10 W.D 25 mm),Plan 10X (N.A 0.25 W.D 5 mm), Plan 20x,Plan 40X (spring loaded) (N.A 0.65 W.D 0.5 mm), Plan 100x (oil, spring loaded) (N.A 1.25 W.D 0.14 mm)Infinity corrected plan optics, Uniformly centered, Interchangeable & Parfocal, Anti-fungus treated, Tropicalised anti fungus treatment ensures image excellence for long periods in conditions, favouring to fungus growth.Trinocular tube & 30 deg inclined seidentopf binocular head, 360 deg rotatable, dioptre adjustment WF 10X (F.N 18 mm Or better) paired eyepiece and left eyepiece should have eyepiece micrometer. The unique optical design of the compensating eyepiece provides relief from eye fatigue and renders color- compensated wide-field images of utmost clarity. Compatible with optionally available eyepiece micrometer.Certification: European CE/BIS (Certificates should be provided on the brand of microscope which the bidder mentioned in the tender)	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
10	Manual Rotary Microtome	• Should be designed for effortless manual sectioning via a counter-balanced, exceptionally smooth-running hand wheel. • Instrument with X/Y specimen orientation • Fast exchange system for specimen clamps • User selectable coarse feed wheel turn direction • Retraction on/off function • Two mechanical trim steps, trimming thickness 10um & 50um • Blade holder for disposable blades and standard specimen clamp • The object head with +/-8° X/Y orientation should be equipped with a fast specimen clamp exchange system for improved workflow. • Storage space on top of the instrument housing must provide room for sectioning tools and accessories. • The instrument must feature a low-maintenance micrometer feed system with backlash • Must have maintenance-free vertical cross-roller guides and horizontal specimen feed via precision cylinder guide system. • Distortion-resistant base plate should ensure optimum overall stability. • The vertical stroke of approx. 59 mm • Horizontal specimen travel range of 25 mm • Should allow to section specimens up to a size of 50 mm x40 mm x 40 mm. • Ergonomically designed hand wheel grip. • Hand wheel lockable in any position via brake lever attached to base plate • Lockable hand wheel in upper position via hand wheel grip. • Section thickness setting range 0.5–60 µm • Section thickness selection from 0.5–2 µm in 0.5 µm-steps • from 2–10 µm in 1 µm-steps • from 10–20 µm in 2 µm-steps • from 20–60 µm in 5 µm-steps • Total horizontal specimen feed 25 mm • Vertical specimen stroke 59 mm • Specimen retraction ON/OFF • Specimen orientation: Horizontal 8° & Vertical 8° with Rotation ± 90° • Should have min. 40-50 no of installations in East India in which –at least 50% should be in Government Institutions • Should have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquarted in Kolkata, having their office in Kolkata to support all districts of West Bengal timely. • Should have CE / USFDA certificate	2
11	Cryostat***	Freestanding cryostat with encapsulated, splash-proof microtome.Spacious, stainless-steel cryochamber with antiglare illumination.Easy to clean and disinfect. Heated, removable sliding window.Stable, self-contained cryocabinet on casters.Handwheel manually lockable in two positions.Easy-to-handle and stable clamping system for clamping the specimen discs.8° XYZ specimen orientation with zero point reference.Cryochamber temperature selection from 0 °C to -30 °C, adjustable in 1K; increments at ambient temperature of 20 °C.Easy-to-clean, actively cooled specimen preparation zone with quick-freezing shelf for up to 10 specimens (max. temperature preferred upto -37 °C).Cryochamber may be defrosted manually or via automatic hot-gas defrosting once every 24 hours.The cycle may be programmed in 15-minute increments.Defrost cycle: 10-12 minutes.Cryochamber and quick-freezing shelf can be defrosted manually.Should be equipped with an acoustic warning signal to prevent unintentional defrosting.Manual defrost cycle for chamber and quick-freezing shelf: 10-12 minutes.Low-maintenance microtome with cross roller guides.Reproducible, high-quality thin sections via stepper motor specimen feed. Section thickness selection from outside the cryochamber.Sectioning thickness range: 2-60 μm,selectable in 0.5 μm increments from 2-5 μm;selectable in 1 μm increments from 5-20 μm;selectable in 5 μm increments from 20-60 μm;Total vertical specimen stroke: 59 mm.Total horizontal specimen feed: 25 mm.Motorized coarse feed in 2 speeds: slow is max.600 μm/s and fast is min. 900 μm/s.Specimen orientation – 8° (x-, y-, z-Axis)Step function: 20 μm each time the key is pressed at slow coarse feed speed.Control panel with membrane-protected buttons and locking function.Self-explanatory symbols for all essential functions and displays.LED display for cryochamber temperature, actual time, defrost time, and section thickness selection. Visual indication of specimen stop positions (Front/Home). Should have at least 8-10 installation in Eastern region incl of Govt & Pvt accounts, with at least 4-5 in Central Govt./State Govt. Institutes or Hospitals; Should have CE / USFDA certificate. Should have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquarted in Kolkata, having their office in Kolkata to support all districts of West Bengal timely.	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
12	Automated Tissue Processor –Vaccum***	Carousel type with 12 stationsConfigurations: – Basic instrument with VacuumCapacity- 80-100 cassettesOption: 1 baskets loadingTissue baskets made of metal with varying capacities of up to 100 cassettesErgonomic control panel with foil-protected keyboard and LCDInfiltration time separately programmable for each stationDelayed start functions up to 9 daysPossibility of interrupting an automatic process for reloading or removing cassettes for special applications before the end of a runEasy editing and changing of programs, even during a processing runAudible alarms, error messages and warning codesAdvanced safety concept with Wide range of accessories should be availableNominal voltage:100 / 120 / 230 / 240 V AC ±10%Nominal frequency: 50 / 60 Hz Wax baths:Number: 2 Capacity: at least 1.8 litresTemperature range45 °C – 65 °CExcess temperature cutout: 75 °C ± 4 °CReagent containers:Number: 9 to 10Capacity: at least 1.8 litresStandard tissue basket:Number:1 Capacity: max. 100 cassettesPrograms:Number: 8 to 9, freely selectableProgrammable infiltration time per station: _ 99 h 59 minDelayed start: 9 daysDrain time: 60 sShould have min. 30 no of installations in East India in which --at least 7-10 nos. should be in Government Institutions in West Bengal stateShould have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquarted in Kolkata, having their office in Kolkata to support all districts of West Bengal timely.Should have European CE / USFDA certificate.	1
13	Autoclave	1. High Pressure, electrically heated vertical steam sterilizer is used for sterilization of surgical instruments, dressing material, lined, rubber, plastic material by means of saturated steam under pressure of 15 to 20 psi (adjustable). A part from health services it is also used in scientific research institutions and universities. 2. Sturdy double walled construction with boiler made of stainless steel of SS-304 sheet is easy to operate. Outer shell is made of Stainless Steel. Stainless steel Bucket with handle with perforated wall. The boiler and outer shell is provided with air insulation: Lid is made of stainless steel plate and is tightened alround by wing nuts. Moulded, jointless gaskets are made of Neoprene rubber: Sterilizer is hydraulically tested upto 40 psi. 3. Fitted with water level arrangements to indicate water position inside the boiler, pressure guage, Air/steam release cock. Loaded safety Valve which can be set at any selected point from 10 psi. to 20 psi. +- 3 psi. and drain, lSI marked immersion heating element (one 1KW) heats the water and steam to desired temperature and pressure. 4. Size: Dia X Depth = 400 mm X 600mm 5. Should be CE/US FDA/BIS	2

Name of the Discipline: PHARMACOLOGY

Sl. No.	Name of the Equipments (Item)	Proposed Specification	Qty.
1	Instruments Sterilliser Electric size 12"x8"x6"	Electric instrument sterilizer, stainless steel make, approx. 3L capacity with tray lifting system.	1
2	Tread Mill Machine	1. The treadmill should always start from 0 mph and speed limit 0-15 mph. 2. Inclination up to 35°, auto adjustable. 3. Should have in-build test protocols and programmes with speaker and computer interface and printer. 4. Should have emergency stop button 5. LCD touch screen displaying heart rate, Speed, time, calorie expenditure, BMI, work load or oxygen consumption (Vo2 in ml/kg/min), timer with alarm and hand sensor. 6. It should have a load capacity of maximum 400 lbs and should have facility to run the self – calibration programme. Treadmill should have minimum 50-60" waking surface with PVC non slip surface. 7. Electrical safety conforms to standards for electrical safety requirements.	1
3	Autoclave Electric	1. High Pressure, electrically heated vertical steam sterilizer is used for sterilization of surgical instruments, dressing material, lined, rubber, plastic material by means of saturated steam under pressure of 15 to 20 psi (adjustable). A part from health services it is also used in scientific research institutions and universities. 2. Sturdy double walled construction with boiler made of stainless steel of SS-304 sheet is easy to operate. Outer shell is made of Stainless Steel. Stainless steel Bucket with handle with perforated wall. The boiler and outer shell is provided with air insulation: Lid is made of stainless steel plate and is tightened alround by wing nuts. Moulded, jointless gaskets are made of Neoprene rubber: Sterilizer is hydraulically tested upto 40 psi. 3. Fitted with water level arrangements to indicate water position inside the boiler, pressure guage, Air/steam release cock. Loaded safety Valve which can be set at any selected point from 10 psi. to 20 psi. +- 3 psi. and drain, lSI marked immersion heating element (one 1KW) heats the water and steam to desired temperature and pressure. 4. Size: Dia X Depth = 400 mm X 600mm 5. Should be CE/US FDA/BIS	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
4	Portable digital ECG	1. Compact portable 3-channel (plus long lead) ECG system. 2. Rechargable lithium ion battery with recharge time (from full discharge) with 5 hours. 3. Readout with measurement and interpretation. 4. Membrane keyboard with tactile feedback. 5. Along with standard accessories including chest and limb leads, AC charger, fanfold ECG paper compatible with make and model (quantity sufficient for at least 500 ECGs) and jelly. 6. Should be European CE/US FDA/BIS	4
Name of the Discipline: PHYSIOLOGY			
Sl. No.	**Name of the Equipments (Item)**	**Proposed Specification**	**Qty.**
1	Large extension KYMOGRAPH	Brodie-Sterling Kymograph A spring loaded device should allow turning by hand if necessary It should have a cylinder 6x11"(approx.) with crown wheel engaging shaft Kymograph used to record mechanical activity of muscle. Technical Specifications: Rigid cast iron stand should work up moving in slot in the bed should allow variation in paper length for 60" to 66" & down by a large screw Should have fine adjustment which ensure return of outer arm to exactly the same position after instantaneous speed change clutch with slow, medium change of another paper & fast speeds & intermediate 'off' Should be compatible for smoke / ink writing models•positions Separate smoking• Mercury Manometer • Double Time Maker •System Configuration Accessories, spares and consumables & Smoking Burner (Only if providing smoke writer)•Varnishing apparatus	1
2	PHYSIOGRAPH WITH 3 CHANNEL WITH STANDARD ACCESSORIES	Should be able to record Bio-Electrical Potential e.g. EEG, ECG, ENG, EMG, Pulse,•Technical Specifications Student physiograph should be three channel console with 9 speed (0.5,1,2,5,10,20,25,30• It should be made of light metal for compactness and lightness. •Respiration, Blood Pressure etc. & 50 mm/sec) chart drive, time & Transducers: Pressure, volume, muscle activity/ force respiration belt, Isotonic fine movement,• Couplers: Strain Gauge, isotonic, Pulse Respiration, temperature, EKG and Bio- Potential •event chart, transducers and stimulator pulse, respiration & Data Acquisition System to convert data from physiograph to a computer with HRY and•temperature independent ECG Recording system with software and computer. Earth Lead•System Configuration Accessories, spares and consumables EEG• EKG electrode • & V-pin junction box• III Pin junction box, action potential electrode •EMG paste Chart paper Z- fold• Fuse• Power Supply Power input to be 220-240VAC, 50Hz• Documentation Should have US FDA/European CE/BIS certification• Manufacturer should have ISO certification for quality standards • Nutrition Laboratory Sch. 87 WEIGHING MACHINE ADULT Necessary earthing to be executed by the selected supplier Accessories: Computer with software, Printer, UPS	1
3	Calorimeter	Standard,For physiology lab.	2
4	PERIMETER	The perimeter is an instrument for accurate charting of the field of vision. It consists of. A vertical stand on which a metallic arc is pivoted. It also bear a circular black disc to read the meridian in which the arc in shape of a semicircle with radius 330 mm. Its rotating in any direction and fix at any position with a tightening screw. The arc is graduated from 0º to 90º with a movable test object which is a white color spot of size 10mm diameter painted on a circular disc it can be moved with arc. An adjustable chin rest and a detachable leveling bar is fixed in front of the metallic arc. A scale and circular chart frame to hold the chart paper in position is provided at the back of the circular disc. A metallic graduated scale with a movable pin-punch pointer is fixed to mark on the perimeter chart paper. Lister's Chart	2
5	Thermo-aesthesiometer	Skin-stimulator contact: Circular aluminium plate Contact plate diameter 55 mm Maximum temperature range 5°C to 55°C Stimulus: Temperature increases or decreases from reference until response button is pressed Contact plate reference temperature Selectable in range 25°C/s to 40°C/s Error in temperature setting < 0.5°C at 30°C < 1.0°C at 15°C and 50°C < 1.5°C at 10°C Rate of temperature decrement Selectable in range 0.2°C/s to 2.5°C/s Rate of temperature increment Selectable in range 0.2°C/s to 2.5°C/s Accuracy of rate of change of temperature < 10% error in temperature change over 15 s at 1°C/s from 30°C to 45°C < 13.3% error in temperature change over 15 s at 1°C/s from 30°C to 15°C Lower temperature limit Selectable in range 5°C to 10°C Upper temperature limit Selectable in range 50°C to 55°C Data sampling rate 10 readings per second. Skin and room temperatures: Measured by k-type thermocouple Temperature measurement error < 0.5 ºC in range 15 – 45 ºC Dimensions: Applicator Height 160 mm, diameter 100 mm (base), diameter 55 mm (top), weight 0.8 kg Control box Height 100 mm, length 320 mm, width 470 mm, weight 6.4 kg Power Requirements: 220 to 250 VAC 100VA Options 110 to 120VAC	10

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Laboratory Centrifuge machine	Type of Product : Laboratory Centrifuge Rotor Capacity (ml): 6x15 ml Type of Head : Swing Out Head No. of Tubes :6 Max. Speed (RPM): 4000 Supply: 220 - 240 Volts 50 Hz Single Phase	2

SECTION 5.8B

List of Medical Equipment (Schedule – II)

Schedule - II

Name of the Discipline: ANATOMY			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Drill machine	• Voltage/frequency: 220V/50HZ • Input power: 400W • Load speed: 2600 RPM • Max drill capacity: 10MM	2
2	Hand saw, preferably metal	• Industrial quality hacksaw frame designed for the professional user • Square section tubular frame for perfect combination of balance and rigidity • Fitted with a 12″ (300 mm) chrome alloy steel blade • Size- 400mm • Height- 130mm	3
3	Band saw for sectioning body and limbs	1. Size of cutting table 785 × 585 mm approx 2. Total Table Travel 1245 mm approx 3. Extension Table 455 × 760 mm approx 4. Size of Wheel 455 mm approx 5. Height 1700 mm approx 6. Motor - 2 HP or more	1
4	Storage tank to hold 10 cadavers, static/movable, durable tank with input and output facility with lid	• 7′x3′x2.5′ – 2nos • 7′x6x2.5 – 1nos • 2 vat in one room and one vat should be in another room. • Thick wall – 300mm • Four side tiles- Inner + Outer • Input & Output facility of drainage. • Drainage pipe- 6″ diameter • Underground drainage • Plastic / PVC door / cover • Should be made - Outer wall of the building • Proper ventilation facility-exhaust fan	3
5	Movie camera with projection screen	• 24.2 MP DSLR with lens 18-55 mm Kit • 3 inch TFT LCD • Full HD Recording • f/3.5 - f/5.6 Aperture • ISO sensitivity ranging from 100 to 12800 • LED TV for screening – 55″ or Manual projection Screen (6′x8′) • Screen: 36"	1
6	Computer with internet connection, & video CD library	• Processor: Intel Core i7 • Processor Speed: 3.60 GHZ • Cache: 8 MB • RAM: 16GB • RAM Type: DDR4 • RAM Speed: 2133 MHZ • Chipset: Intel	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
7	Dissecting instruments for cadaveric dissection	• Tooth Forcep (SS) – 6″ • Plain Forcep (SS) – 6″ • Pointed Scissor (SS) – 6″ • Blunt Scissor (SS) – 6″ • BP Handle (SS) – 6″ • Small pointed Scissor (SS)- 4″ • BP Handle Blade / Surgical Blade – 24 No. • Artery Forcep (SS) – 8″ • Brain Cutting Knife (SS)– 12″ • Retractor (SS) – 8″ or 12″ • Rib Cutter (SS) – 8″ • Surgical Suture Needle (Half Circle) with thread – 1no. & 6no. **The above mentioned all materials should be SS 304**	20
8	Meat cutting machine for thin body sections (trans and vertical) for gross anatomy sectional study	• Model: Electric band saw for butcher 2-10°C • Power: 750w • Diameter of belt meter: 205mm • saw belt speed: 15 m/s • Working table specification: 48*38cm • Cutting thickness: 4-180 mm • Packing Size: 530*515*955mm • Weight: 50kg	1
9	Microtomes, Sledge, large cutting	1. These cuts sections in the thickness that ranges from 3 to 30 microns 2. These are not suitable for cutting very hard resins like araldite due to their risk of vibration 3. The sledge microtome is ideal for cutting different material like bone, plastics, resins, wood and large area soft tissues 4. Hard material such as wood, bone and leather require a sledge microtome 5. These microtomes have heavy blades and cannot cut as thin as a regular microtome 6. Special knife for cutting extra hard sections 7. Heavy construction for stability and not usually subjected to vibration 8. Glide way for convenient movements 9. Calibrated veneer type scale for section setting adjustments 10. Heavy duty construction base used for knife holder and secure clamp mechanism	1
10	Paraffin embedding bath	• Thermostatically controlled Double walled with cups and sleeves for glass tubes. • Temperature up to 95° C with accuracy of 1° C • flowing capacity :- 12 Cups and 14 sleeves	1
11	HISTILOGY laboratory Table	Preferebly 3 ft. with racks table cabinet basin	8
12	Laptop	• Core i7 • 7th Gen • Ram - 8 GB • HD- 1 TB • Windows 10 • Graphics Card- 4 GB • Screen 17 inches with wireless Mouse and Speakers	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
13	Dissection microscope	1. Stable cast iron round base with pillar focusing with rack & pinion. 2. Accurate and stable metal stage covering with glass plate with clips. 3. Eye Piece: Optical True 10x, 20x mounted on jointed arms allowing to whole area to be scanned. 4. Complete in box	3
14	Photocopier and Scanner	• Ability to print documents up to A3+ size • Automatic Duplex • Print speed up to Print speed up to 32ppm / 20ppm • Fax and ADF capability • Ethernet & Wi-Fi Direct • 1 year or 80,000 pages whichever comes first	1
15	Koplin jar (Different Size)	made of glass	25
16	Brain Knife	1. Blade Shape: Straight 2. Cutting Edge: 30cm 3. Thickness: 1.7mm 4. Alloy / Material: Stainless Steel 5. Length: 45cm	2
17	Glass jar with lid (200ml)	Glass jar with lid (200ml)	50
18	Computer set with printer	Processor: Intel Core i7 ✔ Processor Speed: 3.60 GHZ ✔ Cache: 8 MB ✔ RAM: 16GB ✔ RAM Type: DDR4 ✔ RAM Speed: 2133 MHZ ✔ Chipset: Intel ✔ Printer -Function : Copy, Scan, Duplex Print, Hi-Speed USB 2.0 Interface, 600 x 600 dpi, HQ1200 , ✔ quality Resolution, Paper size : A4, Letter, A5, A6, Folio, 600 dpi, a 30 ppm printing speed. ✔ Antivirus with Bluetooth facility	1

Name of the Discipline: BIOCHEMISTRY

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
1	Constant temperature water bath Tank	Capacity: 15 ltr. or more Temperature range: Ambient +5° to 80° Celsius Should have a digital display Should have CE/US FDA/BIS	1

<table>
<tr><th>Sl. No.</th><th>Name of the Equipments (Item)</th><th>Specification</th><th>Qty.</th></tr>
<tr><td>2</td><td>pH meters of wide range digital</td><td>a. pH range: 0-14
b. pH Accuracy: +/-0.01
c. pH Resolution: 0.01
d. mV range: +/-1999 mV
e. Temperature range: 0 to 80° C
f. Temperature Accuracy: +/-0.5° C
g. Type of electrode: Combined electrode which can be replaceable
h. Display: LCD screen
i. Accessories included: Adaptor, Probe, Buffer (Acid, Neutral, Basic), Cable, Stand
j. Should be CE/US FDA/BIS</td><td>5</td></tr>
<tr><td>3</td><td>Fixed volume pipettes</td><td>1. Should be non autoclavable
2. Set of 5 x 5 micropippetes

Make: Sartorius/Pipetteman/Eppendorf/Gilson/Biohit/Thermofisher
Set of Micropipttes consists of the following :
<table><tr><th>vol. range</th><th>Accuracy (±%)</th><th>CV (±%)</th><th>No. required</th></tr><tr><td>1000ul</td><td>0.6%</td><td>0.2</td><td>5</td></tr><tr><td>500ul</td><td>0.6%</td><td>0.2</td><td>5</td></tr><tr><td>100ul</td><td>0.6%</td><td>0.2</td><td>5</td></tr><tr><td>10ul</td><td>1%</td><td>0.5</td><td>5</td></tr><tr><td>5ul</td><td>2%</td><td>1</td><td>5</td></tr></table></td><td>5</td></tr>
<tr><td>4</td><td>Vortex mixers</td><td>a) Silent operational Brushless DC motor
b) 3 way switch Touch,Standby and Continuous modes with status on LED
c) Digital display toggles between speed and time every 5 seconds
d) Speed range: 0-2500rpm
e) Orbit: 4.5mm
f) Capacity: 50ml
g) Timer setting
h) Power requirement: 220V
i) Should have CE/US FDA/BIS</td><td>2</td></tr>
<tr><td>5</td><td>Boiling Water baths</td><td>1. Unstirred water bath with electronic temperature control
2. Operating temperature : 50° C to 100° C
3. Drainage of water : by drainage stopcock
4. Capacity : 15 Litres
5. Temperature display : Digital display
6. Temperature control : Microprocessor controlled for over temperature protection
7. Exterior is to made of Cold rolling sheet
8. Inner container is to be made of stainless steel
9. Roof cover or Lid is to be made of stainless steel and should have holes to accommodate large tubes.</td><td>2</td></tr>
<tr><td colspan="4">Name of the Discipline: Community Medicine</td></tr>
<tr><th>Sl. No.</th><th>Name of the Equipments (Item)</th><th>Specification</th><th>Qty.</th></tr>
<tr><td>1</td><td>Barometer (Mercury based instruments to be replaced with other alternatives)</td><td>Digital Barometer
Should be European CE approved</td><td>1</td></tr>
<tr><td>2</td><td>Filter, Pasteur Chamberland, complete set</td><td>-</td><td>1</td></tr>
<tr><td>3</td><td>Filter, Berkefeld</td><td>-</td><td>1</td></tr>
</table>

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
4	Hydrometres, Spirit	-	2
5	Hydrometres, milk	-	2
6	Hydrometers, wet and dry bulb	-	1
7	Balance for weighing food stuff (Capacity 2 Kg)	-	1
8	Salters Baby weighing machine	Should supply 2 nos. (5kg & 20 kg); Hanging type; Should come with a bag	2
9	Harpender Calipers (for skinfold thickness)	Dial graduation: 0.20 mm Measuring range: 0 to 80 mm	3
10	Height measuring stand	Made of polyacrylic meterial	3
11	Chloroscope	Used for detection of residual chlorine in purified water	10
12	Horrock's Apparatus	Used for estimation of dose of bleeching powder needed to disinfect water	3
13	MUAC tapes	Shakir's tape	10
14	Kata Thermometer	Used for measuring cooling power of air	3
15	Globe Thermometer	Used for measuring radiant heat	3
16	Anemometer	Used for measuring wind speed	3
17	Sound level meter	dB meter; SPL based Should be European CE approved	3
18	Soil testing kit	Should be portable type; Used for estimation of pH, Nitrogen, Phosphorus & Potassium	1
19	Vaccine carrier	-	5
20	Glucometer	Should be digital, battery operated Code strips should be easily available Should operate at room temperature Package should come with disposable sterile lancet Should give results within 1 minute Should be able to store data for at least last 3 tests Should be supplied with 50 strips Should be European CE/US FDA approved	10
21	Solar radiation thermometer	Digital type	3
22	First Aid Kit	Antiseptic cream and lotion, gauze, bandage, adhesive tape, cotton, box made of plastic etc.	1
23	Otoscope	Indicative make: Heine/Welch allyn	1
24	Ophthalmoscope	Ophthalmoscope (indirect) Indicative make: Heine/Welch allyn	1
25	Balance Analytical 200 gm.	1. Range: .1mg-200g (at least) 2. Pan size: 150mm (approx) 3. Repeatability: 0.02 4. Casing: Glass casing 5. Digital display 6. Automated Taring system. 7. Should be European CE approved	2
26	Dissecting microscope	Binocular type: glass lens (anti fungal coated) Objective: 2X/4X / -10X Working distance: 105 mm (approx) Field of view: 2X = 11.5 mm (approx), 4X = 5.7 mm (approx) Transmitted light: LED Eyepiece: 10X pair Should be CE/US FDA/BIS approved	20
27	Laptop	-	1
28	Computer with printer, scanner and photocopier and Internet facility	-	3

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
29	Oil immersion Microscope	• Co-axial low drive mechanical stage (125mm x 145mm)(+/- 5 mm) with traverse area of 50 mm x 76 mm (+/-5mm) with single side holder • Co-axial coarse & fine controls with a focus adjustment and fine adjustment knobs, Coarse Focus range 20 mm. Fine focus range 0.2 mm • Rack & pinion mounted condenser holder • Centerable abbe condenser with aperture iris diaphragm (N.A. 1.25) focusable with rack & pinion through 20 mm and a continuously variable iris diaphragm with a removable blue filter for daylight observation. • LED light source (with battery back-up) High brightness, longlife (30,000). • Quintaple revolving nosepiece based on precision ball-bearing mechanism with positive click stop. • Objectives: Plan 4X, Plan 10X, Plan 20X, Plan 40X & Plan 100X (oil) Infinity corrected plan optics, Uniformly centered, Interchangeable & Parfocal, Anti-fungus treated, Tropicalised anti fungus treatment ensures image excellence for long periods in conditions, favouring to fungus growth • Binocular (30 deg inclined seidentopf), 360 deg rotatable, dioptre adjustment • Certification: CE & ISO 9001:2015	1
Name of the Discipline: Forensic Medicine			
Sl. No.	**Name of the Equipments (Item)**	**Specification**	**Qty.**
1	Stop Watch	Digital stopwatch - capable of measuring up to 1/100th of a second. Display size: minimum 5 inch	2
2	Anthropometric set	Laboratory **OSTEOMETRIC BOARD** (For measurement of Bone length of long bones like TIBIA & FEMUR) with following specs:- • Preferably be made of SS 304 • Calibrated both in Inch & Centimetres for measurement upto a length of 2 ft. • Must utilize a "Channel on Board" linear motion mechanism which provides ease of motion. **BONE CALIPERS** (Sliding anthropometric calipers used to measure a straight-line distance between two bony landmarks) • Preferably be made of SS 304 • 20" (50cm) Measuring Range • Calibrated both in Inches & Cms	2
3	Digital pH meter	a. pH range: 0-14 b. pH Accuracy: +/-0.01 c. pH Resolution: 0.01 d. mV range: +/-1999 mV e. Temperature range: 0 to 80° C f. Temperature Accuracy: +/-0.5° C g. Type of electrode: Combined electrode which can be replaceable h. Display: LCD screen i. Accessories included: Adaptor, Probe, Buffer (Acid, Neutral, Basic), Cable, Stand j. Should be CE/US FDA/BIS	2
4	Chemical Balance	Weighing scale, digital, resolution: 0.1 mg or better	2
5	Paraffin bath embedding	• Thermostatically controlled Double walled with cups and sleeves for glass tubes. • Temperature up to 95° C with accuracy of 1° C • flowing capacity: 12 Cups and 14 sleeves • Should be European CE/BIS/US FDA	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Weighing machine for dead bodies	Size of Platform / Weighing Plate: 6 – 7 ft. (length) × 3 – 4 ft. (breadth) Range: Upto 200 kgs Other features: Platform should be made of SS 304 grade for easy cleaning and anti-staining Must be plug-in type for easy operation Must be Trolley-mounted for easy shifting Accuracy 50 – 100 gms. Display should be digital and preferably also with an Analogue back-up Should have a rechargeable Battery back-up for usage in power failure Should be easily serviceable locally Demonstration may be sought for before placing purchase order Should be CE/BIS certified	1
7	Autopsy Table	Size of Platform: 7 – 10 ft. (length) × 3 – 4 ft. (breadth) Carrying Capacity: Upto 200 kgs Other features: Entire table should be made of SS 304 grade for easy cleaning and anti-staining Height must be adjustable from 2.5 to 3.5 ft Circumferential perforation must be present for disposal of wastes Should be fitted with wash basin / sink at one end Hand sprinkler must be fitted with basin for easy washing Should be easily serviceable locally Demonstration may be sought for before placing purchase order Company or Product should be certified by ISO / appropriate authorities Should be CE/BIS certified	2
8	Autopsy saw, with accessories	Must be electrically operated, based on High-Speed-Oscillating-Action principle Must be plug-in type for easy operation Electrical cord must be 8 – 10 ft. long The set should be equipped with a large no. of blades plus at least 2 arbors Grip area should be comfortable for a firm grip Switch for On/Off, preferably Sliding type should be placed on the body of the instrument Demonstration may be sought for before placing purchase order Should be easily serviceable locally Should be CE/BIS certified	3
9	Weighing machine for organs	Size of Platform / Weighing Plate: 1 – 1½ ft. (length) × 1 – 1½ ft. (breadth) Range: Upto 10 kgs Other features: Platform should be made of SS 304 grade for easy cleaning and anti-staining Must be plug-in type for easy operation Must be Trolley-mounted for easy shifting Accuracy ±5 gm Display should be digital and also with an Analogue back-up Preferable to have a rechargeable Battery back-up for usage in power failure Should be easily serviceable locally Demonstration may be sought for before placing purchase order Should be CE/BIS certified	2
10	Magnifying Glass	Compact and lightweight design Magnification: 10 X Material: High-quality metal, optical glass lenses	4
11	Rectal Thermometer	Temperature Range: 0 to 50 degree C	2
12	Portable X-Ray Machine	CAT	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
13	Dissection Set	**Autopsy Instrument Box** containing at least the following instruments Set of Post mortem Instruments complete in wooden case consisting of: • 1 Chisel, rectangular • 1 Chisel with cross handle • 1 Forceps, Bone cutting • 1 Forceps Dissecting • 1 Hammer with hooked handle • 1 Set Hook and Chain • 1 Knife. Brain, solid forged • 3 Knife, Cartilage, solid forged • 6 Needles, curved triangular • 1 Saw with 8" blade • 3 Scalpel, solid forged • 1 Scalpel, extra large, solid forged • 1 scissors, Bowed • 1 Scissors, ordinary, dissecting • 1 Silk hank • 1 Skull rest, Bipod • 1 Spinal Wrench • Tooth extractor • Rib shear • Retractor	70
14	Water Bath for Tissue floatation	Rectangular water bath for flattening paraffinembedded tissue sections in all areas of biomedical research and routine diagnostics.used for maintaining specimens and solutions at requiredtemperature for immunohistochemical and enzymechemical application. Digital display, membrane keyboard, temperaturerange from ambient to +75°C, set value memory. High temperature consistency(control accuracy 0.2°C), working temperature above +44°C indicated by flashing LED. Settemperature displayed in addition to actual temperature. Jet-black aluminium surface with specialscratch-proof plastic coating ensures highest thermal	2
15	Hacksaw	• Industrial quality hacksaw frame designed for the professional user • Square section tubular frame for perfect combination of balance and rigidity • Fitted with a 12" (300 mm) chrome alloy steel blade • Size- 400mm • Height- 130mm	4

Name of the Discipline: MICROBIOLOGY

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
1	Anaerobic apparatus (Gas pak)	Anaerobic system Provision for transparent unbreakable polycarbonate jar of 3.5 L capacity with sturdy aluminium lid clamp and sealing ring with built in safety measures	1
2	Distilled water Plant	Distillation Unit, Double Stage, with Borosilicate Boiler & Condenser, Built-in Cut-Off with Reset Button, cabinet type, Horizontal Model. Output: 1.5 - 2.5L /Hr. (approx); Electrical point: 1KW single phase (preferable); Cooling Water Consumption: 100 L /Hr; Biological Property: Pyrogen Free; pH of water: 6.9-7.1.	1
3	Dropping bottles	Plastic	500
4	Dispenser Dropper 2ml	Thumb press dispensing dropper made from non toxic polyethylene semitransparent available in natural colour	50
5	Wash Bottles 500ml	Made from non toxic polyethylene semitransparent available in natural colour	50
6	Concavity Glass Slide, 1 & 3 Cavity	Polished spherical concavities 16 mm in diameter x 0.5 mm depth, made of non corrosive glass with bevelled and polished edges and corners	110

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
7	Koplin Jar	Autoclavable coplin jar air tight, water tight dome style screw capped with self standing capability, three sides grooved bottom and two sides to protect the glass slides, wider mouth provided to put the slides properly, unbreakable, non reactive with any solvent, random grade PPCP (poly-co-polymer)	4
8	Staining Troughs	Staining Tray and Rack to catch excess stain as it drains from the slides. There should be four bar rack holding 22 slides (3" x 1"). It should be provided with screws for levelling the rack.	60
9	Sterilsation Indicator	Steam indicator tape – size 18 mm (1 no = 1x55 mt), indicator strips with visual indication of proper sterilization	2
10	Regent Bottles With Stopper, 2000,1000,500,250,100cc	Narrow mouth, flat bottomed bottles made of high quality borosilicate glass provided with acid proof polypropylene stoppers. Both the glass bottles and stoppers should be autoclavable.	100
11	Lab Refrigerator	Frost free. Capacity - 400 Liters or more Temperature Range - 2°C to 8°C Temperature Accuracy - ±0.5°C Controller - PID Controller Construction - Exterior: Powder Coated Mild Steel; Interior: Stainless Steel Door - Standard hinged Double doors with double gasket Insulation - PUF insulation Trays - Perforated trays made of stainless steel Refrigeration - CFC Free compressor Air Circulation - Forced air circulation Should be supplied with digital thermometer for upper and lower chamber seperately Alarms - Audio / Visual alarm for High / low temperature Power - 220 / 230 Volts 50 Hz Should be CE/US FDA/BIS	5
12	Tissue Homogenizer with Pestle	Tissue Homogenizer with serrated and plain pestle	6
13	Laminar flow (table/Cabinet)	Size: 4 x 2 x 2 (ft) In and outer chamber: SS304 Air flow: Vertical Air Velocity: between 0.4 to 0.5 m/s ±20% HEPA Efficiency Pre-filter - 99.997% at 0.3 microns with DOP test Washable with an arrestance up to 90% at 5 microns Sound Level - Less than 65 dB (Acoustic) UV light source and visual light source Light Intensity (visual): Lux 900 to 1300 Lux Federal Power Supply: 220 V Single phase 50 Hz Should be CE/US FDA/BIS	1
14	Micrometer eye pieces	European CE / BIS approved	2
15	Single pan digital balance	Capacity: 1000g Pan Size: 170x190 mm (approx) Transparant glass cover Power Connection: 220/230 V AC Calibration: Internal Linearity: 0.02g Repeatability: 0.01g Readability: 0.01g	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
16	Micrometer stage	• Axes of Travel: X • Maximum Stage Travel: 46 mm • Thread Type: 1/4-20 • Load Capacity: 191 N • Vertical Load Capacity: 67 N • Angular Deviation: < 200 μrad • Material: Aluminum • Bearings: Ball Bearings • Drive Location: Side drive • Platform Size: 3.0 x 4.0 in. • Height: 1.0 in. • Recommended Adjustment Screw: AJS100-2 • Recommended Vernier Micrometer: SM-50 • Recommended LTA Motorized Actuator: LTA-HS	2
17	Needle and Syringe Destroyer	Size: 175 mm (l) x 115 mm (w) x 120 mm (h) Power: 220-230V AC / 50-60Hz ; 110-130V AC / 50-60Hz Protection: Cartridge fuse Weight: Approx 2 kg	2
18	Durham's Tube	These tube are made of neutral Glass and they are autoclavable. Length = 25-27mm Diameter = 6-7mm	500
19	Glass Beads	Transparent undrilled beads of approximately 0.5 - 1.0 mm diameter. The beads are highly resistant to water,neutral and acid solutions; even during extended period of reaction and at temperatures above 100°C	100
20	Autoclaving Busket	Aluminum buskets are epoxy coated for maximum corrosion resistance. The epoxy coating is resistant to rust, corrosion, abrasion, solvents, acids, and alkalies. Usable in the temperature range of -220°C to +120°C, these baskets are autoclavable and provide a superior product in laboratory use.	10
21	Sterilizing pans	polypropylene container Volume= 14 L (approx)	10
22	Antibiotic Zone scale	transparant plastic material; Size= 370 X 65 mm	3
23	Petri Dish Carrier 10&6	Should carry 10 and 6 petri dishes at a time Stainless steel Petri dish carrier with handle, made out of SS 304. For diameter of 100 mm dish	10
24	Hand Lens	Compact and lightweight design Magnification: 10 X Material: High-quality metal, optical glass lenses	2
25	Computer Unit	Item Height 57.7 Centimeters Item Width 38.6 Centimeters Item Weight 6.5 Kg Product Dimensions 6.2 x 38.6 x 57.7 cm Item model number AIO 24 3464 Processor Brand Intel Processor Type Core i3 Memory Technology DDR4 Hard Drive Size 1 TB Graphics Coprocessor Intel HD Graphics Number of USB 2.0 Ports 2 Number of USB 3.0 Ports 2 Operating System Windows 10 Included Components AIO, Wireless Keyboard and Mouse, AC Adapter, User Guide and Manuals	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
26	Printer	• Printer Type - Ink Tank ; Functionality - All-in-One (Print, Scan, Copy) , Scanner type - Flatbed; Printer Output - Colour • Connectivity - USB • Pages per minute - 7.5 (Black & White), 4.5 (Colour) ; Cost per page - 10 Paise (Black & White), 18 Paise (Colour) - As per ISO standards • Ideal usage - Home and Small office, Regular / Heavy usage (more than 300 pages per month) • Page size supported - A4, B5, A6, DL envelope ; Duplex Print - Manual ; Print resolution - Up to 4800 x 1200 optimized DPI (Colour), Up to 1200 x 1200 rendered DPI (Black) • Compatible Ink - HP GT52 Original Ink Bottle (Cyan, Magenta, Yellow), HP GT51 Original Black Ink Bottle ; Page Yield - 6000 pages (Black & White), 8000 pages (Colour) (as per ISO standards) • Duty Cycle (Maximum monthly recommended prints) - Up to 1000 pages per month	1
27	Scanner	Colour Black Item Weight 2.28 Kg Package Dimensions 45 x 31.4 x 8.8 cm Item model number Lide 120 Operating System DOS	1
28	Macntosh Fildes Jar	The jar, about 20″×12.5″ is made up of metal. Its parts are as follows: 1. The body made up of metal (airtight) 2. The lid, also metal can be placed in an airtight fashion 3. A screw going through a curved metal strip to secure and hold the lid in place 4. A thermometer to measuring the internal temperature 5. A pressure gauge to measuring the internal pressure (or a side tube is attached to a manometer) 6. Another side tube for evacuation and introduction of gases (to a gas cylinder or a vacuum pump) 7. A wire cage hanging from the lid to hold a catalyst that makes hydrogen react to oxygen without the need of any ignition source	2
29	Cryo Marker	Description- Cryo Marker Pen Set; Multi-Color For Use With (Equipment) - cryovials and boxes	2
30	Slit air sampler System	Particle capture mechanism: Sieve impaction Sampling Volume (maximum): 1600 litre Sampling time: 10 min Flow rate: 100 litre/min Particle diameter cut off size (maximum): 1.3 μm Perforation diameter (maximum): 1 mm Agar volume for sample culture: 20 ml	1
31	Chemical Balance-ordinary Apothecary"s	Mechanical type In wooden frame with glass walls Capacity: 200 gm Usage/Application: Laboratory Accuracy: 1 mg Pan Diameter: Mm 7.5 cm Pan Material: Stainless Steel	2
32	Calibrated weight	Material: metallic Standard set of weight Range: 1 mg to 500 gm ISO certified Calibrated according to tolerances specified by Organisation for Legal Metrology, Class M2	1
33	PH determination apparatus	-	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
34	Vortex Mixer	Touch or free operation Easy Vortex intensity regulation Half sphere shape for maximal stability on the desktop Can accept test tubes from 0.5ml to 50 ml Oscillation speed 200 to 2500RPM Operating Temp Range: +4 to +65 degree C	2
35	Complete Electrophoresis apparatus with power supply (Paper, PAGE, agarose)	-	2
36	Nichrome Inoculating Loop	1. Changeable nichrome loop embedded in Brass rod with heat resistant handle. 2. Loop diameters and volume of fluid - 4.00 mm (0.01ml), 2.00 mm (0.005ml) & 1.30 mm (1μl)	60
37	Nichrome Inoculating Wire Straight	1. Changeable nichrome straight wire embedded in Brass rod with heat resistant handle 2. 24 gauge, 4 inch length	10
38	Tongue Depressor	1. Material – stainless steel 2. Overall width : 13MM , 22MM 3. Sizes : Child , Adult	4
39	Nasal Speculum	Length 2-3/4" Tip Configuration Blade Instrument Type Nasal Speculum Material Stainless Steel Disposable or Reusable Reusable Sterile or Non-Sterile Non-Sterile Latex or Latex-Free Latex-Free	2
40	Micropipettes – Multi channel & Single channel	1. SINGLE CHANNEL PIPETTES • Spring Loaded Tip Cone for connecting tips very tightly • Adjustment opening for adjusting pipettes to a specific liquid and volume. • Control Button with very low operating force, Color indication for pipette volume. • Tip ejector with very low operating force, positioned for perfect ergonomics. • Volume Display: 4 Digits with magnifier. • To provide thermal, mechanical and chemical stability piston should manufactured with the combination of Fortron and PEEK material • Very easy removable lower part for cleaning pipette • Fully Autoclavable • No discoloration upon UV irradiation • 2 Years Warranty ACCURACY- + 1% REPRODUCIBILITY - 1% - 0.5% Volume range a.Micropipettes 0.5 – 2 μl b.Micropipettes 5- 50 μl c.Micropipettes 20 - 200 μl d.Micropipettes 50- 500 μl 2. MULTI CHANNEL PIPETTES (8 channel) Light weight Pipette for high Professional Standards that provide optimal support in work Only one multi function rocker for liquid aspiration & dispensing. To provide thermal, mechanical and chemical stability piston should manufactured with the combination of Fortron and PEEK material Indicative make: Thermofisher/Eppendorf Accessories with stand to be provided Piston should automatically return Zero position when tip is ejected. Should have in built help menu. Spring loaded tip cone that provide maximum tightness with minimal attachment force. Provision to autoclave the lower parts Should have adjustable volume range from (10- 200 μl, 1 – 20 μl and 50-300 μl Should have Documentation Certificate of calibration and inspection from factory.	31

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
41	Autoclave	High Pressure, electrically heated vertical steam sterilizer is used for sterilization of surgical instruments, dressing material, lined, rubber, plastic material by means of saturated steam under pressure of 15 to 20 psi (adjustable). A part from health services it is also used in scientific research institutions and universities. Sturdy double walled construction with boiler made of stainless steel of SS-304 sheet is easy to operate. Outer shell is made of Stainless Steel. Stainless steel Bucket with handle with perforated wall. The boiler and outer shell is provided with air insulation: Lid is made of stainless steel plate and is tightened alround by wing nuts. Moulded, jointless gaskets are made of Neoprene rubber: Sterilizer is hydraulically tested upto 40 psi. fitted with water level arrangements to indicate water position inside the boiler, pressure guage, Air/steam release cock. Loaded safety Valve which can be set at any selected point from 10 psi. to 20 psi. +- 3 psi. and drain, lSI marked immersion heating element (one 1KW) heats the water and steam to desired temperature and pressure. Size: Dia X Depth = 400 mm X 600mm • Service facility in Kolkata • 5 years guarantee of all parts, Thereafter AMC (please quote) • Record of installation in reputed institutes in Kolkata and certificate from users ISO-2013 Compatible	5
42	Deep Freeze -20° C	(-) 20 ° FREEZER Parameter/ Feature THRESHOLD LIMIT / RANGE HOLD OVER TIME IN AMBIENT TEMPERATURE IN HOURS 2 or more Temperature range for machine in °C (-) 20 to (-) 15 Ability to work in ambient room temperature in °C (10 to 35) or more VOLUME in Litres 300 or more No. OF ADJUSTABLE STEEL RACKS IN INNER CHAMBER 3 or more THICKHNESS OF Powder coated CRCA steel sheet of OUTER BODY in mm 1 MUST HAVE SPECIFICATION Parameter/ Feature Yes/No Type: Horizontal INNER CHAMBER WITH Stainless steel for insulation to minimize heat loss MICROPROCESSOR BASED TEMPERATURE CONTROL Solid state digital indicator cum controller with audio visual alarm ALARM FOR: HIGH LOW TEMPERATURE, POWER FAILURE Counter balanced door, Inside acrylic doors to avoid temperature loss CFC FREE REFRIGERANT Digital temperature display with 0.1°C graduation SILICON OR POLYURETHENE FOAM INSULATION PANNEL FOR CASING AND DOOR QUALITY STANDARD & SAFETY CERTIFICATION EUROPEAN CE OR US FDA	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
43	Deep Freezer -80° C	(-) 80 ° FREEZER Parameter/ Feature THRESHOLD LIMIT / RANGE HOLD OVER TIME IN AMBIENT TEMPERATURE IN HOURS 2 or more Temperature range for machine in °C (-) 40 to (-) 80 Ability to work in ambient room temperature in °C (10 to 35) or more VOLUME in Litres 300 or more No. OF ADJUSTABLE STEEL RACKS IN INNER CHAMBER 3 or more THICKHNESS OF Powder coated CRCA steel sheet of OUTER BODY in mm 1 MUST HAVE SPECIFICATION Parameter/ Feature Yes/No Type: Upright INNER CHAMBER WITH Stainless steel for insulation to minimize heat loss MICROPROCESSOR BASED TEMPERATURE CONTROL Solid state digital indicator cum controller with audio visual alarm ALARM FOR: HIGH LOW TEMPERATURE, POWER FAILURE Counter balanced door, Inside acrylic doors to avoid temperature loss CFC FREE REFRIGERANT Digital temperature display with 0.1°C graduation SILICON OR POLYURETHENE FOAM INSULATION PANNEL FOR CASING AND DOOR QUALITY STANDARD & SAFETY CERTIFICATION EUROPEAN CE OR US FDA	1
44	Water bath with variable temperature	1 Rectangular water bath for flattening paraffinembedded tissue sections in all areas of biomedical research and routine diagnostics.used for matntarmng specimens and solutions at requiredtemperature for immunohistochemcal and enzymechemcal application 2 Digital display, temperaturerange from ambient to 75˚C, set value memory 3.High temperature consistency(control accuracy 0.2˚C), working temperature above 44˚C Indicated by flashing LED Settemperature displayed in addition to actual temperature. 4.Jet-black aluminium surface with specialscratch-proof plastic coating ensures highest thermal conductivity. 5. Tank: High grade SS tank 6. Operating Voltage: 230±10VAC 50Hz 7.Capacity: 5-8 ltr.	2

Name of the Discipline: PATHOLOGY

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
1	Ultrapure water solutions - Distilled water plant	Distillation Unit, Double Stage, with Borosilicate Boiler & Condenser, Built-in Cut-Off with Reset Button, cabinet type, Horizontal Model. Output: 1.5 - 2.5L /Hr. (approx); Electrical point: 1KW single phase (preferable); Cooling Water Consumption: 100 L /Hr; Biological Property: Pyrogen Free; pH of water: 6.9-7.1	1
2	Single pan digital balance	Capacity: 1000g Pan Size: 170x190 mm (approx) Transparant glass cover Power Connection: 220/230 V AC Calibration: Internal Linearity: 0.005g Repeatability: 0.002g Readability: 0.001g Should be CE/BIS approved	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
3	Stand alone cold plate	Temperature Range ambient to -10° C chilling area for approx 60 cassettes specimen. Digitally controlled temperature, 220 V/50 Hz	1
4	Troughs for staining	Stainless steel die punched rack Stainless steel joint less staining trough edges for easy cleaning, 25 Slides	20
5	Coplin jars	Autoclavable coplin jar air tight, water tight dome style screw capped with self standing capability, three sides grooved bottom and two sides to protect the glass slides, wider mouth provided to put the slides properly, unbreakable, non reactive with any solvent, random grade PPCP (poly-co-polymer)	20
6	Digital Tissue Floatation bath	Should be able to process wrinkle free specimen Should have round double walled single piece inner and outer chamber made of aluminium rim should be wide enough to dry the wet slides Should have a capillary thermostat from ambient to 70 degree centi grade with accuracy of ± 2 degree celcius Microprocessor based temperature control	2
7	Paraffin Dispenser***	Temperature upto 70° C Tank capacity: 4 ltr or more Digital temperature display Microprocessor based temperature control	2
8	Single Pan Digital Balance, Chemical	Capacity: 1000g Pan Size: 170x190 mm (approx) Transparant glass cover Power Connection: 220/230 V AC Calibration: Internal Linearity: 0.005g Repeatability: 0.002g Readability: 0.001g Should be CE/BIS approved	2
9	Band saw	Usefull for preparing speciman of big size in Anatomy & meat deptt. Fitted with large table. Specifications :- Size of cutting table 850 x 800 mm in 2 parts (one part Sliding for easy movement) Size of wheel 455 mm Blade length Track 1065x 685 mm Height 1700 mm Meat guaze 3.5mts x 13/12 mm The table is made of thick special heavy C.S. Supplied complete with 1 blade, starter, cord, & plug Suitable to work on220 V single phase, 50Hz, AC supply Should be CE/BIS approved	1
10	Saws, Wire for cutting bones	Made up of stainless steel	6
11	Microscopics Slide Cabinet (Closed Pack Manner)	25000 slides capacity	10
12	Automatic timer	Digital stopwatch	5
13	X-ray viewing box (LED)	Capable of viewing 1 no. of 14 inch x 17 inch film	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
14	Lab Refrigerator (minimum 400 litres)	Frost free. Capacity: 400 Liters or more Temperature Range: 2°C to 8°C Temperature Accuracy: ±0.5°C Controller: PID Controller Construction: Exterior- Powder Coated Mild Steel; Interior- Stainless Steel Door: Standard hinged Double doors with double gasket Insulation: PUF insulation Trays: Perforated trays made of stainless steel Refrigeration: CFC Free compressor Air Circulation: Forced air circulation Should be supplied with digital thermometer for upper and lower chamber seperately Alarms: Audio / Visual alarm for High / low temperature Power: 220 / 230 Volts 50 Hz Should be CE/US FDA/BIS	2
15	Sternal puncture needle adult size	stainless steel conventional type	6
16	Sternal puncture needle child size	stainless steel conventional type	6
17	Stop watch reading at 1/5 second	Digital stopwatch	5
18	pH Meter electric	a. pH range: 0-14 b. pH Accuracy: +/-0.01 c. pH Resolution: 0.01 d. mV range: +/-1999 mV e. Temperature range: 0 to 80° C f. Temperature Accuracy: +/-0.5° C g. Type of electrode: Combined electrode which can be replaceable h. Display: LCD screen i. Accessories included: Adaptor, Probe, Buffer (Acid, Neutral, Basic), Cable, Stand j. Should be CE/US FDA/BIS	5
19	Surgical instruments	Scissors: long, short & curved Forceps: toothed and untoothed, artery Forceps, Scalpel Handle and blades (20 to 24) Long knife, scale, 10 cc volume FNAC gun	5
20	Automatic Urine Analyzer	Semi-quantitative - albumin, bilirubin, creatinine, glucose, ketone, leukocytes, nitrite, pH, protein, specific gravity and urobilinogen Should be US FDA/European CE/BIS approved	2
21	Sp. Gravity Measure	conventional urinometer	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
22	PH meter	a. pH range: 0-14 b. pH Accuracy: +/-0.01 c. pH Resolution: 0.01 d. mV range: +/-1999 mV e. Temperature range: 0 to 80° C f. Temperature Accuracy: +/-0.5° C g. Type of electrode: Combined electrode which can be replaceable h. Display: LCD screen i. Accessories included: Adaptor, Probe, Buffer (Acid, Neutral, Basic), Cable, Stand j. Should be US FDA/European CE/BIS approved	2
23	Needle and Syringe Destroyer	electrically operated conventional	2
24	Instrument Steriliser	-	2
25	Tissue Cassettes, metal & Plastic	large cassettes with lid- made up of plastic, microwave and xylene proof	10
26	Leukart's L plate, brass	conventional, brass	5
27	Metal & Plastic moulds for embedding	included in hot and cold embedding machine	5
28	Microscopics Slide Cabinet (Horizontal Manner)	25000 slides capacity	40
29	Aluminum slide trays	conventional aluminium tray, capacity 20 or more	6
30	Haemacytometers with red and white pipettes	glass made conventional	90
31	Urinometers (Mercury based instruments to be replaced with other alternatives)	conventional urinometer	10
32	Pipettes of various sizes with disposal tips	1. Should be non autoclavable 2. Set of 5 x 4 micropippetes Make: Sartorius/Pipetteman/Eppendorf/Gilson/Biohit/Thermofisher a) variable 5 to 50 µl b) variable 20 to 200 µl c) fixed 500 µl d) fixed 1000 µl	10
33	Haemoglobinometer	conventional hemocytometer box with comparator box, hemoglobin pipette, N/10 HCL bottle & stirrer	10
34	Albuminometer	Esbach's conventional albuminometer	10
35	Centrifuge tube graduated	1.5ml, 2ml- eppendorf tube; 10ml,15ml- glass tube	40
36	Cytocentrifuge	16 tubes/ 32 tubes	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
37	Three Part Fully Automated Cell Counter	High priced machine, actual necessity to be decided by higher authority	1
38	**Grossing Station** - Stainless steel, with Control panel, air filtration system, Track mounted adjustable computer arm with articulation, LED lights that are color and intensity, Dedicated USB ports for camera control and data transfer adjustable, Integrated pathology camera system, Instrument Set (High quality) Height Adjustable Stainless Steel Chairs With Split AC of appropriate capacity	2 ventilation options:- High-quality stainless steel construction, Vacuum breaker-protected water supply, disposal, Polyethylene dissecting, Magnetic instrument holder, Dissecting area rinse, Shelving, Spray hose assembly, with facility for formalin gas exhust. Should be CE/BIS approved	1
39	Cold Plate for Modular Tissue Embedding System	Operating temperature: -6 °C (self-regulating); Min. guaranteed workload capacity: 60 blocks solidified in 30 minutesCooling efficiency is important, so the cold plate must be designed with an environment adaptive control module to make sure the operating temperature is always stabilized at -6 °C. Provision for Self Regulation so that no need to turn down the temperature in summer or worry about too fast cooling in winter.Should have CE / USFDA certificate Should have minimum 10 installation in government institution in East India Should have dedicated Service Support only for East India with a team of service engineers (at least 2 persons) headquartered in Kolkata, having their office in Kolkata to support all districts of West Bengal timely.	1
40	Single pan Analytical balance	1. Range: 0.1mg-200g (at least) 2. Pan size: 125mm (approx) 3. Repeatability: 0.02 mg 4. Transparant casing 5. Digital display 6. Automated Taring system 7. Internal calibration 8. External calibration with weight from statutory body	2
41	Water bath (Tissue Floatation)	Rectangular water bath for flattening paraffinembedded tissue sections in all areas of biomedical research and routine diagnostics.used for maintaining specimens and solutions at requiredtemperature for immunohistochemical and enzymechemical application. Digital display, membrane keyboard, temperaturerange from ambient to +75°C, set value memory. High temperature consistency(control accuracy 0.2°C), working temperature above +44°C indicated by flashing LED. Settemperature displayed in addition to actual temperature. Jet-black aluminium surface with specialscratch-proof plastic coating ensures highest thermal conductivity. Capacity- approx 2L	2

Name of the Discipline: PHARMACOLOGY

Sl. No.	Name of the Equipments (Item)	Proposed Specification	Qty.
1	Stop watch	Digital stopwatch - capable of measuring up to 1/100th of a second.	20
2	Pupillometer	Portable hand held pupillometer for measuring pupil size.	10
3	Sherrington Starling kymograph (electrically driven)	1. Microprocessor controlled 7-speed digital kymograph. 2. Drum height 170 mm and diameter 150 mm. 3. Digital display (Indicative make & model: Orchid Scientific, Nashik. Model SK-01) with Kymograph paper.	3
4	Starling's long extension Kymographs with time markers	Brodie Starling large extension kymograph with stand. (Indicative make: Orchid Scientific, Nashik) with Kymograph paper.	3
5	The ideal Respiration Pump (500cc. CAP)	Intermedaite animal volume controlled ventilator for animals weighing between 1 to 30 kg. Indicative make: Harvard Apparatus Model 665.	3

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
6	Refrigerators	300 L refrigerator (domestic type) double door	2
7	Automatic electric recording drums	Microprocessor controlled 7-speed digital kymograph. Drum height 170 mm and diameter 150 mm. Digital display (Indicative make & model: Orchid Scientific, Nashik. Model SK-01) with Kymograph paper.	4
8	Colorimeters	Benchtop colorimeter, with wavelength selection, resolution 1%T, 0.01 Abs, 0.1 to 1 concentration	3
9	Canulas (different types)	Arterial cannulas of different sizes for rabbits / cats - made of high quality glass.	48
10	Smoking Burners Palmer A-291 and a-265	Mechanical smoker for kymograph drums (kersosene burner with stand). Indicative make: Orchid Scientific, Nashik.	1
11	Tracheal Canula Metal Palmer E-76	Tracheal Cannula for Rabbit/Small Cat, OD 6.0 mm, L 30 mm, with Large Y-Adapter (OD 10 mm)	4
12	Animal weighing machine for small animals like rats and gunea pig	Weighing scale, mechanical, kitchen type capable of weighing up to 500 g. Scale for large animals not required. Accuracy: 1gm	6
13	Dissection instruments	Dissection set for small animals. (at least 20 pc. Set). Injection syringes not required.	10
14	Distillation apparatus	Glass water distillation unit, output at least 4 L/h, output quality - pyrogen free water	4
15	Chemical Balance-ordinary Apothecary"s	Weighing scale, digital kitchen type capable of weighing up to 500 g. Accuracy: 1 gm	2
16	Chemical Balance-Sensitive	Weighing scale, digital, resolution up to 1 mg	2
17	Actophotometer	1. Infra-red actophotomer (actimeter) to record spontaneous activity in rodesnts. 2. Indicative make: Orchid Scientific, Nashik.	1
18	Animal cage	Change designation to Animal Cage: Polypropylene shoe-box type cages equipped with stainless steel lids and water bottles	4
19	Digital pH meter	Digital pH meter, pH range 0-14, resolution 0.01, with Combination glass pH electrode (0-70ºC), Standard buffer tablets and Electrode stand with clamp	1
20	DIGITAL PLETHYSMOMETER	Digital plethysmometer capable of recording paw volume of rats. Indicative make: Orchid Scientific, Nashik	1
21	Antihistamine Chamber with manometer	Histamine chamber with aersol generation unit and aneroid type manometer.	1
22	Disection instrument set (Plethysmograph assorted 4 Pneumograph Palmer E 1 Piston Recorder Palmer C.51 1 Tambours mareys Palmer C.5 & C.11 4 Tetanus Set Palmer H2O 1 Stop Watches Jacquets 12 Oxygen Cylinders with Trolleys 20 cu.ft 4 Carbon-di-oxide cylinder 2 Operating lamps-Phillips 4 Animal trolley with 12 cages)	This series of items should basically include 5 components - a) Small animal operating table (Brodies' operating table) - Required No. 1; b) Operating lamp (cold lamp) on stand - Required No. 1; c) Oxygen cylinder trolley - Required No. 1 d) U-tube mercury manometer on stand - Required No. 1 e) Marey's tambour 28 mm dia - Required No. 2	4
23	Digital Sphygmomanometer	Digital BP monitor, battery operated, with auto-inflation cuff and memory function, equipped with standard size adult cuff. Should be CE/US FDA/BIS	20

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
24	Critical Flicker Fusion Apparatus	1. Flicker fusion apparatus with digital display of flicker frequency. 2. Red flickering field of 10 mm diameter with white surround. 3. Intensity of the field as well as its surround to be variable. 4. Light to dark ratio of each cycle is adjustable from 1:9 to 9:1. 5. Frequency variable to show intermittent light, 6. Flicker and continuous light.	10
25	Bicycle Ergometer	1. Exercise bicycle with digital display of parameters. 2. User weight up to at least 120 kg. 3. Height adjustable. 4. Equipped with resistance controller. 5. Handle can be adjusted horizontally and vertically. 6. Braking by knob push.	1
26	Dale's Isolated organ bath	1. One channel system isolated tissue organ bath. 2. Durable plastic (not glass) construction with reservoir coil made of Perspex. 3. Inbuilt water circulation pump for uniform temperature control. 4. Digital temperature controller. 5. Equipped with water bath tube and aeration tube.	4
27	Rotarod Assembly	1. Combined mouse/ rat rotarod apparatus (through change of rotor). 2. Multi-lane (at least 5 lanes) with individual lane timers (resolution of 0.1 s). 3. Automatic detection of fall. 4. Electronic rod speed adjustment (5 - 80 rpm).	1
28	Cook's Pole Climbing Apparatus	1. Selectable light or audio stimuli. 2. Digital voltmeter for setting voltage in the range of 16-200V DC. 3. Digital Timer for setting timer in the range of 0.1-999s. 4. Climbing pole made of high quality plastic / wood. 5. Chamber equipped with excreta tray.	1
29	Electro-Convulsiometer	1. Indicative make: Orchid Scientific, Nasik 2. Voltmeter – Digital, Corneal Electrodes – on Bakelite, Timer-Digital. 3. Corneal Electrodes – 03 pairs (4, 6 & 8mm and a pair of eye clips are supplied as std) 4. Ammeter – Digital (0.1s-1s) 5. Timer – Digital (0.1s – 1s) 6. Current – 0.25mA-360mA 7. Foot Switch – YES	1
30	Water bath	1. Capacity: 10 ltr. 2. Rectangular water bath 3. Digital display, membrane keyboard, temperature range from ambient to +75°C, set value memory. 4. High temperature consistency (control accuracy 0.2° C), working temperature above +44°C indicated by flashing LED. Set temperature displayed in addition to actual temperature. 5. Jet-black aluminium/SS surface with special scratch-proof plastic coating ensures highest thermal conductivity.	4

Name of the Discipline: PHYSIOLOGY

Sl. No.	Name of the Equipments (Item)	Proposed Specification	Qty.
1	Phacoscope	Should have good quality lens, prism	1
2	Hand grip dynamometer	Durable sensor used to measure handgrip and pinch force, Range: 0-135 lb-F (0-600 N), Sensitivity: 26.7 mV / lb-F (6 mV / N)	2

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
3	Tuning fork –	128 Hz 10 Should be made up of stainless steel with frequency marked	7
4	Tuning fork-	256 Hz Should be made up of stainless steel with frequency marked	7
5	Tuning fork-	512 Hz 10 Should be made up of stainless steel with frequency marked	7
6	Animal Weighing scale	Digital type Weighing range: 125 kg or more High Precision mechanism with the unique weighing system Should have large view scratch resistant glass/fibre Powder Coated with ABC plastic top cover Should have MS Steel Body Dimensions Should be of high precision mechanism (50 gm or less graduation) with the unique weighing system	2
7	Double demonstration eye piece	23 mm dia. eye piece, making it possible for two persons to see the same object at the same time. Should be fitted with a pointer. Instrument should be supplied with top class quality optical components. This instrument should have a Beam Splitting Prism to optical Glass Pointer. Should cover the entire field and should enable clear vision to the observer and sub observer. It should have 360° rotation. It should be held in the desired viewing position by a knurled headed pinch screw.	3
8	Maddox rod	-	1
9	Marey' Tambour	This device should convert changes in air pressure into movements of a stylus that scribes a kymograph. Should have Dia. 22mm or 28mm (Approx) Should have Stainless Steel capillary lever Should have ¼ '' hollow stem. Should have sliding adjustment to writing point should have tie-on Diaphragm.	20
10	Schematic eye	Should be physical model that represents the basic optical features of the real eye. Should be made of plastic or fiber. It should have a semi-detachable arrangement for demonstration.	1
11	NEWTON'S COLOUR WHEEL	The seven colors in Newton's optical spectrum (red, orange, yellow, green, blue, indigo and•Technical Specifications: violet) should be recombined in a number of ways, including the seven-mirror device and the oscillating prism Newton's Colour Wheel should have a multi-coloured disc mounted on wooden stand rotated by• a hand wheel	1
12	Stage Incubator	Temperature range should be 3°C above room temperature to 50°C•Stage Incubator - Electric CO2 Microscope Stage Incubator Temperature control accuracy should be as follows:• ±0.3°C (Chamber temperature feedback) Should have Electric Heating Technology• ±0.2°C (Specimen temperature feedback). Should have Chamber temperature feedback and Specimen temperature feedback• CO2 range should be 0 to 100%• Manufacturer should have ISO certification for quality standards•	1
13	COLORIMETER	Filter : Seven Glass filter Photometric Range : 0-100%T(Transmittance) 0- 2.0Abs(Absorbance) Should be with digital readout Sample Container : Square cuvette 10x10x45(mm) Round cuvette 10(ID),12(OD),105(L)mm Should work on 230V,50 Hz Acessories Filter case-1 pc Filter-7 Pc Analog output cable-1 Pc Power cord-1 Pc Operation manual -1 copy Bulbs-3 nos Extra Cuvettes -10 nos The supplier should be ISO certified for quality standards. Should be FDA/CE or BIS approved product.	1
14	ANAESTHESIA INSTRUMENTS	Suitable all instruments required for provide the anaesthesia for small and big animal like dog	1
15	DALE'S BATH FOR INTERNAL ORGANS	Should be thermostatically controlled with stirrer, Uprights, glass inner vessel• Dale's tissue organ bath should record intestinal movements and effects of drugs •Technical Specifications & Oxygen tube with platinum tip, warming coil and frontal lever from SS capillary tubing. Documentation Manufacturer should have ISO certification for quality standards•	10

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
16	SAHLI (SAHLI- ADAMS) HAEMOGLOBINOMETER OR HAEMOMETER	Should be able to determine the haemoglobin in the blood by diluting an acidified sample and• Should have permanent non-fading colour standards made with optical precision for accurate•comparing it with a coloured standard and exact matching of colour. The total error of definition of concentration of a haemoglobin (in view of an error of a method,• It should measure optical density of a solution with precision not worse than 1 %. • Measuring range should be 40-360 g/litre. •Technical Specifications and also errors of dosing of a blood and solutions), obtained at comparative medical tests, Optical length of a cuvette or cylindrical test tube should be 10 ± 0.1 mm.• The volume of liquid for photometry should be not less than 1 ml. •should not exceed 2 %. System Configuration Accessories, spares and consumables Brush• Haemoglobin pipette • Dropping pipette • Graduated dilution tube • Glass rod• Suction tube• Blood pipette • Pasteur pipette etc • Amber coloured acid vial • Stirrer •	36
17	Smoke out fit with fume cupboard	Protective device for the user, Extraction of fumes, aerosols and dust from the internal workspace to prevent dangerous amounts of pollutants from escaping into the laboratory. To prevent the formation of dangerous potentially explosive atmospheres in the internal workspace. Protection from splashes of hazardous substances. Protection from flying particles, bodies or parts escaping from the internal workspace. Not suitable for openly breaking down chemicals. Service outlets in the rear panel of the internal workspace. Control units located horizontally on the service rail of the support unit	1
18	Vernishing Outfit	to fix the recording on the smoked paper. It is useful for varnishing cut papers up to 3 or 4 inch in length and any width not exceeding 10 inch.	1
19	Compass Aesthesiometer	to examine tactile sensations. A divider(of geometry box) like instrument	10
20	Water Distillation Unit Plant	Features : • Corrosion resistance steel • Easy to operate • Optimum performance Capacity 4 Liter/Hour 3KW Power supply 220/230 volts A C Supply Standard accessories Cord and plug , wall mounting clamp, rubber tubing 5 meters Spare heating elements	1
21	All glass distillation apparatus double stage	Distillation Apparatus consists of a vessel mounted in a heating bath and fitted with a condenser for condensing the vapours. A receiver with drain valve can be added for receiving the condensate.	1
22	MOSSES ERGOGRAPH	For recording work done by a finger on to the drum surface. with special arm fixation rests, finger holders, finder strap, recording lever for drums, pulleys & a set of 5 kgs slotted weights.	6
23	Knee hammer	Should be able to test deep tendon reflexes A rubber component should be attached to a flat metallic handle. It should have T-Shape, double point solid rubber with reflex point and brush Taylor (fish type) should be with brass nickel plated solid handle, with brush and pin end.	20
24	Venus and arterial canula	Should be at least 10 numbers of different sizes	12
25	Surgical instrument for operative procedure	Scalpels, blades, syringes, pulleys, bone cutter, pithing needle etc. for small animals	1
26	Douglas Bag	Should have capacity upto 300 litres	2
27	Instrument trolley	Should be movable, Height should be adjustable 70-90 cm (approx.) Should be of SS 304 Size: 3 x 2 with siderail	1
28	Stethograph	Corrugated rubber tube which should be 60 cm long and 2 cm diameter. One end should be blind and other end is connected to pressure rubber tubing.	6

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
29	Electric time marker 100/sec	Should be accurate	6
30	BICYCLE ERGOMETER	Work Load Range: 10 – 600Watt .Independent Rpm: 20 – 130rpm Work Load range Dependent RPM. Lap Time: 9h 59min 59sec Load Steps : 1 – 99 Watt Time Steps : 1 – 99 Min Load Programs: Manual 1 Load/Step PWC 170, 150, 130 HR Steady State Safety Protection Automatic Load: Heart rate, Blood Pressure, Systolic Blood Pressure, Diastolic Acoustic signal; Dynamic Static Adjustments (Height): 83cm–110cm Saddle: 68cm – 108mm Handle bars: free rotation Accuracy of load: 2% or 3 Watt Input/output External Control: RS – 232 Inputs: Analogue control Start signal Heart rate Blood pressure S Blood pressure D; Outputs: work load Pedaling Speed Step Marker Power supply: 110 – 240V, 50 – 60Hz; Power consumption: 100VA; Safety Standard: class 1, CE; Dimensions (cm): Base plate 79X48; Weight: approx 46Kg.	2
31	Nasal Field Olfactometer	Detection Technique: Human Nose Discrete Dilution Ratios: 2, 4, 7, 15, 30, 60 D/T's (Standard Dilution-to-Threshold Ratios) Response Time: As fast as 3-seconds (2 inhalations) Accuracy: +/- 10% of D/T Repeatability: +/- 2% Inhalation Rate: 16-20 liters per minute Operating Temperature Range: 32° to 104°F, 0° to 40°C Power Requirements: Standard 9-Volt Alkaline Battery Dimensions: 14″(L) x 7.5″(H) x 4″(W) (35.5 x 19 x 10 cm) Weight: 2.0 lbs (0.91 kg) Materials of Construction: PTFE and Polymer Alloys Odor Filter Cartridge: 3.5″ diameter x 1.5″ (H) (8.9 cm diameter x 7 cm) Nasal Mask: 2.75″ (H) x 2.25″ (W) (7 cm x 5.7 cm)	1
32	Edridge-Green Colour Perception Lantern	This lantern enables tests to be made under conditions very closely allied to those found in every day practice, while the colours chosen are those which rapidly and definitely disclose any defects in colour perception. It is used by in screening of all personnel where colour perception is of paramount importance.	1
33	Digital Stopwatch	Digital Running Timer Chronograph should be Stopwatch with Strap , Small and lightweight, portable and fashionable. With hour, minute, second, AM/PM indicator, month, data, and day of the week function 12/24 hour display, easy to use and read 1/100 second Chronograph up to 23 hours, 59 minutes, 59 seconds Timer Stopwatches alarm with 4 minutes snooze Hourly chime.	10
34	Refrigerator	300 litre, of good quality and branded.	2
35	Voltage Stabilizer	• Electronic voltage stabilizer for refrigerator (Up to 300 Ltr) • Low & High Voltage Cut-off Protection • Fail Safe Circuit Protection from branded companies.	3
36	Stepdown transformer	For use in animal laboratory. Voltage: 9 V.	1
37	Laptop	• Intel Core i5 8th Gen • Quad Core 1.6 GHz Clock Speed • 8 GB DDR4 RAM • 1 TB Hard Disk • 2 GB NVIDIA Graphics Card • 15.6 inches, 1920 x 1080 pixels • Windows 10 OS	1

Sl. No.	Name of the Equipments (Item)	Specification	Qty.
38	Photocopier	• 50 Copies Per Minute • Auto Duplex (2 Sided Copying) • Auto Document Feeder (RADF) • Electronic Sorting • (2) 550 Sheet Paper Drawers • (2) 1,500 Sheet Paper Trays • Paper Sizes: 5-1/2 x 8-1/2 to 11 x 17 • Network Print/Scan	1
39	Basal Metabolism Apparatus	Benedict Roth Spirometer	1
40	Opthalmoscope	7 apertures for diagnostic flexibility in both large and small pupils. Aspherical optics avoid corneal and iris reflex. 74 single-diopter steps (from –36 to +38dpt) for perfect focus even with high refractive error. The optics is mounted on a metal frame to ensure a lifetime of optical precision. 7 different apertures for retinal examination with both large and small pupils. Separate interference red-free filter for improved contrast when viewing retinal blood-vessels. A powerful HEINE XHL Xenon Halogen bulb for full illumination with bright, white light. Dustproof and maintenance-free for the life of the instrument. The ergonomic rounded shape fits the orbit comfortably. Ergonomic, one-handed operation. The multi-coated, recessed eyepiece avoids stray light during the examination. The soft brow rest steadies the instrument and protects the examiners glasses.	1
41	Spirometer Ordinary	• 6 liter capacity for vital capacity • Used as a gas meter with chain/ plastic tread compensated counter balance to the float balance to cut its movement • Pulley calibrated to denote volume inlet & outlet tubes • Side cock for gases • Cock for draining off water strong construction	6

SECTION 5.9

List of Furniture

Section 5.9
List of Furniture

Sl. No.	Items of Furniture	Minimum indicative specification / requirement with reference Model No.	Nos. Required for 1MCH
Academic Building:			
1	Conference Table - 24 seater with chairs	Godrej Interio Table - Encarta Chair - Kareena Conference room OR equivalent.	1
2	4 seater Dining Table with chairs	Godrej Interio Cantina OR equivalent.	15
3	Examination Table	Midmark (formerly Janak) Table - 1807 & Step - 1604 OR equivalent.	4
4	Principal's & MSVP's Table	Godrej Interio Arrive OR equivalent.	2
5	Principal's & MSVP's Chair	Godrej Interio Halo - Very high back OR equivalent.	2
6	Visitor's Chair for Principal & MSVP	Godrej Interio Kareena - Visitor OR equivalent.	20
7	Office Table	Godrej Interio Office Desks OR equivalent.	80
8	Officer's Chair	Godrej Interio Aspire - Mid Back OR equivalent.	80
9	Teacher's Table	Stellar Desk OZ-7112W-709+756 OR equivalent.	45
10	Teacher's Chair	Godrej Interio Aspire - High Back OR equivalent.	45
11	Visitor's Chair	Godrej Interio multi-purpose chairs - 1007 OR equivalent.	250

Section 5.9
List of Furniture

Sl. No.	Items of Furniture	Minimum indicative specification / requirement with reference Model No.	Nos. Required for 1MCH
12	HOD's Chair	Godrej Interio Leoma - High Back OR equivalent.	15
13	HOD's Table	Godrej Interio Ascent OR equivalent.	15
14	Visitor's Chair for HODs	Godrej Interio Leoma - Visitor OR equivalent.	60
15	SS Waiting Chair-3 seater	Godrej Interio Perch / Nano Perch 3 seater OR equivalent.	50
16	Disection Table	Godrej Interio SS Disection Table (1800mm x 600mm x 900mm) OR equivalent.	20
17	Computer Table with Chair	Godrej Interio Work OR equivalent.	15
18	Lecture Hall Table + Seating Bench-2seater	Godrej Interio Namaste II OR equivalent.	470
19	Chair with Desk Arm	Godrej Interio Training and learning chairs - CH 18C OR equivalent.	1800
20	Book Storage Rack - Type -1	Godrej Interio Sliding glass door unit OR equivalent.	40
21	Book Storage Rack - Type -2	Godrej Interio Glass door Storwel OR equivalent.	40
22	Almirah Steel	Godrej Interio Kd plain OR equivalent.	150

Section 5.9
List of Furniture

Sl. No.	Items of Furniture	Minimum indicative specification / requirement with reference Model No.	Nos. Required for 1MCH
23	Laboratory Table with Sink	Godrej Interio Fusion OR equivalent.	500
24	Laboratory Table without Sink	Godrej Interio Fusion OR equivalent.	150
25	Lab. Table Seating Stool	Midmark (formerly Janak) 1022 Steel stool OR equivalent.	1300
26	Student's Chair	Godrej Interio multi-purpose chairs - 1007 OR equivalent.	500
27	Table Type -6 seater for library	Godrej Interio Insite (1800mm x 900mm) OR equivalent.	40
28	Table Type -4 seater for library	Godrej Interio Insite (900mm x 900mm) OR equivalent.	40
29	Locker For Stuents	Methodex SDLC 21: Safe Deposit Locker Cabinets type 3 OR equivalent	8
30	Notice Board	Godrej Interio Notice Board (1200mm x 900mm) OR equivalent.	6
31	Black Board	Godrej Interio Black Board (2400mm x 1800mm) OR equivalent.	6
32	White Board	Godrej Interio White Board (2400mm x 1800mm) OR equivalent.	20
33	Musium Rack single sided	Godrej Interio Musium Rack single sided OR equivalent.	50

Section 5.9
List of Furniture

Sl. No.	Items of Furniture	Minimum indicative specification / requirement with reference Model No.	Nos. Required for 1MCH
34	Musium Rack double sided	Godrej Interio Musium Rack double sided OR equivalent.	50
Hostel Block:			
1	4 seater Dining Table with seating arrangement	Methodex Radiance 01 : Cafeteria furniture OR equivalent	88
2	Study Table	Godrej Interio Unitized tables - t8 OR equivalent.	230
3	Study Chair	Godrej Interio multi-purpose chairs - 1007 OR equivalent.	230
4	Single Steel Bed without Matress	Godrej Interio Fiona Single Bed OR equivalent.	230
5	Visitor 's Chair 3 seater	Godrej Interio Perch / Nano Perch 3 seater OR equivalent.	12
6	Teacher's Table	Godrej Interio Office Desks OR equivalent.	2
7	Teacher's Chair	Godrej Interio Aspire - Mid Back OR equivalent.	2
8	Almirah Steel	Godrej Interio Kd minor OR equivalent.	230
OPD Building:			
1	Examination Table with Matress and steps	Midmark (formerly Janak) Table - 1807 & Step - 1604 OR equivalent.	100
2	Hospital Bed with Matress & accessories	Midmark (formerly Janak) Bx2000 Plus with accessories OR equivalent.	60

Section 5.9
List of Furniture

Sl. No.	Items of Furniture	Minimum indicative specification / requirement with reference Model No.	Nos. Required for 1MCH
3	Doctor's Table	Godrej Interio Office Desks OR equivalent.	150
4	Doctor's Chair	Godrej Interio Aspire - Mid Back OR equivalent.	500
5	Visitor's Chair	Godrej Interio multi-purpose chairs - 1007 OR equivalent.	500
6	Faculty's Chair	Godrej Interio Aspire - High Back OR equivalent.	10
7	Faculty's Table	Stellar Desk OZ-7112W-709+756 OR equivalent.	10
8	SS Waiting Chair-3 seater	Godrej Interio Perch / Nano Perch 3 seater OR equivalent.	500
9	Computer Table with Chair	Godrej Interio Table - Stylo + Chair - Premier-Midback OR equivalent.	15
10	Almirah Steel	Godrej Interio Kd plain OR equivalent.	20
11	SS Seating Stool	Midmark (formerly Janak) 1022 Steel stool OR equivalent.	1200

SECTION 6

General Conditions of Contract (GCC)

SECTION – 6

GENERAL CONDITIONS OF CONTRACT (GCC)

1
General Provisions

1.1
Definitions

In the Conditions of Contract ("these Conditions"), the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1
The Contract

1.1.1.1 **"Contract"** means the Agreement, these Conditions, the Employer's Requirements, the Tender, and the further documents (if any) which are listed in the Contract Agreements.

1.1.1.2 **"Agreement"** means the Agreement referred to in Sub- Clause 1.6 [Agreement], including any annexed documents.

1.1.1.3 **"Employer's Requirements"** means the document in Section – 5 of the Bidding Documents titled Employer's Requirements, as included in the Contract, and any additions and modifications to such document in accordance with the Contract. Such document specifies the purpose, scope, and/or design and/or other technical criteria, technical specifications, technical requirements for the Works.

1.1.1.4 **"Tender"** means the Contractor's signed offer for the Works and all other documents which the Contractor submitted therewith (other than these Conditions and the Employer's Requirements, if so submitted), as included in the Contract.

1.1.1.5 **"Performance Security"** and **"Schedule of Payments"** mean the documents so named (if any), as included in the Contract.

1.1.2
Parties and Persons

1.1.2.1 **"Party"** means the Employer or the Contractor, as the context requires.

1.1.2.2 **"Employer"** means West Bengal Medical Services Corporation Limited and includes its successors-in-interest and/ or assigns.

1.1.2.3 **"Contractor"** means the person(s) named as contractor in the Agreement and the legal successors in title to this person(s).

1.1.2.4 **“Employer’s Representative”** means the person(s) named by the Employer in the Contract or appointed from time to time by the Employer under Sub-Clause 3.1 [The Employer’s Representative], who acts on behalf of the Employer.

1.1.2.5 **“Contractor’s Representative”** means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub-Clause 4.3 [Contractor’s Representative], who acts on behalf of the Contractor.

1.1.2.6 **“Employer’s Personnel”** means the Employer’s Representative, the assistants referred to in Sub-Clause 3.2 [Other Employer’s Personnel] and all other staff, labour and other employees of the Employer’s and of the Employer’s Representative, and any other personnel notified to the Contractor, by the Employer or the Employer’s Representative, as Employer’s Personnel.

1.1.2.7 **“Contractor’s Personnel”** means the Contractor’s Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and any other personnel assisting the Contractor in the execution of the Works.

1.1.3 Dates, Tests, Periods and Completion

1.1.3.1 **"day"** means a calendar day and **"year"** means 365 days.

1.1.3.2 **"Commencement Date"** means the date notified under Sub-Clause 8.1 [Commencement of Works], unless otherwise defined in the Contract Agreement.

1.1.3.3 **"Time for Completion"** means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Particular Conditions (with any extension under Sub-Clause 8.5 [Extension of Time for Completion]), calculated from the Commencement Date.

1.1.3.4 **"Tests on Completion"** means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Employer.

1.1.3.5 **"Taking-Over Certificate"** means a certificate issued under Clause 10 [Employer's Taking Over].

1.1.3.6 **"Tests after Completion"** means the tests (if any) which are specified in the Contract and which are carried out under Clause 12 [Tests after Completion] after the Works or a Section (as the case may be) are taken

over by the Employer.

1.1.3.7 **"Defects Notification Period"** means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections]. This period shall be three years.

1.1.3.8 **"Performance Certificate"** means the certificate issued under Sub-Clause 11.9 [Performance Certificate].

1.1.4
Money and Payments

1.1.4.1 **"Contract Price"** means the agreed amount stated in the Agreement for the planning, design, execution and completion of the Works and the remedying of any defects, and includes adjustments (if any) in accordance with the Contract.

1.1.4.2 **"Cost"** means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

1.1.4.3 **"Final Statement"** means the statement defined in Sub-Clause 14.11 [Application for Final Payment].

1.1.4.4 **"Statement"** means a statement submitted by the Contractor as part of an application for payment under Clause 14 [Contract Price and Payment].

1.1.4.5 **"Currency"** means Indian National Rupees (INR).

1.1.4.6 **"Defects Liability Period"** means three years from the date of issuance of Taking Over Certificate.

1.1.5

Works and Goods

1.1.5.1 **"Contractor's Equipment"** means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Employer's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

1.1.5.2 **"Goods"** means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

1.1.5.3 **"Materials"** means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

1.1.5.4 **"Permanent Works"** means the permanent works to be planned, designed and executed by the Contractor under the Contract.

1.1.5.5 **"Plant"** means the apparatus, machinery and vehicles intended to form or forming part of the Permanent Works.

1.1.5.6 **"Section"** means a part of the Works specified as a Section (if any).

1.1.5.7 **"Temporary Works"** means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

1.1.5.8 **"Works"** mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.5.9 **"Products"** means and include, without limitation, such medical equipment, furniture, beds, components, intermediate products and the products which the Contractor is required to supply, install and commission in terms of this Contract.

1.1.5.10 "**Project**" means planning, design and construction of medical colleges in terms of Guidelines of Medical Council of India (MCI) or any such apex statutory authority regulating medical education in India alongwith supply and installation of medical equipment and furniture thereat. Such colleges shall comprise of academic buildings, two separate hostels for male and female students, interns and resident doctors and separate staff quarters in terms of the Guidelines of Medical Council of India (MCI) or any such apex statutory authority regulating medical education in India as well as a standalone Out Patient Department (OPD) building in the sites as explained in detail in the Bill of Quantities (BOQ).

1.1.5.11 **"Services"** means and include services ancillary to the supply of Products

and performance of Works including without limiting to transportation and supply at the point of consignee and such other obligations as required under this Contract.

1.1.6

Other Definitions

1.1.6.1 **"Contractor's Documents"** means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature supplied by the Contractor under the Contract; as described in Sub-Clause 5.2 [Contractor's Documents].

1.1.6.2 **"Country"** means India.

1.1.6.3 **"Variation"** means any change to the Employer's Requirements or the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

1.1.6.4 **"Force Majeure"** is defined in Clause 19 [Force Majeure].

1.1.6.5 **"Laws"** means all national (or state) legislation, statutes, ordinances and other laws, and regulations and bye-laws of any legally constituted public authority.

1.1.6.6 **"Performance Security"** means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].

1.1.6.7 **"Site"** means the places where the Permanent Works are to be executed and to which Plants, Materials and Products are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

1.2

Interpretation

In the Contract, except where the context requires otherwise:

(a) words indicating one gender include all genders;

(b) words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and

(d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record. The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

1.3

Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices and requests, these communications shall be:

(a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission; and

(b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract. However:

(i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and

(ii) if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed.

1.4

Law and Language

The Contract shall be governed by the laws of India only.

The language in the contract shall be English only. The language for communication for the purpose of this Contract shall be English only.

In addition to this, any document, which is in any language other than English, shall be translated to English and certified.

If there are versions of any part of the Contract which are written in more than one language, the version which is in English shall prevail.

The Contractor shall familiarize himself with the local laws and administration of West Bengal and comply by them.

1.5

Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

(a) the Agreement [including the Financial Bid/ Bill of Quantities (BOQ)],

(b) these General Conditions of Contract,

(c) the Employer's Requirements,

(e) the bidding documents and any other documents forming part of the Contract.

1.6

Agreement

The Contract shall come into full force and effect on the date stated in the Agreement. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Agreement shall be borne by the Contractor.

1.7

Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated:

(a) the Contractor shall have obtained (or shall obtain) the planning, zoning or similar permission for the Permanent Works, and any other permissions described in the Employer's Requirements as having been (or being) obtained by the Contractor; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so. However, the Employer shall assist and/or facilitate (without any recourse or liability) obtaining of all permits, licences, approval, clearances, No Objection Certificates and the like, as required by the Laws and shall sign such documents as may be required by statute. The cost for obtaining the sanctions and/or permission in respect of such permit, licence, approval, No Objection Certificate, clearance and the like, shall be paid by the Contractor, which shall be reimbursed by the Employer within 60 days from the date of submission of necessary documents claiming reimbursement including supporting documents; and

(b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the planning, design, execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so. However, the Employer shall assist and/or facilitate (without any recourse or liability) obtaining of all permits, licences and approval, as required by the Laws and shall sign such documents as may be required by statute.

1.8
Care and Supply of Documents

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Employer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Employer's Requirements, the Contractor's Documents, and Variations and other communications given under the Contract, The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect of a technical nature in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9
Confidentiality

Both Parties shall treat the details of the Contract as private and confidential, except to the extent necessary to carry put obligations under it or to comply with applicable Laws. The Contractor shall not publish, permit to be published, or disclose any particulars of the Works in any trade or technical paper or elsewhere without the previous agreement of the Employer.

1.10
Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This licence shall:

(a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,

(b) entitle any person in proper possession of the relevant part of the Works to copy,

use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and

(c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent; be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11
Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Employer's Requirements and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract.

They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12
Confidential Details

The Contractor shall not be required to disclose, to the Employer, any information which the Contractor described in the Tender as being confidential, The Contractor shall disclose any other information which the Employer may reasonably require in order to verify the Contractor's compliance with the Contract.

2
The Employer

2.1
Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within 14 days of the issuance of Letter of Acceptance / Notification of Award. The right and possession may not be exclusive to the Contractor. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If the Contractor suffers delay as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion].

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents including submission of Performance Security, the Contractor shall not be entitled to such extension of time.

2.2
Permits, Licences or Approvals

It will be the duty of the Contractor to apply for and obtain any permits, licences, approvals, clearances or No Objection Certificates required by the Laws of the Country, which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws] for commencement of construction, completion of construction, delivery of Goods and Products including clearance through customs, supply, installation and commissioning of Goods and Products. It is made clear that such list is not exhaustive and is merely indicative in nature. Upon obtaining of such permits, licenses, approvals, clearance or no objection certificate from the appropriate authority, the Contractor shall provide a copy of such permits, licenses, approvals, clearance or no objection certificate to the Employer. It is made clear that failure to do so, the Employer shall be entitled to take action in terms of Clause 4.23 of these Conditions the delivery of Goods and Products, including clearance through customs.

2.3
Employer's Personnel

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site:

(a) co-operate with the Contractor's efforts and

(b) take actions similar to those which the Contractor is required to take under Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.24 [Protection of the Environment].

2.4
Employer's Claims

If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, it shall give notice and particulars to the Contractor. However notice is not required for payments due under Sub-Clause 4.25 [Electricity, Water and Gas] or for other services requested by the Contractor.

The notice shall be given as soon as practicable after the Employer became aware of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers itself to be entitled in connection with the Contract. The Employer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

The Employer may deduct this amount from any moneys due, or to become due, to the Contractor. The Employer shall only be entitled to set off against or make any deduction from an amount due to the Contractor, or to otherwise claim against the Contractor, in accordance with this Sub-Clause or with sub-paragraph (a) and/or (b) of Sub-Clause 14.6 [Interim Payments].

Whenever any claim or claims for payment of a sum of money arises out of or under the Contract or against the Contractor, the Employer's Representative or the Employer shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the Mobilisation Advance Bank Guarantee and/or Performance Security, if any deposited by the Contractor, pending finalization or adjudication of any such claim. In the event of the Performance Security, being insufficient to cover the claimed amount or amounts, the Employer's Representative or the Employer shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the Contractor under the same Contract or any other Contract with the Employer's Representative of the Employer or any contracting person through the Employer's Representative pending finalisation of/adjudication of any such claim.

It is an agreed term of the Contract that the sum of money or moneys so withheld or retained under the lien referred by the Employer's Representative or the Employer will be kept withheld or retained as such by the Employer's Representative or the Employer till the claim arising out of or under the Contract is determined by the arbitrator (if the Contract is governed by the arbitration clause) or by the competent court, as the case may be and that the Contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the Contractor. For the purpose of this clause, where the Contractor is a limited company, the Employer's Representative or the Employer shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any limited company.

3

The Employer's Administration

3.1

The Employer's Representative

The Employer may appoint an Employer's Representative to act on its behalf under the Contract. In this event, it shall give notice to the Contractor of the name, address, duties and authority of the Employer's Representative.

The Employer's Representative shall carry out the duties assigned to him, and shall exercise the authority delegated to him, by the Employer. Unless and until the Employer notifies the Contractor otherwise, the Employer's Representative shall be deemed to have the full authority of the Employer under the Contract, except in respect of Clause 15 [Termination by Employer].

If the Employer wishes to replace any person appointed as Employer's Representative, the Employer shall give a notice to the Contractor.

3.2
Other Employer's Personnel

The Employer or the Employer's Representative may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials.

3.3
Delegated Persons

All these persons, including the Employer's Representative and assistants, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by a delegated person, in accordance with the delegation, shall have the same effect as though the act had been an act of the Employer. However:

(a) unless otherwise stated in the delegated person's communication relating to such act, it shall not relieve the Contractor from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances;

(b) any failure to disapprove any Works, Plants, Materials or Products shall not constitute approval, and shall therefore not prejudice the right of the Employer to reject the Works, Plants, Materials or Products; and

(c) if the Contractor questions any determination or instruction of a delegated person, the Contractor may refer the matter to the Employer, who shall promptly confirm, reverse or vary the determination or instruction.

3.4
Instructions

The Employer may issue to the Contractor instructions which may be necessary for the Contractor to perform his obligations under the Contract. Each instruction shall be given in writing and shall state the obligations to which it relates and the Sub-Clause (or other term of the Contract) in which the obligations are specified. If any such instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

The Contractor shall take instructions from the Employer, or from the Employer's Representative or an assistant to whom the appropriate authority has been delegated under this Clause.

3.5
Determinations

Whenever these Conditions provide that the Employer shall proceed in accordance with this Sub-Clause to agree or determine any matter, the Employer shall consult with the Contractor in an endeavour to reach agreement. If agreement is not achieved, the Employer shall make a reasonable determination in accordance with the Contract, taking due regard of all relevant circumstances and after giving an opportunity to the

Contractor of being heard.

The Employer shall give notice to the Contractor of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination, unless the Contractor gives notice, to the Employer, of his dissatisfaction with a determination within 14 days of receiving it. Either Party may then refer the dispute to arbitration in accordance with Sub-Clause 20.3 [Arbitration].

4
The Contractor

4.1
Contractor's General Obligations

The Contractor shall plan, design, execute and complete the Works and commissioning of the Products in accordance with the Contract, and shall remedy any defects in the Works and Products. When completed, the Works or the Products shall be fit for the purposes for which the Works or the Products are intended as defined in the Contract.

The Contractor, after obtaining any necessary consent from any relevant authority, shall submit to the Employer, proposals showing the layout of pedestrian routes, lighting, signs, and guarding any road opening or traffic diversion which may be required in connection with the execution of the Works and which the Contractor intends to construct. Any consent given by the Employer to such proposals shall not relieve the Contractor of any obligation under the Contract or absolve the Contractor from any liability for or arising from such proposals or the implementation thereof.

The Contractor’s proposals for erection of all ancillary and Temporary Works shall be in conformity with the proposals submitted along with the tender and modifications thereto as approved by the Employer.

The Contractor shall submit drawings, supporting design calculations where called for by the Employer and other relevant details of all such works to the Employer for approval at least 45 days before it desires to commence such works and the Employer shall endeavour to get such drawings and designs approved within a period of 30 days from the date of submission of such designs and drawings. Approval by the Employer of any such proposal shall not relieve the Contractor of his responsibility for the adequacy of such works.

No extra payment will be made for complying with the provisions of this clause and the cost of the work under this element shall be deemed to be included in the Financial Bid.

The Contractor shall provide the Plants and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this plan, design, execution, completion and remedying of defects.

The Works shall include any work which is necessary to satisfy the Employer's Requirements, or is implied by the Contract, and all works which (although not

mentioned in the Contract) are necessary for stability or for the completion, or safe and proper operation, of the Works.
The Contractor shall be responsible for the adequacy, stability and safety of all Site operations, of all methods of construction and of all the Works.

The Contractor shall, whenever required by the Employer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Employer.

The Contractor shall survey and fix the alignment, set out the buildings maintaining vertical & horizontal clearances and keeping in view important site references and obligatory locations in consultation with the Employer. GTS bench mark, temporary bench marks and three control points on all straights & other details shall be obtained by the Contractor. However, the Employer shall assist and/or facilitate (without any recourse or liability) in such obtaining of GTS bench mark, temporary bench marks etc.

The Contractor shall establish at its cost, at suitable points, additional reference lines and bench marks as may be necessary. The Contractor shall remain responsible for the sufficiency and accuracy of all his benchmarks and reference lines. It shall take precautions to see that lines, points and bench marks fixed by the Employer are not disturbed by its work and shall make good any damage thereto.

4.2

Performance Security

The Contractor shall obtain (at its cost) a Performance Security for proper performance, equal to 10% of Contract Price, prior to execution of the Agreement.

The Performance Security should be submitted in the form of a Bank Guarantee from a scheduled bank. No Performance Security will be accepted from the Contractor, if the location of the branch of the bank is not situated within the municipal limits of any of the cities of Kolkata, Bidhannagar and New Town Kolkata. The Performance Security shall have a validity of 12 months and upon expiry of 11 months from the date of issue of Performance Security but prior to expiry of the 12 months period, the Contractor shall revalidate the Performance Security for another 12 months period. The Contractor shall continue to keep its Performance Security duly validated and enforceable for such successive periods of 12 months or for such shorter period as may be directed by the Employer, until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and all defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract in the event of:

(a) failure by the Contractor to extend the validity of the Performance Security as described in the preceding paragraph, in which event the Employer may claim the

full amount of the Performance Security,

(b) failure by the Contractor to pay the Employer an amount due, as either agreed by the Contractor or determined under Sub-Clause 2.4 [Employer's Claims] or Clause 20 [Claims, Disputes and Arbitration], within 42 days after the signing of the Contract or determination,

(c) failure by the Contractor to remedy a default within such reasonable period as may be specified by the Employer in its notice after receiving the Employer's notice requiring the default to be remedied, or

(d) circumstances which entitle the Employer to termination under Sub-Clause 15.2 [Termination by Employer], irrespective of whether notice of termination has been given.

The Employer shall return the Performance Security to the Contractor within 21 days after the Contractor has become entitled to receive the Performance Certificate.

4.3 Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Employer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked, or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, as far as practicable, without the prior consent of the Employer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.4 [Instructions].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Employer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative and all these persons shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

4.4 **Deleted.**

4.5 **Deleted.**

4.6

Time of supply of Products

The Products have been classified and segregated into medical equipment sub-divided into two Schedules, depending on the respective department of the medical colleges, to which they shall be put to use, which is as follows:

Medical Equipment Schedule – I

Time of supply – After completion of 80% of the Works
Departments – Anatomy, Physiology, Bio-chemistry and Forensic Medicine
(Only furniture pertaining to the office of the Principal of the medical colleges, may be required to be delivered prior to completion of 80% of the Works)

Medical Equipment Schedule – II

Time of supply – After completion of 100% of the Works and prior to issue of Taking –Over Certificate

Departments – Microbiology, Pathology, Community Medicine, Pharmacology

4.7

Special provisions For Products

(i) All major and minor spare parts shall be available with the Contractor/ manufacturer for a period of 10 years from the date of supply.
(ii) The Contractor shall have a team of trained and experienced service engineers available to remedy defects in the Products and/ or repair any breakdown therein, who shall be available to take inspection of such defect/ breakdown in the Products, within a period of 24 hours, from the reporting of such defect/ breakdown by the Employer.
(iii) The Contractor shall supply 2 copies of user manual in hard copy and in compact disc of each Products supplied.
(iv) One copy of maintenance manual with Block diagram, parts price list, troubleshooting procedure and detailed preventive maintenance protocol is to be provided by the Contractor to the Employer.
(v) Certificates of test and calibration with complete details done at factory, prior to dispatch shall be sent with the installation report by the Contractor to the Employer.
(vi) Compliance Report with respect to specifications of the offered Make/ Brand and model of the Products shall be submitted by the Contractor. Non-compliance/ partial compliance shall be explained clearly in the Remarks column. While filing compliance against each item in Technical Specifications sheet, actual values shall be furnished along with “yes” or “no” reply.

4.8 Safety Procedures

4.8.1. Codes etc to be complied with

The Contractor shall ensure and arrange at its cost, fire and the safety provisions, as provided under National Building Code of latest edition, Bureau of Indian Standards, safety manuals of the Employer, if any, and such provisions as are locally in force from time to time for all labour, directly or indirectly employed in the works for performance of this Contract. The Contractor will indemnify the Employer from any consequence arising due to Contractor's failure in respect of safety provisions.

Following Codes may be referred to in this connection:

IS 5916 Safety code for construction involving use of hot bituminous materials.
IS 7293 Safety code for working with construction machinery
IS 7969 Safety code for handling and storage of building materials.
IS 8989 Safety code for erection of concrete framed structures.
IS 13415 Protective barriers in and around buildings - Code of Safety
IS 13416 Preventive measures against hazards at work places - Recommendations (Parts - 1 to 5)

4.8.2 First Aid & Industrial Injuries

4.8.2.1 First aid facilities at easily accessible place shall be provided by the Contractor as per the applicable labour laws or Rules of the Authority controlling the area where work is carried out.

4.8.2.2. The Contractor shall make arrangements with hospitals for ambulance service and for treatment of industrial injuries to meet eventualities leading to the need for such facilities. The Employer's Representative shall be informed of their telephone numbers and addresses of the Hospitals.

4.8.2.3 Details of all critical industrial injuries shall be reported promptly to the Employer's Representative.

4.8.2.4 Report shall cover type, nature, cause, physician's report and action for prevention of those types again.

4.8.3 General Safety Rules

4.8.3.1 Smoking within plant, restricted areas, closed areas, near storage place of lubricant oil and fuel etc. is strictly prohibited.

4.8.3.2 The Contractor shall erect and maintain barricades required in connection with its operation to guard or protect

(a) Excavation
(b) Hoisting/lifting
(c) Slab openings
(d) Hazardous areas
(e) Employer's existing property likely to be subjected to damage by the Contractor's

operations

(f) Unloading spots

4.8.4 Accidents - Precautions at Worksite

No materials on the sites shall be so stacked or placed as to cause danger or inconveniences to any person or to the public. The Contractor shall provide all necessary fencing and lights to protect the public from accidents and shall be bound to bear expenses of defence of every suit, action or other proceedings at law, that may be brought by any person, for injury sustained, owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceeding, to any such person or which may, with the consent of the Contractor be paid to compromise any claim by any such person. In case any damage or destruction of public utilities is caused at the site by any act or omission of the Contractor, the Contractor shall also be liable to bear the costs and expenses for replacement or repair of such public utilities and all costs and expenses arising in connection thereto, upon such costs and expenses being determined by the Employer or the appropriate Government body. The Employer shall have the right to deduct all costs and expenses arising out of application of this clause, from the monthly bills payable to the Contractor.

4.8.5 Electrical Equipments - Precautions

All temporary and permanent electrical installations, power distribution and supply required for execution of Works shall be carried out conforming to existing industrial and domestic safety rules and regulations. Important specific points to be noted are as under,

(i) Meter room and main switches should be freely accessible at all times and fully protected against all weather conditions.
(ii) Power distribution system shall be identifiable with display marking on switches.

(iii) All power distribution shall be carried out with coated, adequately insulated and of appropriate current/load rating cables. It shall be securely routed for this purpose. No loose, naked, hanging wires shall be permitted.
(iv) Over load protection devices shall be installed whenever and wherever heavy current/load consuming construction plant or machinery susceptible to hazard is in use and as directed by the Employer's Representative.
(v) Metallic plugs and sockets shall be used in field work. Switch board shall be in close proximity so as to have quick control over the supply.
(vi) Proper and adequate earthing connection should be provided for all installations, plant and machinery and distribution system.
(vii) Hand lamps and inspection lamps shall be adequately insulated and guarded with wire mesh and should have proper plugs for use.
(viii) Security and illuminatory light shall be secured firmly and protected to withstand all weather conditions.

4.8.6 Maintenance of Safety Devices

All scaffoldings, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate maintenance facilities shall be provided at or near places at work.

4.8.7 Personal Safety

(a) All necessary personal safety equipment as considered adequate by the Employer's Representative shall be available for use of persons employed on the Site and maintained in a condition suitable for immediate use and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

(b) Workers employed on mixing asphaltic materials, cement, and lime mortars/ concrete shall be provided with protective footwear and protective gloves.

(c) Those engaged in handling any materials which are injurious to eyes shall be provided with protective goggles.

(d) Workers employed on erection works, etc. shall be provided with helmets, safety belts etc.

(e) Workers employed on concrete finishing, welding, painting and other works above 2 metres height shall be provided with a suitable safety belt, as per the applicable Factory Rules.

4.8.8 Storing Fuel, Oil and Lubricant

The Contractor shall take approval from the Safety Officer of the Employer for storing the lubricants, oil and fuel at site for running the machinery required for the construction.

4.8.9 Fire Extinguishing

Suitable, sufficient number of fire extinguishers for all types of fire, shall be provided at work site. In addition, sufficient number of fire buckets filled with water and sand shall also be provided. The firefighting equipment as outlined above shall be dispersed in a suitable and purposeful manner.

4.8.10 Fire Precautions

The Contractor shall comply with regulations of the controlling authority in force at the Site of the Works relating to the precautions to be taken against fire hazards.

4.8.11 Protection arrangements at the site of Works

Adequate protection against any form of damage or deterioration shall be provided for in all sections of the Works. This shall include protective tapes, casings, guard rails and the like, which shall be provided as necessary. Particular care shall be taken to protect finished surfaces during the execution of adjacent in-situ work. The Contractor

shall carry out all steps necessary and comply with the directions and instructions of the Employer's Representative to its satisfaction.

4.8.12 Safety Arrangements for labour

The Contractor shall, at its own expense, arrange for the safety provisions as given above and as required by the Employer's Representative, in respect of all labour directly or indirectly employed for performance of the work and shall provide all facilities in connection therewith. In case the Contractor fails to make arrangements to provide necessary facilities as aforesaid, the Employer's Representative shall be entitled to do so and recover the cost thereof, from the Contractor.

4.8.13 Safety Manual

The Contractor shall submit a Safety Manual indicating the safety measures proposed to be adopted in light of above provisions, for approval of the Employer's Representative.

4.8.14 Accidents - Reporting

The Contractor shall, within twenty four (24) hours of the occurrence of any accident on, or about the Site, or in connection with the execution of the Works, report such accident to the Employer's Representative and to the appropriate authority wherever such report is required by law. The Contractor will indemnify the Employer from all accident cases.

4.8.15 Security Measures

The Contractor shall be responsible at its cost for security of Works for the duration of the Contract and shall provide and maintain continuously adequate security personnel to fulfill these obligations. The requirements of security measures shall include, but not limited to, maintenance of Law and order at site, provision of all lighting, guard, flagmen, and other measures necessary for protection of Works within the camps and elsewhere at site, for all materials delivered to the site and all persons employed in connection with the Works continuously throughout working and non-working periods including nights, Sundays, holidays, for the duration of the Contract (including the Defects Liability Period). At work sites in close proximity of traffic corridors where public are likely to come close to the work area, suitable fencing as directed by the Employer's Representative should be provided.

4.8.16 The Contractor shall not disturb the ongoing activities of adjacent Institute, if any. It shall take care that its activities do not result in any kind of accidents, spread of any infection etc. in the campus. At the same time it shall as well ensure that its personnel are safe and do not get any infection from the hospital activities.

4.9 Quality Assurance The Contractor shall institute a quality assurance system / manual to demonstrate compliance with the requirements of the Contract. The system shall be in accordance

with the details stated in the Contract. The Employer shall be entitled to audit any aspect of the system. The Employer, at its sole discretion, may direct the Contractor to send the sample for quality check to any national or regional institution in respect of each of the sites. The system / manual should cover the following items as minimum :

i) Q.A. Plan for Basic Construction Materials indicating the details of tests to be undergone before use in works.

ii) Q.A. Plan for site activities indicating the details of tests to be conducted at the various stages of construction for various activities.

iii) In house/on site testing facilities to be developed for materials, site activities and calibration of equipments.

iv) Site documents to be maintained including records of results of tests for materials and workmanship, inventory record on availability of vital materials and their consumption vis-à-vis design requirements, site inspection records, quality audit record, safety audit record, site progress record, etc.

v) Check lists for source approval of materials etc., check lists for site activities and proforma for recording results of tests.

vi) Method statements for important construction activities.

Details of all procedures and compliance documents shall be submitted to the Employer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Employer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of its duties, obligations or responsibilities under the Contract.

4.10

Site Data

The Employer shall have made available to the Contractor for his information, prior to signing of the Contract, all relevant data in the Employer's possession in respect of the Site. Such relevant data shall be indicative only and not exhaustive.

The Contractor shall be responsible for verifying and interpreting all such data. The Employer shall have no responsibility for the accuracy, sufficiency or completeness of such data. The Employer reserves the right to obtain reports on soil testing or other site data from independent agencies, tally the same with the reports submitted by the Contractor and to appoint any committee comprising of such persons as may be decided by the Employer for determining the tolerance limit of variance and suggest necessary changes, which shall be binding on the Contractor.

The responsibility of Contractor under this sub-clause is full and final and no claim by the Contractor for additional payment or extension of time shall be allowed on the ground of any misunderstanding or misapprehension by the Contractor or that incorrect or insufficient information was given to the Contractor or that it failed to obtain correct and sufficient information.

4.11

Sufficiency of the Contract Price

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Contract Price.

Unless otherwise stated in the Contract, the Contract Price covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper planning, design, execution and completion of the Works and the remedying of any defects.

4.12 Unforeseeable Difficulties

Except as otherwise stated in the Contract:

(a) the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Works;

(b) by signing the Contract, the Contractor accepts total responsibility for having foreseen all difficulties and costs of successfully completing the Works; and

(c) the Contract Price shall not be adjusted to take account of any unforeseen difficulties or costs.

4.13 Rights of Way and Facilities

The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which it may require, including those for access to the Site. The Contractor shall also obtain, at its risk and cost, any additional facilities outside the Site which it may require for the purposes of the Works.

4.14 Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

The Contractor shall maintain a safe environment for patients, personnel and public around, if any.

The Contractor shall ensure that its employees do not leave the Site at any time without the permission of the Employer’s Representative.

The Contractor shall ensure that the vehicles, machines and equipments, which it

uses, are safe and do not cause any harm to patients, students, personnel or public around, if any.

All equipment shall operate under all conditions of load without any sound or vibration, which is objectionable and beyond the limits specified by the relevant laws. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed or annoyingly noticeable inside its own room shall be considered objectionable. The Contractor at its own expenses shall correct such conditions.

Existing roads and other public roads may be used by the Contractor at his risk and cost to carry out construction activities, with prior approval of the competent authority. The Contractor's heavy construction traffic or tracked equipment shall not travel on any public road or bridge, unless the Contractor has made arrangements with the authority concerned and has obtained the approval of the Employer's Representative to such arrangements. The Contractor shall include in his price the cost of strengthening any such public road or bridge if he considers it would be necessary. The Contractor shall repair any damage to the road or bear the cost thereof due to movement of contractor's plants and equipment, vehicles etc. to the specifications and satisfaction of road authorities as well as of Employer's Representative.

The Contractor shall plan transportation of construction materials to work site in accordance with traffic regulations enforced by local traffic authorities from time to time and in such a way that road accidents are avoided and minimum in convenience is caused.

No claim whatsoever shall be entertained on this account. The transportation of certain equipments and materials and launching may not be possible during day and may have to be carried out within time schedule specified by traffic police.

The Contractor must note that the Works at most of the sites have to be executed inside the premises of a working hospital. Hence no part of its works shall interfere or damage or cause harm to the existing activities of the neighbouring institute.

The Contractor shall ensure that the noise levels are not high and do not disturb the patients inside the hospital and academic activities.

Proper barricading shall be provided to ensure the safety of works and public.

4.15

Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

(a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;

(b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;

(c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route,

(d) the Employer does not guarantee the suitability or availability of particular access routes, and

(e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16 Transport of Goods and Products

Unless otherwise stated:

(a) the Contractor shall give the Employer not less than 21 days' notice of the date on which any Plant or a major item of other Goods or Products will be delivered to the Site;

(b) the Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and Products and other things required for the Works;

(c) the Contractor shall be responsible for making all transport arrangements and for payment of freight and insurance costs for the shipment and delivery of Goods and Products and other things required for the Works and

(d) the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods or Products, and shall negotiate and pay all claims arising from their transport.

4.17 Inspection of Goods and Products

All Goods and Products may be subjected to inspection and testing by the Employer or its designated representatives at all times and places including the period of manufacture and in any event prior to final acceptance by the Employer.

Neither the carrying out of any inspection of the Goods nor any failure to undertake any such inspections shall relieve the Contractor of any of their warranties or the performance of any obligations under the Contract.

For such Goods or Products as may be specified by the Employer from time to time, the Contractor has to obtain prior approval from the Employer’s Representative for selection

of any particular Make/Brand or any particular category/subcategory of such Make/Brand. If any Make/Brand or any category/ sub-category thereof is not available in the market, the Employer's Representative can add or substitute Make/Brand or any particular category/sub-category of such Make/Brand apart from that in the list at any stage during progress of the Works, but only upon due application in this respect from the end of Contractor corroborated by necessary documents. The decision in this regard taken by the Employer will be final and binding. Upon approval of the Make/Brand of medical equipment as specified in Schedule – I amongst the Products, the Contractor shall ensure that prior to supply of the said Products, the Contractor obtains Manufacturer's Authorization Form as per Form – 14 from the manufacturer of Products and provides the same to the Employer or causes the manufacturer to send the same directly to the Employer.

For Goods or Products supplied from within India:

a) For Goods or Products supplied from within India, the Employer retains the right to perform pre-shipment inspection at the manufacturer's premises, if necessary or any place where the Goods or Products have been commissioned and are currently in use and an independent quality control laboratory testing at its own cost.

b) The Employer will retain the right to perform further inspections and quality testing at any time till the satisfactory installation of Goods or Products, as it deems fit, at its own cost.

Should any inspected or tested Goods or Product fail to conform to the specifications, the Employer shall reject them and the Contractor shall replace the rejected Goods or Product free of cost to the Employer, within a period of 45 (forty-five) days or such other period as may be specified by the Employer, of intimating such rejection.

4.18. Acceptance and Rejection of Goods and Products

Under no circumstances shall the Employer be required to accept any Goods or Products that do not conform to the specifications of or requirements of the Contract. The Employer may accept the Goods or Product upon the successful completion of acceptance tests, as may be specified in the Contract or otherwise agreed in writing by the Parties. In no case shall the Employer be obligated to accept any Goods or Product unless and until the Employer has inspected the Goods or Products following commissioning of the Goods or Products in accordance with the requirements of the Contract. The Goods or Products shall be deemed to be accepted only after the Employer provides written acceptance.

Provided that, upon supply and installation of the Goods comprising the Works, the right of such Goods shall vest on the Employer and the Contractor will be the custodian of all such Goods till installation, commissioning and handing over to the Employer. The Contractor shall also execute notarised Indemnity Bond as provided in Form - 15 of Section – 4 (Bidding Forms) in favour of the Employer for Goods and Products, warranting the safety and security thereof and that it or its men and agents will not take

any steps for removal, defacement, disfiguring or destruction of such Goods or Products or any part thereof. Along with the Indemnity Bond in original, the Contractor shall submit along with the Goods or Products, the following documents: (a) Manufacture Test Certificate (b) Original Invoice of purchase of such Goods or Products (c) Material Receipt Note (signed in triplicate and containing the endorsement of the Employer's Representative, certifying delivery of such Goods or Products at site)

Notwithstanding any other rights of, or remedies available to, the Employer under the Contract, in case any of the Goods or Products are defective or otherwise does not conform to the specifications or other requirements of the Contract, the Employer may, at its sole option, reject or refuse to accept the Goods or Products, and the Contractor agrees promptly to replace such Goods or Products with Goods or Products of equal or better quality.

Provided that commissioning of the Goods or Products within the meaning of this GCC, will mean and shall be deemed to include obtaining necessary No Objection Certificates or clearances or approvals which may be required for operation of such Goods or Products.

4.19. Consumables relating to Goods

Consumables relating to electro-mechanical equipment (except diesel generator fuel) pertaining to the Goods shall be supplied by the Contractor at its own cost till the expiry of the Defects Liability Period.

4.20 Title

Unless otherwise expressly provided in the Contract, title in and to the Plants, Materials or Products shall pass from the Contractor to the Employer upon delivery of such Plants, Materials and Products and their acceptance by the Employer in accordance with the requirements of the Contract.

4.21 Warranties

Without limitation of any other warranties stated in or arising under the Contract, the Contractor warrants and represents that:

(a) The Goods or Products including all packaging and packing thereof, conform to the specifications of the Contract, are fit for the purposes for which such Goods or Products are ordinarily used and for the purposes expressly made known in writing by the Employer to the Contractor, and shall be of even quality, free from faults and defects in design, material, manufacture and workmanship under normal use in the conditions prevailing in the country of final destination;

(b) If the Contractor is not the original manufacturer of the Goods or Products, the Contractor shall provide the Employer with the benefit of all manufacturers warranties in addition to any other warranties required to be provided hereunder;

(c) The Goods or Products are of the quality, quantity and description required by the Contract;

(d) The Goods or Products are free from any right of claim by any third-party and

unencumbered by any title or other rights, including any liens or security interests and claims of infringement of any intellectual property rights, including, but not limited to, patents, copyright and trade secrets.

(e) Unless otherwise indicated in the Technical Specifications, this warranty shall remain valid for 3 (three) years after the Goods or Products have been commissioned at the final destination indicated in the Contract subject to issue of certificate regarding date of commissioning issued by the Employer.

(f) During the warranty, free comprehensive annual maintenance and repairs services including testing and calibration, labour and spares shall be provided by the Contractor during the period of warranty. If necessary, the Contractor shall engage qualified person to carry out maintenance, repair etc.

(g) If the Contractor, having been notified, fails to remedy the defect(s) within the stipulated period, the Employer may proceed to take such remedial action as may be necessary, at the Contractor's risk and expense and without prejudice to any other rights which the Employer may have against the Contractor under the Contract.

The Contractor shall visit each installation site as recommended in the manufacturer's technical/ service/ operational manual, but at least once in three months during the warranty period for preventive maintenance.

The Goods or Products shall be new and unused and remanufactured/ reconditioned/ demo Goods or Products will not be acceptable and undertaking of the manufacturer to this effect shall be submitted by the Contractor to the Employer. The Contractor shall remain responsive to the needs of the Employer for any services that may be required in connection with any of the Contractors warranties under the Contract. During any period in which the Contractors warranties are effective, upon notice by the Employer that the Goods or Products do not conform to the requirements of the Contract, the Contractor shall replace the defective Goods or Products with Goods or Products of the same or better quality or fully reimburse the Employer for the purchase price paid for the defective Goods or Products; and if having been notified by any means, the Contractor fails to replace the defective Goods or Products within 30 days or such other period as may be specified by the Employer. The Employer may proceed to take such remedial action as may be necessary, at the Contractors risk and expense and without prejudice to any other rights which the Employer may have against the Contractor under the Contract.

4.22 Comprehensive Maintenance Contract (Including Spare parts)

The Employer shall enter into Comprehensive Maintenance Contracts (CMC) with the Contractor/Supplier with respect to sanitary and plumbing system amongst the Works and electro-mechanical equipment amongst the Goods, three months prior to the completion of Warranty Period, for a period of 3 years after the expiry of the warranty period provided that entering into CMC by the Employer shall not relieve the Contractor of any warranty obligations under this Contract. Wherever the Technical Specifications

lay down a different period of CMC, this latter period shall prevail. The CMC will commence from the date of expiry of warranty period. The CMC includes preventive maintenance including testing & calibration as per technical/service/ operational manual, labour and spares.

The CMC includes repairs of entire system, preventive maintenance, testing and calibration, labour and spares and all software updates.

The Comprehensive Annual Maintenance and Repair Charges (after Warranty period) shall be paid quarterly in four equal installments.

Details of CMC requirements or otherwise, as spelt out in the Employer's Requirements, will prevail over those given in this Section.

4.23

Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works.

For any imported Contractor's Equipment or part thereof offered by the Contractor, it will have to make its own arrangements for import formalities and procurement of equipment without involving the Employer in any way for any clearance certificates /licenses /assistance.

The Employer may, at its sole discretion, assist (but is not obligated to) the Contractor, where required, in obtaining clearance through the Customs for Constructional Plant, Materials and other things required for the Works.

The Contractor shall obtain all permits / licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

4.24

Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of its operations.

The Contractor shall maintain ecological balance by preventing deforestation, water pollution and defacing of natural landscape. The Contractor shall so conduct its construction operations as to prevent any avoidable destruction, scarring or defacing of natural surrounding in the vicinity of work. In respect of ecological balance, the Contractor shall observe the following instructions for which no extra payments will be made.

(a) Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary Works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All work areas shall be smoothened and graded in a manner to conform to natural appearance of the landscape as directed by the Employer's Representative.

(b) All trees and shrubbery, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by Contractor's construction operations and equipment or by their Employees/Workers. The removal of trees or shrubs will be permitted only after prior approval of the Employer's Representative. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Employer's Representative. Trees shall not be used for anchorage. The Contractor shall be responsible for injuries to trees and shrubs caused by his operations and Employees/Workers. The terms "injury" shall include, without limitation, bruising, scarring, tearing and breaking of roots, trunks or branches. All injured trees and shrubs shall be restored as nearly practicable, without delay, to their original condition at Contractor's expense.

(c) Where trees have to be necessarily cut for progressing temporary or permanent works, the Contractor shall arrange for compensatory afforestation as may be required by Environmental Rules and Regulations.

(d) In the conduct of construction activities and operation of equipments, the Contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize air/ noise pollution.

(e) Excessive emission of dust into the atmosphere will not be permitted during manufacture, handling and storage of concrete aggregates/fly ash/ earth/building materials and the Contractor shall use such methods and equipment as are necessary for collection and disposal or prevention of dust during these operations. The Contractor's method of storing and handling cement shall also include means of eliminating atmospheric discharge of dust. Equipment and vehicles that give objectionable emission of exhaust gases shall not be operated. Burning of materials resulting from cleaning of trees branches, combustible construction materials and rubbish may be permitted only when atmospheric conditions for burning are considered favourable.

(f) Special care must be exercised in ensuring that the labour housed in labour camp within the work site area do not indulge in any activity like drinking alcohol, taking drugs, etc, and other activities that may affect the ecological balance such as cutting of shrubs for fuel, creating open air nuisance etc.

The Contractor shall not cut or destroy any tree in the campus to the maximum extent possible. In case any tree is to be cut he shall obtain prior permission from the competent authority under the relevant laws and shall plant equal number of saplings or adhere to the requirements of the prevailing Environmental laws / terms of the permission, whichever is more stringent. The Employer may assist the Contractor in obtaining such permission, including signing necessary documents. The Contractor shall use all means to minimize the effluents from its construction work and

transportation activity or any other activity in the course of the execution of the Works.

The Contractor shall take necessary steps for installation of grid connected roof-top solar photovoltaic systems of 50 KW capacity as per “Alo Shree” programme of the Government of West Bengal, in all the buildings forming part of the Project, to make the Project self-sustaining in utilization of power.

The Contractor shall also make necessary provisions for rain water harvesting in each Project site, set up Water Treatment Plant and Sewerage Treatment Plant as specified under Section – 5 (Employer’s Requirements) and ensure that the buildings constructed do fall under the category of Green buildings as per the applicable rules in the State of West Bengal and that the buildings are energy efficient as far as possible.

4.25

Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services it may require.

4.26

Employer’s Equipment

The Employer shall not supply any material, tools, plant, machinery or equipment. The Contractor has to arrange all tools, plant, equipment as well as construction materials required for the work.

4.27

Progress Report

Unless otherwise stated, fortnightly progress reports shall be prepared by the Contractor and submitted to the Employer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted fortnightly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

(a) charts and detailed descriptions of progress, including each stage of design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trial operation;

(b) photographs and videographs showing the status of manufacture and of progress on the Site;

(c) for the manufacture of each main item of Plants and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of;

  (i) commencement of manufacture,

  (ii) Contractor's inspections,

  (iii) tests,

  (iv) shipment and arrival at the Site, and

  (v) installation

(d) the details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment];

(e) copies of quality assurance documents, test results and certificates of Materials;

(f) list of Variations, notices given under Sub-Clause 2.4 [Employer's Claims] and notices given under Sub-Clause 20.1 [Contractor's claims];

(g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

(h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.28

Security of the Site

(a) the Contractor shall be responsible for keeping unauthorised persons off the Site, and

(b) authorised persons shall be limited to the Contractor's Personnel and the Employer's Personnel; and to any other personnel notified to the Contractor, by (or on behalf of) the Employer, as authorised personnel of the Employer's other contractors on the Site.

4.29

Contractor's Operations on Site

The Contractor shall confine its operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Employer as working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required. All surface and sub-soil drains at the site shall be maintained in a clean, sound and satisfactory state of performance.

Upon the issue of the Taking-Over Certificate for the Works, the Contractor shall clear away and remove all Contractor's Equipments, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfill obligations under the Contract.

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4.30

Watching and Lighting

The Contractor shall in connection with the Works, provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or as required by the Employer's Representative or by any duly constituted authority, for the protection of the Works, or for the safety and convenience of the public or others.

4.31

Way leaves etc.

The Contractor shall bear all costs and charges for special or temporary way leaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional accommodation outside the Site required by him for the purposes of the Works.

4.32

Office for the Employer

The Contractor will provide free of cost furnished accommodation for the Employer's Representative and its staff, at the site of work, in terms of Section- 5 (Employer's Requirements).

4.33

Fossils, Discoveries Items of Value

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Employer, who shall issue instructions for dealing with it and shall take step in accordance with law upon intimating the competent authority. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and after receiving this further notice, the Employer shall proceed in accordance with Sub- Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor must note that the Project may involve some items of demolition. If during such works, the Contractor finds any items of salvage value, which can be sold, it shall indicate the same in the fortnightly progress report submitted to the Employer and sell it off only after the approval from the Employer. The Contract shall be solely entitled to the sale proceeds of such items of salvage value and/ or debris accumulated during demolition and/ or construction works in the Site and neither the Employer nor any Government instrumentality can lay its claim to such sale proceeds.

4.34 Production of Vouchers etc by the Contractor

The Contractor shall, whenever required produce or cause to be produced for examination by the Employer's Representative any quotation, invoice, cost or other account, book of accounts, voucher, receipt, letter, memorandum, paper of writing or any copy of or extract from any such document and also furnish information and returns verified in such manner as may be required in any way relating to the execution of this Contract or relevant for verifying or ascertaining cost of execution of this Contract and the decision of the Employer's Representative on the question of relevancy of any documents, information or return being final and binding on the parties. The Contractor shall similarly produce vouchers etc. if required to prove to the Employer's Representative that the materials supplied by him, are in accordance with the specifications laid down in the Contract.

The obligations imposed by the Employer as above are without prejudice to the obligations of the Contractor under any statute, rules or orders binding on the Contractor.

5
Design
5.1
General Design
Obligations

The Contractor shall be deemed to have scrutinised the Employer's Requirements (including design criteria and calculations, if any). The Contractor shall be responsible for the design of the Works and for the accuracy of such Employer's Requirements (including design criteria and calculations), except as stated below.

The Employer shall not be responsible for any error, inaccuracy or omission of any kind in the Employer's Requirements as originally included in the Contract and shall not be deemed to have given representation of accuracy or completeness of any data or

information, except as stated below, Any data or information received by the Contractor, from the Employer or otherwise, shall not relieve the Contractor from his responsibility for the design and execution of the Works.

The Contractor shall submit its structural drawing upto plinth level and concept architectural design as vetted by the institutions recommended by the Employer and make a Microsoft Power Point presentation to the Employer or its designated representatives or the approval authority within 35 days from the date of issue of Letter of Acceptance / Notification of Award.

If the Employer's Representative has reasonable cause for being dissatisfied with the Contractor's drawings or documents the Employer shall, within a period of 14 days from the date of submission, require the Contractor in writing to make such amendments thereto as the Employer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended drawings or documents for the Employer's approval for the execution of Works within the next 7 days. The Employer shall then intimate the Contractor its in-principle approval to such amended drawings or documents within the next 7 days. The Employer, at its sole discretion may approve such design, drawing or documents in a phased manner so as to expedite the Works.

No extension of time or extra payment shall be given to the Contractor to comply with the above.

Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Employer has previously notified its consent, the Contractor shall, at its own expense, make such alterations or additions as, in the opinion of the Employer, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Employer.

In no circumstances, the Contractor shall commence the construction work beyond 75 days from the date of Notification of Award / Letter of Acceptance.

5.2

Contractor's Documents The Contractor's Documents shall comprise the technical documents specified in the Employer's Requirements, documents required to satisfy all regulatory approvals, and the documents described in Sub-Clause 5.6 [As-Built Documents] and Sub-Clause 5.7 [Operations Maintenance and Service Manuals] and shall include the following :

(a) Detailed drawings including the structural working drawings, architectural working drawings, electrical working drawing including air-conditioning, fire fighting, medical gas pipeline lay out plan, drainage, pavement drawing, sanitary and water supply, bio-medical waste disposal etc.
(b) Consolidated statement in a tabular form for the Standards and Specifications being followed in the design and for materials to be used including that for flooring, internal and external finishes
(c) List of suppliers from whom the materials are proposed to be procured

(d) Tests required to be carried out in the Contract
(e) Outline safety plan for the site and an outline quality plan

Unless otherwise stated in the Employer's Requirements, the Contractor's Documents shall be written in English only.

The Contractor shall include in his design, in additions to space and operational needs, considerations of provisions for infection control, life safety, and protection of affected person during construction and the progress of the Project as detailed out in Employer's Requirements.

The Contractor shall also include in his design provision of landscaping, parking and setting things back into the shape as the original as said in Employer's Requirements.

The Contractor shall satisfy himself that the Design Data, in the case of submissions up to and including the proposed Design, comply with the Employer's Requirements and is in accordance with, and incorporates the Contractor's Technical Proposals.

In the case of submissions subsequent to the proposed Design, the Design Data shall be in accordance with Employer's Requirements and the accepted Design.

The Contractor shall prepare all Contractor's Documents, and shall also prepare any other documents necessary to instruct the Contractor's Personnel.

If the Employer's Requirements describe the Contractor's Documents which are to be submitted to the Employer for review, they shall be submitted accordingly, together with a notice as described below. In the following provisions of this Sub-Clause, (i) "review period" means the period required by the Employer for review, and (ii) "Contractor's Documents" exclude any documents which a required to be submitted for review.

Unless otherwise stated in the Employer's Requirements, each review period shall not exceed 21 days, calculated from the date on which the Employer receives a Contractor's Document and the Contractor's notice. This notice shall state that the Contractor's Document is considered ready, both for review in accordance with this Sub-Clause and for use. The notice shall also state that the Contractor's Document complies with the Contract, or the extent to which it does not comply.

The Employer may, within the review period, give notice to the Contractor that a Contractor's Document fails (to the extent stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted and reviewed in accordance with this Sub-Clause, at the Contractor's cost.

For each part of the Works, and except to the extent that the Parties otherwise agree:

(a) execution of such part of the Works shall not commence prior to the expiry of the review periods for all the Contractor's Documents which are relevant to its design and execution;

(b) execution of such part of the Works shall be in accordance with these Contractor's Documents, as submitted for review; and

(c) if the Contractor wishes to modify any design or document which has previously been submitted for review, the Contractor shall immediately give notice to the Employer. Thereafter, the Contractor shall submit revised documents to the Employer in accordance with the above procedure.

Any such agreement (under the preceding paragraph) or any review (under this Sub-Clause or otherwise) shall not relieve the Contractor from any obligation or responsibility.

5.3

Contractor's Undertaking The Contractor undertakes that the design, the Contractor's Documents, the execution and the completed Works will be in accordance with:

(a) the Laws in the Country, and

(b) the documents forming the Contract, as altered or modified by Variations.

5.4

Technical Standards and Regulations

The design, the Contractor's Documents, the execution and the completed Works shall comply with the Country's technical standards, building, construction and environmental laws, Laws applicable to the product being produced from the Works, and other standards specified in the Employer's Requirements, applicable to the Works, or defined by the applicable Laws.

All these Laws shall, in respect of the Works and each Section, be those prevailing when the Works or Section are taken over by the Employer under Clause 10 [Employer's Taking Over].

If changed or new applicable standards come into force in the Country after the Letter of Acceptance/ Notification of Award, the Contractor shall give notice to the Employer and (if appropriate) submit proposals for compliance. In the event that:

(a) the Employer determines that compliance is required, and

(b) the proposals for compliance constitute a variation,

then the Employer shall initiate a Variation in accordance with Clause 13 [Variations and Adjustments].

In the case of any class of work for which there is no such specification as referred to in Sub-Clause 5.2 above, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case, there is no such specification in Bureau of Indian Standards, the work shall be carried out as per manufacturer's specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Employer's Representative.

5.5

Training

The Contractor shall carry out the training of Employer's Personnel in the operation and maintenance of the Works to the necessary staffs and/or employees of the Employer, as may be indicated by the Employer in writing within 30 days of installation of the equipments. The Contractor shall also provide relevant manual of each of the equipments. If the Contract specifies training which is to be carried out before taking-over, the Works shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until this training has been completed. During each preventive maintenance service, training to be imparted to the Employer's staff, as may be specified by the Employer.

5.6

As-Built Documents

The Contractor shall prepare, and keep up-to-date, a complete set of "as-built" 'records of the execution of the Works, showing the exact as-built locations, sizes and details of the work as executed. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Six copies shall be supplied to the Employer prior to the commencement of the Tests on Completion.

In addition, the Contractor shall supply to the Employer as-built drawings of the Works, showing all Works as executed, and submit them to the Employer for review under Sub-Clause 5.2 [Contractor's Documents]. The Contractor shall obtain the consent of the Employer as to their size, the referencing system, and other relevant details.

Prior to the issue of any Taking-Over Certificate, the Contractor shall supply to the Employer the specified numbers and types of copies of the relevant as-built drawings, in accordance with the Employer's Requirements, The Works shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until the Employer has received these documents.

5.7

Operation,

Maintenance and Service

Manuals

Prior to commencement of the Tests on Completion, the Contractor shall supply to the Employer provisional operation, maintenance and service manuals (both in physical and electronic copies) in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Plant.

The Works shall not be considered to be completed for the purposes of Taking Over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until the Employer has received final operation and maintenance manuals in such detail, and any other manuals specified in the Employer's Requirements for these purposes.

5.8

Design Error

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's Documents, they and the Works shall be corrected at the Contractor's cost, notwithstanding any consent or approval under this Clause.

6 Staff and Labour

6.1 Engagement of Staff and Labour

The Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, housing, feeding and transport.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work; is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor. The Contractor must familiarize himself and comply with relevant labour laws like Minimum Wages Act, 1948 and Contract Labour (Regulation and Abolition) Act, 1970, etc. No extra payment whatsoever shall be made to the Contractor to comply with the rules and laws.

6.3 Persons in the Service of Others

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside normal working hours, unless:

(a) otherwise stated in the Contract,

(b) the Employer gives consent, or

(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Employer.

Where work is permitted outside normal working hours by the Employer's Representative to facilitate the Contractor's operations, temporary lighting equipment as per approved layout shall be provided, installed, maintained for the duration of the

contract and removed after completion of work by and at the expense of the Contractor.

No extra payment will be made to the Contractor for the provision of temporary lighting and fire prevention measures.

6.6

Facilities for Staff and Labour

The Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Employer's Requirements. The Contractor at his cost shall maintain all accommodation in a clean and sanitary condition.

The Contractor shall hot permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

The Contractor shall prepare and submit compliance reports of adherence to labour laws as and when desired by the Employer's Representative.

6.7

Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Employer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Employer may reasonably require.

6.8

Contractor's Superintendence

Throughout the design and execution of the Works, and as long thereafter as is necessary to fulfill the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.

Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and

Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9
Contractor's Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Employer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

(a) persists in any misconduct or lack of care,

(b) carries out duties incompetently or negligently,

(c) fails to conform with any provisions of the Contract, or

(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.10
Records of Contractor's Personnel and Equipment

The Contractor shall submit, to the Employer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Employer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

6.11
Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12
Removal from Site of Undesirable Person

The Employer's Representative may require the Contractor to dismiss or remove from the site of the work any person or persons in the Contractor's employ upon the work who may be incompetent or misconduct himself and the Contractor shall forthwith comply with such requirements.

6.13
Unauthorised Occupation of Buildings during Construction

It shall be the responsibility of the Contractor to see that the buildings under construction is not occupied by anybody unauthorisedly during construction, and is handed over to the Employer's Representative with vacant possession of complete buildings. If such buildings though completed is occupied illegally, then the Employer's

Representative shall have the option to refuse to accept the said buildings/ buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay a levy upto 5% of tendered value of work may be imposed by the Employer's Representative whose decision shall be final both with regard to the justification and quantum and be binding on the Contractor.

However, the Employer's Representative, through a notice, may require the Contractor to remove the illegal occupation any time on or before construction and delivery.

Nothing in Clause 6.13 as stated hereinabove, shall be deemed to restrict or limit the right of the Employer to forcibly evict the illegal occupants by taking recourse of proceedings as per the applicable Laws and initiation of proceedings for evicting such unauthorised occupants shall under no circumstances take away any of the rights of the Employer, as provided in Clause 6.13 above.

7

Plant, Materials, and Workmanship

7.1

Manner of Execution

The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:

(a) in the manner (if any) specified in. the Contract,
(b) in a proper workmanlike and careful manner, in accordance with recognised good practice, and;
(c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

7.2

Samples

The Contractor shall submit samples to the Employer, for review in accordance with the procedures for Contractor's Documents described in Sub-Clause 5.2 [Contractor's Documents], as specified in the Contract and at the Contractor's cost. Each sample shall be labelled as to origin and intended use in the Works.

7.3

Inspection

The Employer's Personnel shall at all reasonable times:

(a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and:

(b) during production, manufacture and construction (at the Site and, to the extent specified in the Contract, elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plants and production and manufacture of Materials.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

In respect of the work which Employer's Personnel are entitled to examine, inspect, measure and/or test, the Contractor shall give notice to the Employer whenever any such work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Employer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Employer does not require to do so. If the Contractor fails to give the notice, it shall, if and when required by the Employer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

7.4

Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

The Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the relevant tests as per IS Code efficiently. The Contractor shall agree, with the Employer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Employer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contract varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Employer shall give the Contractor not less than 24 hours' notice of the Employer's intention to attend the tests. If the Employer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the

Employer, and the tests shall then be deemed to have been made in the Employer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion].

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Employer duly certified reports of the tests. When the specified tests have been passed, the Employer shall endorse the Contractor's test certificate, or issue a certificate to the Contractor to that effect. If the Employer has not attended the tests, it shall be deemed to have accepted the readings as accurate.

7.5
Rejection

If, as a result of an examination, inspection, measurement or testing, any Plants, Materials, Goods design or workmanship is found to be defective or otherwise not in accordance with the Contract, the Employer may reject the Plants, Materials, Goods, design or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Employer requires this Plant, Materials, Goods, design or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.4 [Employer's Claims] pay these costs to the Employer.

7.6
Remedial Work

Notwithstanding any previous test or certification, the Employer may instruct the Contractor to:

(a) remove from the Site and replace any Plant or Materials or Goods which is not in accordance with the Contract,

(b) remove and re-execute any other work which is not in accordance with the Contract, and

(c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

If the Contractor fails to comply with any such instruction, which; complies with Sub-Clause 3.4'[Instructions], the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been

entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.4 [Employer's Claims] pay to the Employer all costs arising from this failure.

7.7

Ownership of Plant and Materials

Each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer, free from liens and other encumbrances, when it is delivered to the Site.

7.8

Royalties

Unless otherwise stated in the Employer's Requirements, the Contractor shall pay all royalties, rents and other payments for:

(a) natural Materials obtained from outside the site, and

(b) the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8

Commencement, Delays and Suspension

8.1

Commencement of Works

(a) The date of commencement of the Works shall be the date of the handing over possession of the Site.

(b) The Contractor shall however commence the design and execution of the Works as soon as is reasonably practicable after the date of Letter of Acceptance / Notification of Award and shall then proceed with the Works with due expedition and without delay.

However, under no circumstances, commencement of Works shall be delayed on the guise of any site clearance or relocation of services.

8.2

Time for Completion

Time for Completion of the entire project is 24 months.

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

(a) achieving the passing of the Tests on Completion, and

(b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of Taking Over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3

Programme

Activities in the initial works program would be arranged as per the Works Break Down Structure (WBS) of the work developed by the Contractor in consultation with and approved by the Employer's Representative.

As soon as possible after the Contract is concluded the Contractor shall submit a Net Work (PERT/CPM) Time and Progress Chart for each activity and milestone and get it approved by the Employer's Representative. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the Works. It shall indicate sequence of various activities of the phased requirement of Plants and Equipments to be deployed by the Contractor, the forecast of the dates of commencement and completion of various trades of sections of the Works and may be amended as necessary by agreement between the Employer's Representative and the Contractor within the limitations of time imposed in the Contract documents and further to ensure good progress during the execution of the Works, the Contractor shall in all cases in which the time allowed for any Works, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per milestone**s** approved by the Employer**.**

After the work has started, the Contractor shall deliver in every fortnight to the Employer an update of the construction programme showing changes, if any, in planning or progress scheduling and reflecting the progress of all the activities of the network and the project status as at the end of previous month.

If the Contractor falls behind the approved construction programme by more than one month, he shall, within fourteen days of the date of such information, submit for approval, a revision of the construction programme showing the proposed measures, including augmentation of plant, labour and material resources to complete the works on time.

Whenever the Contractor proposes to change the construction program he shall immediately advise the Employer's Representative in writing and, if the Employer's Representative considers the change a major one, the Contractor shall submit a revised program for approval.

Detailed Network Plan (Works Programme)

The Employer's monitoring team will have access to all the data/information of the Contractor, required for the assessment of the progress and monitoring. If necessary, the monitoring team will visit the Vendor/Contractor's works in order to assess the status of critical activities.

The Employer will hold periodic Project Status Review Meetings. The Contractor shall depute his Engineers/Managers at appropriate level as decided by the Employer to attend the Review Meetings.

The Contractor shall provide additional inputs whenever there is a possible slippage in the completion schedule. Such additional inputs may require supplementing of equipment, personnel, work in excess of the normal work per day, and work in excess of the normal work per week or other resources. Provisions under Sub-Clause 8.7 will be applicable in cases of delays due to the Contractor.

8.4 Execution of Work

8.4.1 Mobilisation

Period of Mobilisation shall be 14 days counting from the stipulated date of start of work as mentioned in Letter of Acceptance/ Notification of Award by the Employer's Representative. The Contractor shall carry out following activities within this period stated. It shall submit to the Employer's Representative within the same 14 day period, the stipulated date of start, the proposed layout of locating offices, stores, godowns, yards, water, electric network etc. for approval of the Employer's Representative.

Minimum following activities shall be completed within the mobilization period of 1 4 days or such extended period as approved by the Employer's Representative.

- Site office of the Contractor
- Line out including establishing of grid line levels and its approval from the
- Employer's Representative.
- Tapping electric and water connections
- One cement godown and steel yard
- Obtaining insurance policies as per the Contract
- Obtaining labour licences, as required
- Obtaining approval of local authorities and complying with any statutory requirements prior to actual start of Work.
- Establishing water and electric network within site.
- Submitting construction programme as detailed in Sub-Clause 8.3 and its approval by the Employer's Representative.

8.4.2 Setting out of Works

The Contractor shall be responsible for the true and proper setting-out of the Works in relating to original points, lines and levels of reference given by the Employer's Representative in writing and for the correctness, subject as above mentioned, of the position, levels, dimension and alignment of all parts of the Works and for the provision of all necessary instruments, appliances and labour in connection therewith. If, at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Employer's Representative shall, at his own cost, rectify such error to the satisfaction of the Employer's Representative. The checking of any setting-out or of any line or level by the Employer's Representative shall not in any way relieve the Contractor of his responsibility for

the correctness thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the works. The Contractor shall use latest equipments like Total Station/Theodolite and Auto level etc for setting out the Works.

8.4.3 Deleted.

8.4.4 Temporary Works

8.4.4.1 The Contractor is entirely responsible for the design, construction, maintenance and removal of all Temporary Works employed in carrying out the Contract. Within a reasonable time (and in any case not less than 15 days) before it intends to commence construction of any temporary works, the Contractor shall submit full particulars including drawings of the same, for the approval of the Employer's Representative. The Employer's Representative's approval will in no way relieve the Contractor of its responsibility for the safety of the Works, operators, adjoining property, structures or services and compliance with appropriate regulations and codes of practice. Documents for temporary works supporting adjoining buildings, property and public utilities and roads shall also be submitted to the appropriate authority for their approval if requested /required.

8.4.4.2 The Temporary Works shall be designed and constructed in such a manner as to enable the permanent structures to be built around them without detriment to their effectiveness and due allowance will be deemed to have been made for all necessary adjustments thereto to enable the Works to proceed.

8.4.4.3 Timber shoring, boards, struts or similar items shall not be left in position upon completion of the Works without the written consent of the Employer's Representative.

8.4.4.4 All services or utilities on or adjoining the site which are required to be maintained operational shall be protected from movement, subsidence or damage from any cause whatsoever by adequate temporary props, struts, shores and protective screens to the approval of the Employer's Representative and the agent of the service or utility.

8.4.4.5 The Contractor shall make safe and reinstate all areas affected by temporary works.

8.4.4.6 The Contractor shall use properly designed and manufactured steel staging platforms for carrying out work above 3.0 m height. All required staging for supporting, centering, shuttering of beams, slab, masonry work, etc. shall be carried out strictly as per the Supplier's instructions or approved arrangement. It is to be noted that designing of such work shall be carried out by the Contractor and shall be submitted for approval of the Employer's Representative. No work above 3.0 m shall be permitted without compliance of this condition.

8.4.5 Plant, Temporary Works & Materials - Exclusive Use

All constructional plants, temporary works and materials provided by the Contractor shall, when brought on to the site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the site to another, without the consent, in writing, of the Employer's Representative, which shall not be unreasonably withheld.

8.4.6 Use of Site only for Works

The Contractor shall not use any portion of the Site for purpose not connected with the Works without the prior written approval of the Employer's Representative. He shall maintain permanent and Site access roads free of spillage and shall not interfere with the flow of traffic. Also same shall apply to terraces and other developed areas.

8.4.7 Name Board at Site

The Contractor shall prepare and display name board at site as per design approved by the Employer's Representative. It shall have

- Name of Works
- Name of Employer
- Name of Consulting Architect (if any)
- Name of Project Management Consultant (if any)
- Name of Contractor

8.4.8 Site Drainage/Cleaning/Nuisance

8.4.8.1 All water which may accumulate on the Site during the progress of the works or in trenches and excavation, shall be removed from the site to the satisfaction of the Employer's Representative at the Contractor's cost.

8.4.8.2 The Site shall be maintained free from rubbish. Proper stacking of scaffolding materials, shuttering material, bricks/brick bats, steel pieces, etc. needed for work on day to day basis shall be organized. Heaps in unplanned manner and disorderly fashion shall not be permitted. The Employer's Representative's decision in this matter shall be final.

8.4.8.3 The Contractor shall not, at any time, cause or permit any nuisance on the Site or do anything which shall cause unnecessary disturbance or inconvenience to the Employer, tenants or occupants of other properties near the site and to the public in general.

8.4.9 Disposal of Rubbish

(i) The Contractor shall cart away from Site and deposit where directed by the Employer's Representative all refuse, etc. arising from the Works both as it accumulates and at completion of the Works at the direction of the Employer's Representative.

(ii) It is the responsibility of the Contractor to obtain a certificate from the local authorities concerned to the effect that all rubbish arising out of Contractor's activities at the construction site or any other offsite activities borrow pits and/or disposal area (s) has been properly disposed off.

8.4.10 Shift Working

The Contractor shall be allowed to work in three shifts with prior approval of the Employer's Representative.

8.4.11 Urgent Repairs

If, by reason of any accident or failure, or other event occurring to, in, or in connection with the Works or any part thereof, either during the execution of the Works or during the period of Maintenance, any remedial or other work or repair shall, in the opinion of the Employer's Representative, be urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the Employer's Representative may consider necessary. If the Work or repair so done by the Employer is work which, in the opinion of the Employer's Representative, the Contractor was liable to do at his own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the Contractor by the Employer or may be deducted by the Employer from any moneys due or which may become due to the Contractor. Provided always that the Employer's Representative, shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.

8.4.12 Contractor to search

The Contractor shall, if required by the Employer's Representative in writing, search under the directions of the Employer's Representative for the cause of any defect, imperfection or fault appearing during the progress of the Works or within the Period of Maintenance (Defect Liability Period). If such defect, imperfection or fault shall be one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and it shall in such case repair, rectify and make good such defect, imperfection or fault at its own expense in accordance with the provisions of Clause 17 hereof.

8.5
Extension of Time for

Completion

The Contractor at the discretion of the Employer may be granted subject to Sub-Clause 20,1 [Contractor's Claims] an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:

(a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]),

(b) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors on the Site.

If the Contractor is of the opinion that it should be allowed an extension of the Time for Completion, the Contractor shall give notice to the Employer in accordance with Sub-Clause 20.1 [Contractor's Claims] pointing out the grounds for such extension. Extension of Time shall only be granted by the Employer, if the Employer's find the grounds to be reasonable and acceptable. When determining each extension of time under Sub-Clause 20.1, the Employer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.6

Rate of Progress

If, at any time:

(a) actual progress is too slow to complete within the Time for Completion, and/or

(b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme],

other than as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Employer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Employer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.4 [Employer's Claims] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 below.

8.7

Delay Damages

If the Contractor fails to maintain the required progress in terms hereof, or to complete the work and clear the site on or before the Date for Completion or extended date of completion, it shall, without prejudice to any other right or remedy available under the law to the Employer on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below.

This will also apply to items or group of items for which a separate period of

completion has been specified.

Compensation for delay of work @1.50% of tendered value per month of delay to be computed on per day basis.

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the tendered value of work or of the tendered value of the item or group of items of work for which a separate period of completion is originally given.

The penalty shall not relieve the Contractor from his obligation to complete the Works or from any other of its obligations and liabilities under the Contract.

The Contractor shall co-ordinate his program to the extent feasible with the program of other Contractors to be engaged at the Site or in the vicinity of the Site as furnished by the Employer's Representative so that the project can be completed in time as per the overall programme.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other Contract with the Employer. In case, the Contractor does not achieve a particular milestone as approved by the Employer or the rescheduled milestone(s), the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the Contractor. However, if the Contractor catches up with the progress of Work on the subsequent milestone(s), the withheld amount shall be released. In case the Contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

8.8 Suspension of Work

The Employer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Employer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9 and 8.11 shall not apply.

8.9 Consequences of Suspension

If the Contractor suffers delay for complying with the Employer's instructions under Sub-Clause 8.8 [Suspension of Work], and/or from resuming the work, the Contractor shall give notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and

After receiving this notice/the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

8.10

Compliance with Norms

The Contractor is to ensure that full compliance of the norms of Medical Council of India (MCI) or any such apex statutory authority regulating medical education in India, as applicable on the date of submission of bid for the Academic Block (including the internals thereof) with an intake capacity of 150 MBBS students and 100 students for hostels and intern quarters and other structures. The Employer shall determine whether the Academic Block and the other sections of the medical colleges are in total compliance with the norms of MCI or such apex statutory authority and such findings of the Employer shall be binding on the Contractor.

8.11

Prolonged Suspension

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Employer's permission to proceed. If the Employer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Employer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.12

Resumption of work

After the permission or instruction to proceed is given, the Parties shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension.

8.13

Damages for Products

Save and except as provided elsewhere in the Conditions, the Contractor shall ensure that at no point of time, any Products are non-functional beyond 7 days of intimation of such non-functionality from the end of the Employer. In case the Products are found to be non-functional beyond a period of 7 days, the following delay damages shall be applicable on per diem basis beyond the period of 7 days:

(a) Products whose value is below INR 10,000/- : INR 300/- per extra day
(b) Products whose value is above INR 10,000/- but below INR 1,00,000/- - INR 500/- per extra day
(c) Products whose value is above INR 1,00,000/- but below INR 10,00,000/- - INR 1,000/- per extra day
(d) Products whose value is above INR 10,00,000/- - INR 3,000/- per extra day

9

Tests on Completion

9.1

Contractor's Obligations The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4, [Testing] after providing the documents in accordance with Sub-Clause 5.6 [As-Built Documents] and Sub-Clause 5.7 [Operation and Maintenance Manuals] including tests prescribed in NBC 2005 & IS and / or instructed by Employer's Representative.

The Contractor shall give to the Employer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Employer shall instruct.

The Tests on Completion shall be carried out in the following sequence:

(a) pre-commissioning tests, which shall include the appropriate inspections and ("dry" or "cold") functional tests to demonstrate that each item of Plants or Materials can safely under-take the next stage, ;

(b) commissioning tests, which shall include the specified operational tests to demonstrate that the Works or Section can be operated safely and as specified, under all available operating conditions; and

(c) trial operation, which shall demonstrate that the Works or Section perform reliably and in accordance with the Contract.

During trial operation, when the Works are operating under stable conditions, the Contractor shall give notice to the Employer that the Works are ready for any other Tests on Completion, including performance tests to demonstrate whether the Works conform to the criteria specified in the Employer's Requirements and with the Performance Guarantees.

Trial operation shall not constitute a taking-over under Clause 10 [Employer's Taking Over]. Any product produced by the Works during trial operation shall be the property of the Employer.

In considering the results of the Tests on Completion, appropriate allowances shall be made for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed each of the Tests on Completion described in sub-paragraph (a), (b) or (c), the Contractor shall submit a certified report of the results of these Tests to the Employer.

9.2

Delayed Tests If the Tests on Completion are being unduly delayed by the Contractor, the Employer may by notice require the Contractor to carry out the Tests within 21 days after

receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which it shall give notice to the Employer.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. These Tests on Completion shall then be deemed to have been parried but in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3
Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Employer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4
Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Failure to Pass Tests on Clause 9.3 [Retesting], the Employer shall be entitled to:

(a) order further repetition of Tests on Completion under Sub-Clause 9.3;

(b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or

(c) issue a Taking-Over Certificate.

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.4 [Employer's Claims] and Sub-Clause 3.5 [Determinations].

10
Employer’s Taking Over

10.1
Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-

Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Employer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section. If such Sections comprise of supply, installation, commissioning and testing of any Goods, such taking over by Employer can only take place, once the Contractor obtains necessary certification from the appropriate authorities (as may be necessary), as per applicable laws.

The Employer shall, within 28 days after receiving the Contractor's application:

(a) issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or

(b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Employer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works due to Default of the Contractor and Recovery of Additional Cost

Parts of the Works (other than Sections) shall not be taken over or used by the Employer, except as may be stated in the Contract or as may be agreed by both Parties.

If Contractor:

i) At any time makes default during currency of work or does not execute any part of the work with due diligence and continues to do so even after a notice in writing of 7days in this respect from the Employer’s Representative; or

ii) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 7 days even after a notice in writing is given in that behalf by the Employer’s

Representative; or

iii) Fails to complete the work(s) or items of work with individual dates of completion, on or before the date (s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Employer's Representative

the Employer's Representative on behalf of the Employer, without prejudice to any other right or remedy against the Contractor which have either accrued or accrue thereafter to the Employer, by a notice in writing to take the part work / part incomplete work of any item (s) out of his hands and shall have powers to:

a) Take possession of the site and any materials, constructional plant, implements, stores etc., thereon; and / or

b) Carry out the part work / part incomplete work of any item (s) by any other Agency.

In such an event, the Contractor shall be liable for loss / damage suffered by the Employer because of action under this clause and to compensate for this loss or damage, the Employer shall be entitled to recover a sum equivalent to 20% of the value of the part work / part incomplete work so taken away subject to a maximum limit of 10% of the tendered value of the work.

The value of the work taken away shall be calculated for the items and Quantities taken away, at the Contract rates including price variation as applicable on the date when notice in writing for taking away part work, was issued to the Contractor. The Contractor from whom part work is being taken out, shall not be allowed to participate in the tendering process for carrying out such work.

The amount to be recovered from the Contractor as determined above, shall, without prejudice to any other right or remedy available to the Employer as per law or as per agreement, will be recovered from any money due to the Contractor on any account, and if such money is insufficient, the Contractor shall be called upon in writing and it shall be liable pay the same within 30 days.

If the Contractor fails to pay the required sum within the aforesaid period of 30 days, the Employer's Representative on behalf of the Employer shall have the right to sell any or all of the Contractor's unused materials, constructional plant, implements, temporary building at site etc., and adjust the proceeds of sale thereof towards the dues recoverable from the Contractor under the Contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the Contract.

In the event of above course being adopted by the Employer's Representative, the Contractor shall have no claim to compensation for any loss sustained by it by reasons of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the Contract.

10.3
Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on

Completion by a cause for which the Employer is responsible, the Contractor shall carry out the Tests on Completion as soon as practicable.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Employer and. shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and

(b) payment of any such Cost plus reasonable profit, which shall be added to the Contract Price.

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

11
Defects Liability

11.1
Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

(a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Employer, and

(b) execute all work required to remedy defects or damage, as may be notified by the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Employer shall notify the Contractor accordingly. The defects shall include the maintenance activities including supply of materials like consumables, fittings and fixtures etc.

11.2
Cost of Remedying Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

(a) the design of the Works,
(b) Plants, Materials, Goods, Products or workmanship not being in accordance with the Contract,
(c) improper operation or maintenance which was attributable to matters for which the Contractor is responsible (under Sub-Clauses 5.5 to 5.7 or otherwise), or
(d) failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Employer shall give notice to the Contractor accordingly, and Sub-Clause 13.3 [Variation Procedure] shall apply.

11.3
Extension of Defects Notification Period

The Employer shall be entitled subject to Sub-Clause 2.4 [Employer's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or damage. However, a Defects Notification Period shall under no circumstances be extended, beyond the expiry of the Defects Liability Period.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4
Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at its option):

(a) carry out the work itself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.4 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;

(b) agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or

(c) if the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5

Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6

Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Employer may require the repetition of any of the tests described in the Contract, including Tests on Completion and/or Tests after Completion. The requirement shall be made by notice within 28 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7

Right of Access

Until the Taking-over Certificate has been issued, the Contractor shall have the right of access to all parts of the Works and to records of the operation and performance of the Works, except as may be inconsistent with the Employer's reasonable security restrictions.

11.8

Contractor to Search

The Contractor shall, if required by the Employer, search for the cause of any defect, under the direction of the Employer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search plus reasonable profit shall be agreed or determined in accordance with Sub-Clause 3.5 [Determinations] and shall be added to the Contract Price.

11.9

Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Employer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Employer shall issue the Performance Certificate within 28 days after the expiry of the Defects Liability Periods. If the Employer fails to issue the Performance Certificate accordingly, the Performance Certificate shall be deemed to have been issued on the date 28 days after the date on which it should have been issued, as required by this Sub-Clause.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10

Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the

fulfillment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11
Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 28 days after the Employer issues the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer

12
Tests after Completion

12.1
Procedure for Tests after Completion

If Tests after Completion are specified in the Contract, this Clause shall apply, unless otherwise stated:

(a) the Contractor shall provide any other plant, equipment and suitably qualified and experienced staff, as are necessary to carry, out the Tests after Completion efficiently; and

(b) the Contractor shall carry out the Tests after Completion in the presence of such Employer's and/or Contractor's Personnel as either Party may reasonably request.

the Tests after Completion shall be carried out as soon as is reasonably practicable after the Works or Section have been taken over by the Employer. The Employer shall give to the Contractor 21 days' notice of the date after which the Tests after Completion will be carried out. Unless otherwise agreed, these Tests shall be carried out within 14 days after this date, on the day or days determined by the Employer.

The results of the Tests after Completion shall be compiled and evaluated by the Contractor, who shall prepare a detailed report. Appropriate account shall be taken of the effect of the Employer's prior use of the Works.

12.2
Delayed Tests

If the Contractor incurs costs as a result of any unreasonable delay by the Employer to the Tests after Completion, the Contractor shall (i) give notice to the Employer and (ii)

be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus reasonable profit, which shall be added to the Contract Price.

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If, for reasons not attributable to the Contractor, a Test after Completion on the Works or any Section cannot be completed during the Defects Notification Period (or any other period agreed upon by both Parties), then the Works or Section shall be deemed to have passed this Test after Completion.

12.3 Retesting

If the Works, or a Section, fail to pass the Tests after Completion:

(a) sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying of Defects] shall apply, and

(b) either Party may then require the failed Tests, and the Tests after Completion on any related work, to be repeated under the same terms and conditions.

If and to the extent that this failure and retesting are attributable to any of the matters listed in sub-paragraphs (a) to (d) of Sub-Clause 11.2 [Cost of Remedying Defects] and cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.4 [Employer's Claims] pay these costs to the Employer.

12.4 Failure to Pass Tests after Completion

If the Works, or a Section, fail to pass a Test after Completion and the Contractor proposes to make adjustments or modifications to the Works or such Section, the Contractor may be instructed by (or on behalf of) the Employer that right of access to the Works or Section cannot be given until a time that is convenient to the Employer. The Contractor shall then remain liable to carry out the adjustments or modifications and to satisfy this Test, within a reasonable period of receiving, notice by (or on behalf of) the Employer of the time that is convenient to the Employer. Even if the Contractor does not receive this notice during the relevant Defects Notification Period, the Contractor shall not be relieved of this obligation.

13

Variation and Adjustments

13.1

Right to Vary

Variations may be initiated by the Employer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. A Variation shall not comprise the omission of any work which is to be carried out by others.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Employer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, {ii) it will reduce the safety or suitability of the Works, or (iii) it will have an adverse impact on the achievement of the Performance Certificate. Upon receiving this notice, the Employer shall cancel, confirm or vary the instruction.

If there is any change and/or alteration in the Guidelines of the MCI or the apex statutory authority regulating medical education in India prior to issue of Taking Over Certificate by the Employer, which requires the Contractor to make changes and vary the construction, the Contractor shall be required to make appropriate changes and vary its construction so as to comply with such Guidelines. Such change and/or alteration in the the Guidelines shall also constitute a Variation.

13.2

Value Engineering

The Contractor may, at any time, submit to the Employer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

13.3

Variation Procedure

If the Employer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why it cannot comply (if this is the case) or by submitting:

(a) a description of the proposed design and/or work to be performed and a programme for its execution,

(b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion and

(c) the Contractor's proposal for adjustment to the Contract Price.

The Employer shall, as soon as practicable after receiving such proposal (under Sub-

Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Employer to the Contractor, who shall acknowledge receipt.

Upon instructing or approving a Variation, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine adjustments to the Contract Price and the Schedule of Payments. These adjustments shall include reasonable profit, and shall take account of the Contractor's submissions under Sub-Clause 13.2 [Value Engineering] if applicable.

13.4 Payment in Applicable Currencies

Payment under this Contract shall be made only in Indian Rupees.

13.5 Foreclosure of Contract due to Abandonment or Reduction in Scope of Works

If at any time after acceptance of the tender, the Employer shall decide to abandon or reduce the scope of the Works for any reason whatsoever and hence not require the whole or any part of the Works to be carried out, the Employer's Representative shall give notice in writing to that effect to the Contractor and the Contractor shall act accordingly in the matter. The Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which it might have derived from the execution of the Works in full but which it did not derive in consequence of the foreclosure of the whole or part of the Works.

The Contractor shall be paid for Works executed at site to be decided by the Employer.

13.6 Daywork

For work of a minor or incidental nature, the Employer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the daywork schedule included in the Contract, and the following procedure shall apply. If a daywork schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods or Products for the work, the Contractor shall submit quotations to the Employer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any such Goods or Products.

Except for any items for which the daywork schedule specifies that payment is not due, the Contractor shall deliver each day to the Employer accurate statements in duplicate

which shall include the following details of the resources used in executing the previous day's work:

(a) the names, occupations and time of Contractor's Personnel,

(b) the identification type and time of Contractor's Equipment and Temporary Works, and

(c) the quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Employer and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Employer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payments].

14
Contract Price and Payment

14.1
The Contract Price

Unless otherwise stated:

(a) payment for the Works shall be made on the basis of the lump sum Contract Price; and

(b) the Contractor shall pay all taxes, duties and fees required to be paid by it under the Contract, and the Contract Price shall not be adjusted for any of these costs.

14.2
Mobilisation Advance

Mobilisation Advance not exceeding 10% of the Contract Price may be given, if requested by the Selected Bidder/Contractor in writing within 30 days of the issue of Notification of Award. The Employer shall pay the Mobilisation Advance to the Contractor, in the following 2 tranches, upon completion of the following events :-

(a) First tranche of 5% of the Mobilisation Advance shall be paid by the Employer, upon completion of the following events/ activities:
  (i) Construction of labour camp, Contractor’s site office and making arrangements for water supply
  (ii) Construction of the Employers’ temporary site office at the site.
  (iii) Obtaining a Mobilisation Advance Bank Guarantee from a scheduled bank as per form given in Section - 7 (Contract Forms) aggregating to the full amount of Mobilization Advance (including both tranches) in favour of the Employer and submission of such Bank Guarantee to the Employer.

(b) Second tranche of 5% of Mobilisation Advance will be released by the Employer to the Contractor, upon completion of payment by the Employer, of 15% of the total Contract Price.

The Mobilisation Advance above shall bear simple interest @ 10% per annum. Repayment of the Mobilisation Advance shall commence from payment of the running account bill first raised after disbursement of first tranche of the Mobilisation Advance and shall be entered as a deduction from Interim Payment (@ 10% of the value of all the running account bills paid so far + simple interest @ 10% of the total Mobilisation Advance amount). For subsequent running account bills, Mobilisation Advance shall be deducted from the interim payment @ 10% of the value of such subsequent running account bill + simple interest @ 10% of the unadjusted Mobilisation Advance. Such deduction of Mobilisation Advance shall continue until the total amount of advance loan has been repaid by the contractor, provided that the complete recovery of the Mobilisation Advance shall be made before completion of 90% of the Works.

Recovery of advance at any intermediate stage shall be effected, if necessary, by encashment of part Bank Guarantees if the appropriate pro-rata amount of advance is not available from the Works done by the Contractor.

If the circumstances are considered reasonable by the Employer, the period mentioned for request by the Contractor in writing for grant of Mobilisation Advance may be extended in the discretion of the Employer.

The said Bank Guarantees for advances shall initially be made for the full amount and valid for the Contract period, and be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

14.3
Application for Interim Payments

The Contractor shall submit a Statement in two copies to the Employer after the end of each month in respect of each site, in a form approved by the Employer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the relevant report on progress in accordance with Sub-Clause 4.21 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in INR, in the sequence listed:

(a) the estimated contract value in accordance with Payment Schedule (including Variations but excluding items described in sub-paragraphs (b) and (c) below);

(b) any other additions, or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and

(c) the deduction of amounts included in previous Statements.

14.4
Schedule of Payments

Schedule of Payments is specified in Section 5.7A – Payment Schedule of the Employer's Requirements in which the Contract Price will be paid. Section 5.7B of the Payment Schedule provides for payments to be made for supply of items against

which 60% of the corresponding milestone payment will be made. Such Schedule of Payments for planning, design and construction of the Works shall be subject to the condition that the Contractor shall not submit more than two bills per month per site, provided that each such running account bill shall relate to one or more completed activities of the Project as described in Section - 5 (Employer's Requirements).

Provided that, upon supply and installation of the Goods comprising the Works, the right of such Goods shall vest on the Employer and the Contractor will be the custodian of all such Goods till installation, commissioning and handing over to the Employer. The Contractor shall also execute Indemnity Bond as provided in Form - 15 of Section – 4 (Bidding Forms) in favour of the Employer for such Goods as may be specified by the Employer, warranting the safety and security thereof and that it or its men and agents will not take any steps for removal, defacement, disfiguring or destruction of such Goods or any part thereof.

In case of Products to be supplied for each site, the Employer shall make the payment in the following manner :

Medical equipment

(a) Upon supply : 80% of value of the equipment as quoted in the BOQ/ Financial Bid
(b) Upon installation and commissioning : 15% thereof
(c) Upon training : 5 % thereof.

Furniture

(a) Upon supply : 80% of value of the furniture as quoted in the BOQ/ Financial Bid
(b) Upon installation and commissioning : 20% thereof

14.5 **Deleted.**

14.6
Interim Payments

No amount will be paid until the Employer has received and approved the Performance Security. Thereafter, the Employer shall within 7 days after receiving a Statement and supporting documents, give to the Contractor notice of any items in the Statement with which the Employer disagrees, with supporting particulars. Payments due shall not be withheld, except that:

(a) if any thing supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or

(b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and .had been so notified by the Employer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Employer may, by any payment, make any correction or modification that should

properly be made to any amount previously considered due. Payment shall not be deemed to indicate the Employer's acceptance, approval, consent or satisfaction.

14.7
Timing of Payments

Except as otherwise stated in Sub-Clause 2.4 [Employer's Claims], the Employer shall pay to the Contractor:

(a) the first tranche of Mobilisation Advance within 30 days after the date of delivery of possession of the Site subject to commencement of work at the site including setting up of site office etc. both for Contractor and the Employer

(b) the amount which is due in respect of each Statement, other than the Final Statement, within 15 working days after receiving the Statement and supporting documents; and

(c) the final amount due, within 60 working days after receiving the Final Statement and written discharge in accordance with Sub-Clause 14.11 [Application for Final Payment] and Sub-Clause 14.12 [Discharge].

Payment of the amount due in INR shall be made into the bank account, nominated by the Contractor.

14.8
Provisions for Recording of Progress vis-à-vis Payment

(a) **Cement :** For different cement related executed items, consumption of cement statement for relevant item as per CPWD latest SOR will be followed. In case the said item is not available in CPWD SOR, WBPWD SOR will be followed for the same if the item is available there. In case same is not available in any of the two, same will be calculated on fundamental engineering basis.

(b) **Steel, aggregates, bricks etc. :** Same will be calculated on the basis of relevant IS Code and current WBPWD SOR. In case same is not available there, fundamental engineering basis will be followed for the same.

(c) Measurement of steel will be on linear basis, lesser of the length as provided at site or as per approved drawing (provided the same is approved by the authority). If there be any variation between unit weight of the relevant steel as per IS Code, Unit weight with tolerance limit as per relevant IS Code may be allowed to use in the work if authority feels. However, payment will be made on the basis of unit weight as per physical test report, (provided it is within tolerance limit) subject to restriction that in no case the weight considered for billing purpose should exceed the standard weight as per IS:1786.

(d) The Contractor should submit statement showing consumption of Steel, Bricks and other basic Building materials with every running account bill as well as with Final Bill to verify with supply/materials brought at site vis-à-vis quantity of materials consumed based on consumption chart mentioned herein above.

(e) Whenever by computing the consumption of materials of any description in any item or group of items of work requiring use of such materials –

(i) If it is found that the Contractor has used less materials than are required by the specification and/or as shown in consumption chart mentioned herein above, the value of the quantity of materials less used (but within tolerance limit) shall be recovered from the Contractor at 10 (ten) percent extra over rate of materials as decided by the Employer's Representative based on purchase rate of the Contractor from Contractor's running account bill/Final Bill, provided the work so done is acceptable by the Employer. Otherwise, the work may be rejected and the Contractor has to rectify the same at his own cost and responsibility.

(ii) Provided that recovery of materials used less as indicated in paragraph (i) above shall be subjected to the decision of the Employer's Representative who may allow Variation according to limit mentioned in relevant SOR as mentioned.

14.9 Supporting Documents

Copies of all such reports at various stages recording the progress of the Project and completion of the consequential Project milestone, shall be compulsorily appended with each running account bill as well as the Final Bill, failing which no payment shall be released by the Employer to the Contractor.

14.10 Statement at Completion

Within 60 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Employer six copies of supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payments], showing:

(a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,

(b) any further sums which the Contractor considers to be due, and

(c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Employer shall then give notice to the Contractor in accordance with Sub-Clause 14.6 [Interim Payments] and make payment in accordance with Sub-Clause 14.7

[Timing of Payments].

14.11
Application for Final Payment

Within 30 days after receiving the Taking Over Certificate for the Works, the Contractor shall submit, to the Employer, six copies of a draft final statement with supporting, documents showing in detail in a form approved by the Employer:

(a) the value of all work done in accordance with the Contract, and

(b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Employer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Employer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Employer the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement",

14.12
Audit

The Employer shall have the right to cause an audit and technical examination of the works and the draft final statement of the Contractor including all supporting vouchers, abstract, etc. to be made after payment of the draft final statement and if as a result of such audit and technical examination, any sum is found to have been overpaid in respect of any work done by the Contractor under the Contract or any work claimed to have been done by him under the Contract and found not to have been executed, the Contractor shall be liable to refund the amount of over payment and it shall be lawful for the Employer to recover the same from him in the manner prescribed in these General Conditions or in any other manner legally permissible.

However if, following discussions between the Parties and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Employer shall pay the agreed parts of the draft final statement in accordance with Sub-Clause 14.6 [Interim Payments] and Sub-Clause 14.7 [Timing of Payments]. Thereafter, if the dispute is finally resolved under Sub-Clause 20.3 [Arbitration], the Contractor shall then prepare and submit to the Employer a Final Statement.

14.13
Discharge

When submitting the Final Statement, the Contractor shall submit a written discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the out-standing balance of this total, in which event the discharge shall be effective oh such date.

14.14
Final Payment

In accordance with sub-paragraph (c) of Sub-Clause 14.7 [Timing of Payments], the

Employer shall pay to the Contractor the amount which is finally due, less all amounts previously paid by the Employer and any deductions in accordance with Sub-Clause 2.4[Employer's Claims].

14.15
Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

(a) in the Final Statement and also

(b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

However, this Sub-Clause shall not limit the Employer's liability under his indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

15

Termination by Employer

15.1

Notice to Correct If the Contractor fails to carry out any obligation under the Contract, the Employer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2

Termination by Employer The Employer shall be entitled to terminate the Contract if the Contractor:

(a) fails to comply with a notice under Sub-Clause 15.1/Notice to Correct],

(b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,

(c) without reasonable excuse fails to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension],

(d) fails to comply with the milestone as approved by the Employer or such modified milestone as subsequently approved by the Employer,

(e) If the Contractor being a company shall pass a resolution or the Court shall make an order that the Contractor shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the Court or the creditor to appoint a Receiver or a manager or which entitles the court to make a winding up order,.

(f) If the Contractor shall suffer an execution being levied on its goods and allows it to be continued for a period of 30 days.

(g) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or

(h) gives or offers to give (directly or indirectly) to any person any bribe, gift commission or other thing of value, as an inducement or reward:

(i) for doing or forbearing to do any action in relation to the Contract, or

(ii) for showing or forbearing to show favour or disfavour to any person in relation to the Contract,

(i) if any of the Contractor's Personnel or agents gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (h). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.

In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub-paragraph (h) or (i), the Employer may by notice terminate the Contract immediately.

The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Employer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice for the protection of life or property or for the safety of the Works.

After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor.

The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

In any case in which any of the powers conferred upon the Employer's Representative in terms hereof, shall have become exercisable and the same are not exercised, the non- exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the Contractor and the liability of the Contractor for compensation shall remain unaffected. In the event of the Employer's Representative putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the Contractor, take possession of (or at the sole discretion of the Employer's

Representative which shall be final and binding on the Contractor) use as on hire (the amount of the hire money being also in the final determination of the Employer's Representative) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the Contractor, or procured by the Contractor and intended to be used for the execution of the work/ or any part thereof, paying or allowing for the same in account at the Contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Employer's Representative, whose certificate thereof shall be final and binding on the Contractor. The Employer's Representative may also direct where required, the clerk of the works, foreman or other authorized agent of the Contractor to remove such tools, plant, materials or stores from the premises (within a time to be specified in such notice). In the event of the Contractor failing to comply with any such requisition, the Employer's Representative may remove them at the Contractor's expense or sell them by auction or private sale on account of the Contractor and his risk in all respects and the certificate of the Employer's Representative as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the Contractor.

15.3 Valuation at Date of Termination

As soon as practicable after a notice of term 15.2 [Termination by Employer] has taken effect, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:

(a) proceed in accordance with Sub-Clause 2.4 [Employer's Claims],

(b) withhold further payments to the Contractor until the costs of design, execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or

(c) recover from the Contractor any losses and damages incurred by the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 1.5.3 [Valuation at Date of Termination], After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.

15.5

Employer's Entitlement to Termination

The Employer shall be entitled to terminate the Contract, at any time for the Employer's convenience, by giving notice of such termination to the Contractor, The termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice.

After this termination, the Contractor shall proceed in accordance with Clause 16 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release].

16

Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination], or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

(a) cease all further work, except for such work as may have been instructed by the Employer for the protection of life or property or for the safety of the Works,

(b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and

(c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.

17

Risk and Responsibility

17.1

Indemnities

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

(a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the design, execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, willful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and

(b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss:

(i) arises but of or in the course of or by reason of the design, execution and completion of the Works and the remedying of any defects, and

(ii) is not attributable to any negligence, willful act or breach of the Contract by the Employer, the Employer's Personnel, their respective agents, or anyone directly or indirectly employed by any of them,

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, willful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2 Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section of the Works, responsibility for the care of the Section shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [Employer's Risks], the Contractor shall rectify the loss -or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.3 Employer's Risks

The risks referred to in Sub-Clause 17.4 below are:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(b) rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country,

(c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel and other employees of the Contractor,

(d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and

(e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.

17.4 Consequences of Employer's Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Employer and shall rectify this loss or damage to the extent required by the Employer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Employer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will ,be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and

(b) payment of any such Cost, which shall be added to the Contract Price.

After receiving this further notice, the Employer shall proceed in accordance with Sub Clause 3.5 [Determinations] to agree or determine these matters.

17.5 Intellectual and Industrial Property Rights

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

(a) an unavoidable result of the Contractor's compliance with the Employer's Requirements, or

(b) a result of any Works being used by the Employer;

(i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or

(ii) in conjunction with any thing not supplied by the Contractor, unless such use was disclosed to the Contractor is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any

other claim which arises out of or in relation to (i) the Contractor's design, manufacture, construction or execution of the Works, (ii) the use of Contractor's Equipment, or (iii) the proper use of the Works.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it, The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6

Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than under Sub-Clause 16.4 [Payment on Termination] and Sub-Clause 17.1 [Indemnities].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.25 [Electricity, Water and Gas], Sub-Clause 4.26 [Employer's Equipment], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum stated as the Contract Price in the Agreement.

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

18

Insurance

18.1
General Requirements for Insurances

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers. These terms shall be consistent with any terms agreed by both Parties before they signed the Agreement. This Agreement of terms shall take precedence over the provisions of this Clause.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage,

The relevant insuring Party shall, within such respective periods (calculated from the Commencement Date), submit to the other Party:

(a) evidence that the insurances described in this Clause have been effected, and

(b) copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance of Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required

to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.4 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

18.2 Insurance for Works and contractor's Equipment

The insuring Party shall insure the Works, Plants, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, arid for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability] and Clause 12 [Tests after Completion]).

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment,

Unless otherwise stated, insurances under this Sub-Clause:

(a) shall be effected and maintained by the Contractor as insuring Party,

(b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated between the

Parties for the sole purpose of rectifying the loss or damage,

(c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Employer's Risks], and

(d) may however exclude loss of, damage to, and reinstatement of:

(i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),

(ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,

(iii) a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and

(iv) Goods while they are not in the Country, subject to Sub-Clause 14.5 [Plant and Materials intended for the Works].

18.3

Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 {Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

This insurance shall be for a limit per occurrence of not less than the amount as may be subsequently informed by the Employer, with no limit on the number of occurrences. If an amount is not stated in the Contract, this Sub-Clause shall not apply.

Unless otherwise stated, the insurances specified in this Sub-Clause:

a) shall be effected and maintained by the Contractor as insuring Party,

b) shall be in the joint names of the Parties,

c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and

d) may however exclude liability to the extent that it arises from:

i) the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,

ii) damage which is an unavoidable result of the Contractor's obligation to execute the Works and remedy any defects, and

iii) a cause listed in Sub'-Clause 17.3 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4
Insurance for Contractor's Personnel

The Contractor shall effect and maintain insurance against liability for claims, Personnel damages, losses and expenses (including legal fees and expenses) arising from injury sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

The Employer shall also be indemnified under the policy of insurance, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works,

19
Force Majeure

19.1
Definition of Force Majeure

In this clause, Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below:

(i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies.

(ij) rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war;

(iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel and other employees of the Contractor ,

(iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and

(v) natural catastrophes such as earthquake, hurricane, typhoon or volcanic

activity or flood.

19.2

Notice of Force Majeure If a Party is or will be prevented from performing any of its obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, haying given notice, be excused performance of such obligations for so long as .such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

19.3

Duty to Minimise Delay Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of Force Majeure.

A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4

Consequences of Force

Majeure

If the Contractor is prevented from performing any of his obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.5 [Extension of Time for Completion], and

(b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19;1 [Definition of Force Majeure] and, in the case of sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost.

After receiving this notice, the Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

19.5 **Deleted.**

19.6
Optional Termination,
Payment and Release

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

Upon such termination, the Employer shall pay to the Contractor the amounts payable for any work carried out till that date to be determined in terms of Sub-Clause 3.5.

19.7
Release from Performance
Under the Law

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfill its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

(a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and

(b) the sum payable by the Employer to the Contractor shall be the same as Would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20

Claim, Disputes and Arbitration

20.1

Contractor's Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract the Contractor shall give notice to the Employer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Employer. Without admitting liability, the Employer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Employer to inspect all these records, and shall (if instructed) submit copies to the Employer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Employer, the Contractor shall send to

the Employer a fully detailed claim which includes full supporting particulars 'of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

(a) this fully detailed claim shall be considered as interim;

(b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Employer may reasonably require; and

(c) the Contractor shall send a final claim within 30 days after the issuance of Taking Over Certificate of the Works, or within such other period as may be proposed by the Contractor and approved by the Employer.

Within 60 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Employer and approved by the Contractor, the Employer shall respond with approval, or with disapproval and detailed comments. It may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time,

Each interim payment shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

The Employer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.5 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

20.2

Amicable Settlement

Both Parties shall attempt to settle any dispute or difference between them amicably.

20.3

Arbitration

Unless settled amicably, all disputes and differences shall be settled by the parties by arbitration. Unless otherwise agreed by both Parties:

(a) the dispute shall be settled under the rules of arbitration of the Arbitration & Conciliation Act, 1996,

(b) the dispute shall be settled by a sole arbitrator to be appointed by the Additional Chief Secretary/ Principal Secretary/ Secretary, Department of Health & Family Welfare of the Government of West Bengal, India in accordance with the Act,

(c) the arbitration shall be held at Kolkata, and Courts at Kolkata shall alone have jurisdiction (to the exclusion of all other Courts) to entertain all disputes arising out of the Contract, and

(d) the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language].

SECTION 7

Contract Forms

SECTION – 7

CONTRACT FORMS

FORM OF AGREEMENT

(ON NON JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

Agreement No. _____ dated

THIS AGREEMENT is made on ___day of _____ Two Thousand_____ between WEST BENGAL MEDICAL SERVICES CORPORATION LIMITED (WBMSCL) hereinafter called the "Employer" (which expression shall, wherever the context so demands or requires, include their successors in office and assigns) of the One Part and M/s. _____hereinafter called the "Contractor" (which expression shall wherever the context so demands or requires, include his/their successors and assigns) of the Other Part.

WHEREAS the Employer is desirous that Project should be executed and has by Notification of Award dated _____ accepted a tender submitted by the Contractor for the project at a total Contract Price of Rs. _____ /- (Rupees _____ only).

NOW THIS AGREEMENT WITNESSETH as follows :-

1. In this Agreement, words and expressions shall have the same meaning as are respectively assigned to them in the General Conditions of Contract hereinafter referred to.

2.

Documents

The following documents in conjunction with Addenda/Corrigenda to Bidding Documents shall be deemed to form and be read and construed as part of this Agreement viz.

i. Notice Inviting e-Tender
ii. Instructions to Bidders
iii. Evaluation and Qualifying Criteria
iv. Bidding Forms
v. Employer's Requirements
vi. General Conditions of Contract.
vii. Contract Forms.

3. **Previous Communications**

This document constitutes the entire Contract between the parties and supersedes all previous communications, whether oral or written, in relation to the Project to be undertaken in accordance with the Contract.

4. **Execution of Project**

In consideration of the payment to be made by the Employer to the Contractor as hereinafter mentioned, the Contactor hereby covenants with the Employer to execute, complete, remedy defects therein and maintain the Project in conformity in all respects with the provisions of the Contract.

5. **Payment**

The Employer hereby covenants to pay to the Contractor in consideration of the execution, completion, remedying of any defects therein and maintenance of the Works, the Contract Price or such other sum as may become payable under the provisions of the Contract at the time and in the manner prescribed by the Contract.

6. **Commencement of the Project**

This Contract will remain in effect from_____ and expire on _____ unless terminated earlier in accordance with the provisions of the Contract.

7. **Acknowledgement**

The Contractor shall confirm acceptance of the terms of this Contract by signing and returning to WBMSCL the duplicate copy enclosed herewith within a period of 21 days from date of receipt of Notification of Award.

IN WITNESS whereof the parties hereto have caused their respective hands to be hereinto affixed the day and year first above written.

_____	_____
In the capacity of _____	For and on behalf of WBMSCL
On behalf of M/s. _____	(The Employer)
(The Contractor)	In the presence of
In the presence of	Witnesses (Signature, Name &
Witnesses (Signature, Name &	Designation)
Designation)	1.
1.	2.
2.	

PROFORMA FOR BANK GUARANTEE FOR MOBILIZATION ADVANCE

(On Non-Judicial Stamp Paper of Appropriate Value)

To,

_____

West Bengal Medical Services Corporation Ltd.

_____

1. In consideration of, West Bengal Medical Services Corporation Ltd. (WBMSCL) (hereinafter called "The Employer") (which expression shall unless repugnant to the subject or context include its successors and assigns) having agreed under the terms and conditions of the Agreement No. _____ dated _____ with M/s. _____ a company within the meaning of the Companies Act, 2013 and having its registered office at _____ in the State of _____ (hereinafter called "the said bidder" which expression shall unless the context requires otherwise include its administrators, successors and assigns) in connection with the work of _____ (hereinafter called "the said Contract") to make at the request of the bidder a mobilisation advance of Rs. _____/-(Rupees_____only) for utilizing it for the purpose of the Contract on its furnishing a Guarantee acceptable to the Employer , we, _____Bank incorporated under_____and having one of our branches at_____(hereinafter referred to as "the said Bank") do hereby guarantee the due recovery by the Employer of this said advance with interest thereon as provided according to the terms and conditions of the Contract. If the said bidder fails to utilize the said advance for the purpose of the Contract and/or the said advance together with interest thereon as aforesaid is not fully recovered by the Employer, we,_____Bank hereby unconditionally and irrevocably undertake to pay to WBMSCL on demand and without demur to the extent of the said sum of Rs. _____/- (Rupees

_____only),any claim made by the Employer on us for the loss or damage caused to

or suffered by the Employer by reason of the Employer not being able to recover in full the

said sum of Rs.____/-(Rupees _____ only)with interest as aforesaid.

2. We,_____Bank further agree that the Employer shall be the sole judge of and as to whether the said bidder has not utilized the said advance or any part thereof for the purpose of the Contract and the extent of loss or damage caused to or suffered by the Employer on account of the said advance together with interest not being recovered in full and the decision of the Employer that the said bidder has not utilized the said advance or any part thereof for the purpose of the Contract and as to the amount or amounts of loss or damage caused to or suffered by the Employer shall be final and binding on us.

3. We, the said Bank, further agree that the Guarantee herein contained shall remain in force and effect during the period that would be taken for the performance of the said Contract and till the said advance with interest has been fully recovered and its claims satisfied or discharged and till the Employer certifies that the said advance with interest has been fully recovered from the said bidder, and accordingly shall have no claim under this Guarantee after 30 (thirty) days from the date of satisfactory completion of the said Contract (as per the mutually agreed Work Schedule) i.e. upto and inclusive of_____ (date) unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said period i.e._____(date) in which case the same shall be enforceable against the Bank notwithstanding the fact, that the same is enforced after the expiry of the said period.

4. The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity, from time to time, to vary any of the terms and conditions of the said Contractor the advance or to extend time of performance by the said bidder or to postpone for any time and from time to time any of the powers exerciseable by it against the said bidder and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or the advance available to the Employer and the said Bank shall not be released from its liability under these presents by any exercise by the Employer of the liberty with reference to the matters aforesaid or by reasons of time being given to the said bidder or any other forbearance, actor omission on the part of the Employer or any indulgence by the Employer to the said bidder on any other matter or thing whatsoever which under the law relating to

sureties would, but for this provision, have the effect of so releasing the Bank from its such liability.

5. It shall not be necessary for the Employer to proceed against the bidder before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security, which the Employer may have obtained or obtain from the bidder shall at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.

6. We, the said Bank, lastly undertaken not to revoke this Guarantee during its currency except with the previous consent of the Employer in writing and agree that any change in the constitution of the said bidder or the said Bank shall not discharge our liability hereunder.

7. If any further extension of this Guarantee is required the same shall be extended to such required periods on receiving instructions from the bidder M/s. _____ on whose behalf this Guarantee is issued.

8. Notwithstanding anything contained hereinbefore our liability under this Guarantee is restricted to Rs._____/- (Rupees _____only) together with interest @_____. Our undertaking shall commence from the date of execution and shall remain in force upto_____.

Dated this_____day of

_____In presence of For and on behalf of (the Bank)

WITNESS Signature_____

1. _____ Name_____

2. _____ Designation_____

Authorization No.

Seal of the Bank_____

The above Guarantee is accepted by the Employer

For WBMSCL

FORM OF PERFORMANCE SECURITY BANK GUARANTEE

In consideration of the Employer having agreed under the terms and conditions of contract made vide his Notification of Award No.---------dated ------ between West Bengal Medical Services Corporation Ltd. (WBMSCL) (the Employer) represented by its Managing Director and _____(hereinafter called "the said Contractor) for Planning, Design and Construction of 4 Medical Colleges alongwith supply of medical equipment and furniture in the State of West Bengal on Turnkey Basis (herein after called the said Agreement") the Contractor having agreed to production of a irrevocable Bank Guarantee for Rs. - (Rupees - - - - - - - - - - - - - - - - - - - Only) as a Security/Guarantee for compliance of his obligations in accordance with the terms and conditions in the said Agreement:

1. We ---------- (indicate the name of the Bank) (hereinafter referred to as "the Bank" hereby undertake to pay to the WEST BENGAL MEDICAL SERVICES CORPORATION LTD., an amount not exceeding Rs. ---------- (Rupees ----------only) on demand by WBMSCL.

2. We ----------(indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this Guarantee without any demur, merely on a demand from WBMSCL for and on behalf of the Employer as an Agent/Power of Attorney Holder stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs.---------- (Rupees ----------only).

3. We, the said Bank further under take to pay to the Employer represented by WBMSCL for and on behalf of the Employer as an Agent/Power of Attorney

Holder any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any suit or proceeding pending before any court or Tribunal relating thereto, our liabilities under this present being absolute and unequivocal. The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Contractor shall have no claim against us for making such payment.

4. We - - - - - - - - - (Indicate the name of the Bank) further agree that the Guarantee herein contained shall remain in full force and effect for a period of 12 months from the date of issue and upon being extended for similar periods of 12 months each, it shall continue to be enforceable till all dues of the Employer under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till the Employer's Representative on behalf of the Employer certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor and accordingly discharges this Guarantee.

5. We ---------- (indicate the name of the Bank) further agree with the Employer, that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor(s) and to forbear from or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or for any forbearance, act of omission on the part of the Employer or any indulgence by the Employer to the said Contractor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. This Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

7. This Guarantee will neither be cancelled nor revoked by the Bank without the written authorization of WBMSCL. For this purpose, the beneficiary WBMSCL would inform the Bank of their authorized signatories together with the specimen signatures.

8. This Guarantee shall be valid up to a period of 12 months from the date of issue unless extended on demand by the Employer. Notwithstanding anything mentioned above, our liability against this Guarantee is restricted to Rs. ---------- (Rupees ---------- Only) and unless a claim in writing is lodged with us within the date of expiry or the extended date of expiry of this Guarantee, all our liabilities under this Guarantee shall stand discharged.

Dated the ---------- day of ---------- for ---------- (indicate the name of the Bank)".

Note : To be put in sealed cover by Bank and addressed to the concerned officer of WBMSCL.