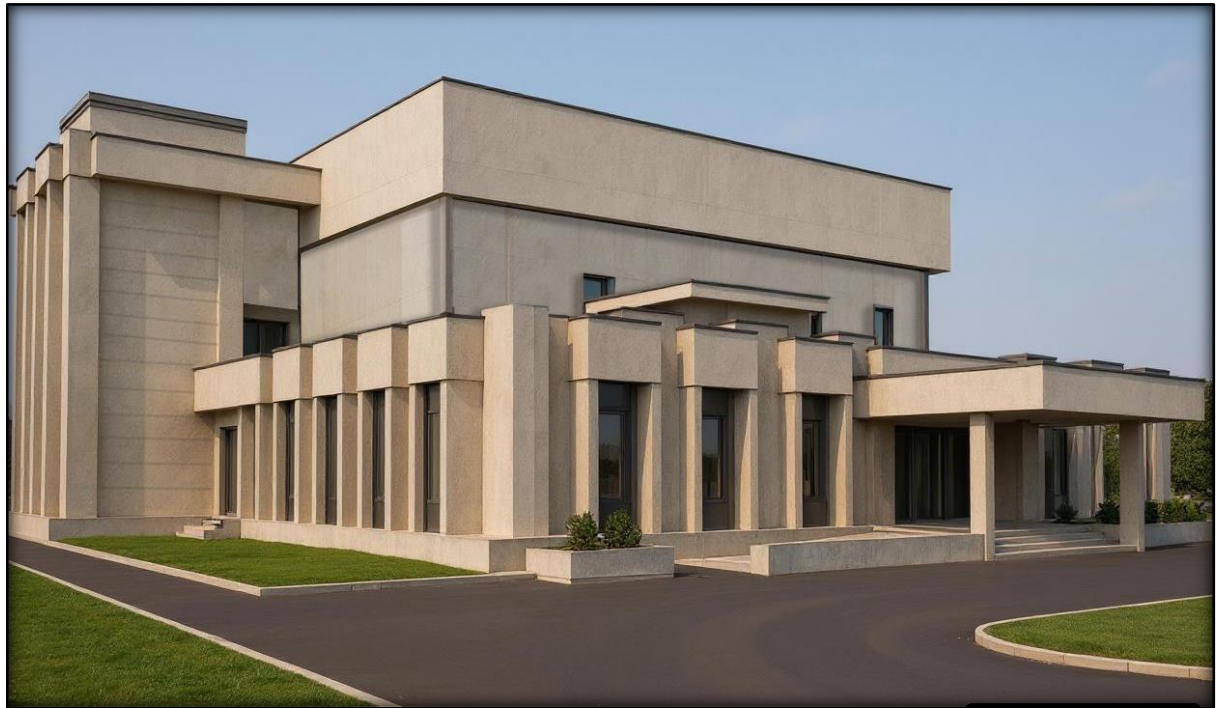


Government of Bihar

Building Construction Department, Patna Bihar



ELECTRICAL DBR

VOL – VII

CONSTRUCTION OF “PROPOSED CENTRE OF EXCELLENCE OF FIRE TESTING TRAINING AND RESEARCH LABORATORY AT IIT, PATNA”.

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1. OBJECTIVE

The scope and objective of electrical system design is to provide electrical power supply duly complying with the applicable safety standards. The power supply after being received at location shall subsequently be distributed to all load centres after passing through safety devices providing protection to both human beings and equipment. The premises shall also be safeguarded against lightning strikes. The electrical distribution system shall be designed with priority emphasized on the following aspects.

- Continuity and reliability of Power supply
- Flexibilities and expendabilities of operation
- Concentration / distribution of loads
- Safety of personnel and equipment
- Operation simplicity
- Ease of maintenance
- Energy management, loss preventions and conservation
- Minimum fire risk
- Maximum interchange ability of equipment resulting minimum intervene and spare parts
- Sustainability

The work is to be executed on Engineering, Procurement and Construction (EPC) (Turn Key) basis. The cost of labour, material, tools and plants and machinery required for execution of the whole project as per Layout plan, detailed design, drawings, specifications as approved is within the scope of this work.

Various electrical services to be provided under this EPC contract have been divided into Sub Heads mentioned technical specification. The scope includes Design, Supply, Installation, testing, commissioning, defect removal, obtaining required statutory approvals, making it useful as per intended use/as required.

2. REFERENCE CODES & STANDARDS:

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. EPC Contractor shall obtain all approvals from statutory authorities' e.g. Electrical inspector, pollution control boards, concerned SEB as applicable before commissioning of electrical/DG sets, Elevators, Indian Electricity Act, Indian Electricity Rules, Factory Act, Pollution Control Act.

- Local By – Laws
 - National Building Code of India – 2016
 - NEC, National Electric Code of India.
 - LEED India
 - Energy Conservation Building Codes 2007 (Revised Version May 2008)
 - IEC 60726/ IS: 2026 (Part 1, II and IV)/ IS 11171(Part III): Transformers (Cast Resin)
 - IEC 60831/ IS 13340 & IS 13341: Capacitors
 - IEC 60947 / IS 13947: Specification for low voltage switch gear & control gear .
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1. All electrical work shall be governed by CPWD Specifications for electrical works amended till date unless otherwise specifically mentioned separately.
 2. IS-732: Code of practice for electrical wiring installation system voltage not exceeding 650V.
 3. IS 3043: 1987 with latest amendments- Earthing.
 4. IS-2309: Code of practice for the protection of buildings and allied structure against Lightning
 5. IS-7689: Guide for control of undesirable static electricity.
 6. IS-3716: Insulation co-ordination application guide.
 7. IS-8130: Conductors for insulated electrical cables and flexible cords.
 8. IS-5831: PVC insulation and sheath of electric cables.
 9. IS-3975: Mild steel wire, strips & tapes for armoring cable.
 10. IS-3961: Current rating of cables
 11. IS-694: PVC insulated (heavy duty) electric cables for working. Voltage up to and including 1100volts.
 12. IS-424- 1475 (F-3): Power cable flexibility test.
 13. IEC-439/IS-7098: Specification for cross linked polyethylene insulated PVC sheathed cable for working voltage up to 1.1KV.
 14. IS-1554: PVC insulated cables up to 1100volts.
 15. IS-10810: Test procedures for cables.
 16. IS-6121: Cable glands.

17. IS-10418: Cable drums.IEC-754(1): FRLS PVC insulated cable.
18. ASTM-D-2863: Standard method for measuring minimum oxygen concentration to support candle like combustion of plastic (oxygen index).
19. ASTM-D-2843: Standard test method for measuring the density of smoke from burning or decomposition.
20. ASTM E-662/IEC 754(A).
21. IS 2309: 1989 with latest amendments- Advance Lightning Protection System.
22. CCTV System to be installed must have STQC Certification.

1. Specification, particular specification if any, and drawings. Indian regulations/codes and standards.

Note: The reference shall be made to the relevant codes and standards as applicable though it is not listed above In addition to above any additional code wherever applicable to be followed. In absence of Indian codes, international codes to be followed. In case of revisions in code, latest codes to be followed.

3. SCOPE

The Scope of work shall include Construction detailed design, supply, installation, testing, commissioning and handing over the entire Electrical system along with As-Built drawings and O&M manual.: -

- i PCC, MCC Hybrid Power Correction system, outdoor feeder panel as Required.
 - ii Power Socket Distribution (Normal / UPS).
 - iii Illumination Systems. (Normal / UPS).
 - iv Cable Duct bank, Cable tray, raceway– Cabling Systems.
 - v Earthing/ Grounding Systems.
 - vi MS Conducting, trunking for all IT systems such as, Data, Voice, CCTV etc.
 - vii Power cabling, Control/signal cabling, Conduit etc. for the Power point, Lighting Point, equipment and for external lighting including lights for roads security wall, canopy, signage etc.,
 - viii Protection and Measurement Systems.
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- ix Internal Electrical Installations.
 - x Electrical Panels as required for any service covered in the scope of work
 - xi Cabling work for power supply to any electrical panel etc. as required.
 - xii Final Distribution Boards (SPN DB's & TPN DB's) with RCCB+MCB as incomer.
 - xiii Earthing system.
 - xiv Provision for Data networking system by providing Floor/Block in boxes, conduit and Face plate for Data networking.
 - xv Street lights on octagonal single /double bracketed GI poles along road work.
 - xvi Obtaining necessary statutory approvals from concern authorities i.e. CEA, local Fire & electricity authorities, explosive authority etc.
 - xvii Charges of feeder cables (supply & laying) from the metering point to existing substation, HT switch gears, lisening with State Electricity Authority, associated civil works are in the scope of contractor.
 - xviii All equipment shall be energy efficient using latest technologies.
 - xix All lighting fixtures, internal, external etc. shall be energy efficient using latest technology LEDs, with appropriate color temperatures, control gear, lighting controls, occupancy.
-

xx Providing Automatic clean agent fire Suppression system for all Main LT /sub panels
Gas suppression system shall be extinguishing agent with non-CFC based clean agent fire suppression system.

xxi Raceways, under floor boxes shall be provided in floors wherever required as per site conditions where ceiling is not available. Copper Sub main wiring / cabling to all Distribution boards in MS conduit.

xxii Conventional type Lightning Protection System (LPS) of the buildings as per IEC 62305. LPS shall be provided on building

xxiii All electrical job to be done in joint venture with OEM authorised vendor at Patna Bihar.

xxiv During work execution contractor will replace, if any damages made to existing cables or wire or any other services.

4. Load Calculation

PARTICULARS	TOATL BUILTUP AREA(SQ.M)	LIGHT & POWER LOAD @30 WATT PER SQ.MT IN KW @COVERAGE	DIVERSITY FACTOR 50%
Ground floor	1315	39.45	19.73
First floor	145	4.35	2.18
Second floor	145	4.35	2.18
		Total(A)	24.09 KW

AC- 26 units	
Power per AC Unit:	2 Ton x 1 kW/Ton = 2 kW
Total Connected Load:	26 units x 2 kW/unit = 52.0 kW
Total AC load with 60% diversity factor (B):-	31.2 KW

Equipment Load in KW (C):-	296.52 KW
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Total Load in KW (A+B+C)	352 KW
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Note:- 1) All equipment load shall be fed from a 415 v , 3-phase ,4-wire supply.

2) The EPC Contractor shall be responsible for submitting detailed cooling load calculations and the certified electrical load data (kW/TR) for all proposed air conditioning equipment prior to the final design of electrical infrastructure.

5. Source of Power & Connection

- ❖ Source: - From the existing transformer the source will be taken through main LT panel.
- ❖ Contractor's Scope (EPC):- Includes supply and laying of all cables and providing all necessary components for cable termination and connection (including glands,lugs,and grounding hardware)for the final connection to the project's main LT panel.

6. EARTHING

Earthing systems shall be provided in accordance with IS: 3043 - 1987 (with latest amendments and other statutory regulations).

All the bus ducts/cable trays shall be earthed with suitable size of 2 nos. G.I. strips in the full length. All electrical equipment shall be earthed with 2 nos. G.I. strips/wires.

The resistance of the earth electrode system, measured at any point, shall not exceed 1.0 ohm, As per IS3043.

Complete earthing system as per electrical and safety requirements.

EARTHING AND LIGHTNING PROTECTION

Complete electrical installation shall be earthed as per IS 3043. All metallic bodies of electrical equipment/ fixtures shall be bounded to the normal earth mass through a network of earthing strips/ conductors. Considering the hazardous nature of electrical energy, safety measures in using this energy is of paramount importance, Earthing system shall be provided in accordance with Indian Standards IS: 3043-1987 & IEEE 80 & other statutory regulations. All non-current carrying metal parts forming the Electrical System shall be connected to the Earthing System as per the requirements. The earthing system shall be so designed that resistance of the earthing network shall be less than 1.0 ohm at any point of the system. All the Bus-Ducts/Cable Trays shall be provided with suitable size of 2 nos. G.I strip in full length. Separate Earthing shall be provided for Computers & entire earthing shall be insulated with PVC tape. Separate earthing grid shall be provided for the earthing of Panels, & earthing of Data/ Telephone Systems and lightning protection system.

I. Panel Earthing

- a. Distribution Board Earthing: Copper Earthing
- b. Equipment Earthing: Copper Earthing
- c. Lightning Protection: Copper Earthing

II. Lighting/Power Circuit Earthing: Copper Wire Earthing

7. LIGHTNING PROTECTION

It is proposed to go with the Conventional lightning protection Method.

A. CONVENTIONAL LIGHTNING PROTECTION SCHEME AS PER IS 2309 :-

This system is based on Faraday's Cage Principle along with Cone of Protection principle in which lightning protection is provided to the building by providing Vertical air terminals (Franklin rods) along with Horizontal air terminations bonded to earth pit on the ground with vertically descending down conductors. In this scheme the number of down conductors is calculated based on the roof area of the building to be protected.

Also no part of the roof should be greater than 8 meters from the nearest horizontal conductor. In this system horizontal air terminations are to be exposed to the atmosphere and hence are generally fixed on the parapet wall on terrace. Each down conductor shall be connected to one number earth pit. All the earth pits provided in ground shall be connected to one another with suitable size of Cu earth strips.

8. LIGHTING SYSTEM

GENERAL

Lighting arrangement is proposed with a judicious combination of energy efficient fixture. The light level will be designed to comply with Illuminating Engineering Society (IES) Standard and as per NBC-2016 .

All lighting fixtures for both interior and exterior applications, shall be Light Emitting Diode (LED) type.

CIMFR Certified LED flameproof batten suitable for lab testing area.

S.No.	Area Usage	Illumination Level (Lux) As Per NBC	Our Recommendation (Lux)
1	Entrance	150-200-300	300 (LED Fixtures, high CRI>80)
2	Live Fire Testing Area	200-300-500	500 (LED Fixture, IP 65, Jet-proof, flameproof, suitable for high ambient temperature)
3	Large Scale Fire Testing Area	200-300-500	500 (LED Fixture, IP 65, Jet-proof, flameproof, suitable for high ambient temperature)
4	Office Area	200-300-500	300 (LED Fixture)
5	Rest Room	100-150-200	150 (LED Fixture, IP44 LED Down Lights)
6	External Lighting	5-10-15	15 (LED Fixture, IP65 LED floodlights)
7	Emergency Escape Routes (Corridors, Stair cases)	75-100-150	100(Fire Rated emergency LED luminaries)

9. POWER DISTRIBUTION LOSS: -

The Power Cabling shall be adequately sized so as to keep the Voltage Drop below 3% for any final sub-circuit and below 5% for the entire system from the origin of supply to any load point, so that the distribution losses do not exceed 1 % of the total Power usage.

10. OUTLINE SPECIFICATIONS

A. Panels

The panels shall be sheet steel enclosed, cubical type, dust and vermin proof with IP-54 to IP-65 rating, copper bus bars, incoming 4 Pole ACB/MCCB and outgoing MCB's / MCCB's as required. All the control panels and SDB's shall be floor or wall mounted type with dead front construction. The distribution boards shall be cubical type recessed/ surface mounted in wall with MCB's in the incoming/outgoing (10 KA C type). All Panel must be according to IEC 61439.

B. Wiring

FRLS PVC insulated copper conductor 1.5 Sq. mm/2.5 Sq. mm/ 4 sq.mm. copper conductor wires of 650/1100 Volts grade for lighting, fans, 6A/16A/6pin outlets conforming to IS-694-1990 (Amended to date), in single core formation, shall be used. The outer sheath colours shall be in accordance with R-Y-B (Red-Yellow-Blue), Black for Neutral and Green for Earthing. Normally the size used shall be 1.5 sq. mm for lighting outlets and for circuit wiring, 6/4.0sq. Mm - for power outlets and 20A AC outlets.

For life safety systems (emergency lights, fire Alarm etc.), high-temperature areas, and other mandated applications, fire survival (IS 16118) wires with LSZH sheath shall be used.

• POWER CABLING

- (i) The power cables shall be XLPE insulated, PVC FRLS inner & Outer sheathed, up to 16 sq mm the conductor shall be copper and above 16 sq mm conductor shall be copper, armored cables rated for 1100 V grade. The power cables shall be of 2 core for single phase, 4 core for sizes up to and including 25 sq.mm, 3-1/2 core for sizes higher than 25 sq.mm for 3 phase. Where high voltage equipment's are to be fed, the cables shall be rated for continuous operation at the voltages to suit the same. Fire Survival cables for Life safety systems as per Internal Electrical Specifications-2023. Termination with lugs/thimbles and cable glands on both sides.
- (ii) Power cables shall be of sizes as indicated in the tender specifications. In all other cases, the sizes shall be as approved by the Engineer-in-Charge, after taking into consideration the load, the length of cabling and the type of load.

C. Conduit & Accessories

MS conduits and MS junction boxes shall be used for concealed/exposed work. The MS conduit shall be rigid – heavy duty type with 2mm wall thickness as per IS-9537 (Amended to date). The conduits shall be recessed in wall and laid along the steel reinforcements during the construction stages itself. Conduits of less than 20mm inner dia shall not be used /laid anywhere in the units. However, surface Conduit shall be MS . And all conduits runs must be continuously earthed and bonded to the main earth grid.

D. Cable Trays

M.S. painted prefabricated ladder type for power cables and perforated type cable trays for control cables and low voltage cables are proposed to be provided for laying of cables thereon. All cable trays must be continuously earthed with two separate GI strips along their entire length.

The mounting and supporting arrangement of cable trays shall be as per drawings.

Switches and socket outlets shall be of moulded design of pre-approved make. Only IS marked MCBs (10KA) shall be provided/installed in the DBs.

E. Scope of Electrical & ELV Works

1. Internal & External Electrical Installations: Complete power and lighting wiring, conduits, distribution boards, and fixtures throughout the campus.
2. Electrical External Service Connection: From the existing transformer the source will taken through feeder panel.
3. Power Wiring & Plug Points: All final power outlets, industrial sockets in labs, and specialized outlets as required.
4. Lightning Protection System (LPS): Complete external and internal lightning protection as per IS/IEC 62305.
5. Telephone Conduiting: Provision of conduit and trucking for telephone lines.
6. Grid-Interactive Rooftop Solar PV System: Supply, Installation, Testing, and Commissioning of a solar power plant.
7. IP-Based CCTV System: Complete surveillance system with cameras, NVR, storage, and monitoring station.
8. Structured Cabling (LAN System): Data cabling for internet and intranet connectivity across offices and labs.
9. Audio-Visual/Conference System: System for conference rooms and training areas.
10. Split AC Power Provision: Electrical wiring and dedicated points with split AC units (AC supply not included).

11. FACILITY MATRIX FOR E&M WORKS

Sl. No.	Facility	Minimum requirement	Design Standards	Location
	MCC/LT panels/Sub LT Panels	As per design requirements mentioned		In Building
		in DBR + 20 % spare of each rating of outgoing or minimum 1, whichever higher.		
	Final distribution Board	As per design requirements with RCCB+MCB as incomer.		In Building
	Cable tray /race way /bus trunking	As per design requirements		In Building
	Earthing	As per design requirements		As per space available
	Lightning Protection System	Lightning Protection Level -3		In Building
	LED Light fitting	As per design requirements for Internal & External Electrification		In Building
	Street Lighting	Hybrid LED light fittings/ bollards/As per requirement		External
	Fire Alarm & Detection system	As per Design requirement Microprocessor based Intelligent addressable		In Building

12. EXTRA LOW VOLTAGE WORKS

- **Introduction**

The document describes the component, design and specification to achieve world class and state of the art ICT solution which includes following component:

- IT Data Networking System including:
- Wi-Fi and all related component
- CCTV,
- Audio and Video Solution.
- All working should have USB –C Type mobile charging , HDMI connectivity, LAN (for internet), telephone, LAN point for TV and any other functional point as per the requirement given by the BCD E/I and it may change as per the site requirement.

The scope of service for the System Integrator (SI) is to Supply, Install, Test & Commission and Maintenance the systems as per the design given in the tender drawings, design and the specifications included in this document. It is the responsibility of the SI to read the tender documents thoroughly and understand all of the requirements. Any doubts should be raised during the design of the system phase and any items not clarified at this stage will be at the risk of the SI.

- **Special Conditions:**

1. All design schemes will be first approved from the BCD and then detail design will be taken up by the EPC contractor.
2. The EPC Contractor will supply and install the equipment necessary to meet the requirements and provide all labour and materials, whether or not described in full, necessary to produce complete and fully operational systems in accordance with the intent of this document.

3. The EPC Contractor/ Agency must familiarize himself with the site drawings and the scope of the facilities that is required in the various areas. He should ensure that he is aware of the operational requirements under which the systems and associated facilities are to be installed and used.
4. All employees used by the EPC contractor to install this system must be competent technicians who are experienced in the installation and interconnection of professional audio-visual systems.
5. Bidder shall be authorized by the manufacturer of the major components of the system to sell their products and initiate warranty service on the same items for this project. Major components of the system shall include, but not be limited to IT Data, Voice and Audio video components etc.
6. Manufacturing authorization letter must be submitted for this Work addressing to Client stating that the bidder is authorized to provide sales and services on behalf of OEM.
7. In view of the above, commissioning and programming will have to be carried out to integrate all the system architecture hardware and software.

Submittals:

- Compliance Statement- (Mandatory)
- Datasheet- (Mandatory- Relevant Pages only)
- Bill of Quantity- (Mandatory)
- Drawings as required
- Manufacture Authorization Letter (Mandatory)
- OEM Certification
- No Deviation Certificate (for Technical Compliance) on EPC Contractor letterhead (Mandatory)

8. Makes and Models: - It is mandatory to provide make and model of the items and their subcomponents as has been sought in the technical bid. Please note that substituting required information by just brand name is not enough. Bidder should not quote hardware or software items which are impending End of Life or End of Support during the contractual period. In case any item is left, written approval of the same is mandatory from BCD.
9. Software, Drivers and Manuals: - The bidder shall supply along with each item, all the related documents, Software Licenses and necessary media of the software loaded in the equipment without any additional cost. The media and documents shall be in English. These will include, but not restricted to, User Manual, Operation Manual, Other Software and Drivers etc.
10. Warranty: The EPC Contractor/ Agency shall Warranty that all provided material and equipment will be free from defects, workmanship and will remain so, for a period of 36 months or more (DLP) from date of final acceptance of system by Engineer In charge / Consultant.
11. The EPC Contractor/ Agency shall provide a summary of all equipment serviced quarterly during this Warranty period to the facility in charge or REC. The report shall clearly mention services rendered, parts replaced and repairs performed.

The System integrator must have to submit the declaration (No Deviation Letter) on their letter head that they have carefully read and understood the document and SI will not deviate from the given design and specification described in the document. Moreover, it is complete responsibility of SI to design and take approvals from BCD on recommendation of consultant.

Complete design with drawing, mapping, 3d simulation, system line diagram must be approved in accordance to document, requirement, specification and preferred make list only.

Mentioned quantities in this document are minimum indicative quantities which may exceed as per the design requirement as per actual EPC contractor need to prepare the drawing, design, schematic, mapping, speaker 3D simulation. The quantity variation will be provided by EPC contractor as per approved design without any extra cost to client

13. IT DATA AND VOICE NETWORKING SYSTEM:

Data Networking is the collection of interconnected communication systems, designed to meet the current and future needs of the Live fire testing lab. Firewall, routers, switches, wireless LAN and telephony combine to form a unified infrastructure to best meet the communication requirements of an organization.

The integrated Data networking infrastructure should incorporate the all-IP related service which includes:

- a. Data Networking and Local area network infrastructure.
- b. Complete Wireless LAN to create Wi-Fi enabled campus.
- c. Complete Telephony Infrastructure for complete campus
- d. All the network requirement of every services deployed in the campus requires the TCP-IP communication i.e.; IBMS, Audio Visual etc

A. SCOPE OF WORK:

The scope of work shall include planning, designing, supply, installation, testing and commissioning of complete LAN and Wi-Fi Systems.

- a. The outlets are as described in the Internal EI subhead. The scope of work also includes the provision of both Active & Passive Components.
- b. The complete system shall be on a 10G backbone.
- c. The core switch shall be ONE working + 1 Stand-by.
- d. The complete system has to be supplied, installed, tested and commissioned in complete manner to have a fully functional system, as required.
- e. The entire convention centre shall be Wi-fi enabled. EPC Contractor shall submit wi-fi hot mapping.

- f. Every floor shall have suitable no. of floor-standing / wall-mounted racks with suitable no. of switch in each wing where the CAT-6A cabling from the respective floor data points shall terminate.
- g. The EPC contractor shall ensure that the maximum length from the switch to the data point including the patch cords etc. does not exceed 90m. There shall be 10% redundancy on each switch.
- h. Each floor rack shall be connected to the Server Room Main racks through backbone Optical Fibre cable and links
- i. The Optical fibre network should be created in two-layer manner:
 - The building/block to building/block must have multi-mode Fibre
 - The interconnectivity between switch within building must be in the multi-mode fibre cable.
- j. The LAN Structured cabling should be of CAT 6A. All user nodes of passive cabling should be on CAT 6A networks with 20 years performance warranty certificate, all passive equipment should be of same make. Third party test should be done for certification of Copper and Fiber nodes. Fiber cable should support 10G & 40G transmission. The IT network backbone shall have redundancy in fiber optic cable topology. All the structured cabling should be ANSI/IEIA/TIA approved for appropriate work. The passive cabling shall be laid as per BICSI standard. All passive cabling & its components should be from same OEM. Fiber route markers with arrow showing the route as per site requirement are required.
- k. Suitable Data Centre with false flooring and ceiling shall be established in Building, which comprises both LAN head ends & IPABX head ends. There shall be proper redundant (24x7) cooling facility in the Data Centre to maintain the desired temperature, humidity & Indoor air quality for smooth operation of the System.
- l. The System will have High Availability mode connected to Core / Distribution Switch Connectivity. Minimum 25Gbps uplinks and switch shell be through Optical Fiber cable. Distribution to edge switch connectivity minimum 10G and each floor Building

with optical fiber cable in underground DWC HDPE pipe of suitable size for outside connectivity or in cable raceway/conduit inside the buildings.

- m. The system shall have Firewall protection, Bandwidth management & required client Access license. The incoming Fiber cable from Service provider for the Campus Broad band connectivity shall be terminated in the Server Room. There shall be a Wireless LAN controller which can control up to 250 AP indoor/ outdoor.
- n. The Rack Panel comprising of jack/Patch panels, Network switches, patch cords, power supply units, Cooling Fans, Wire managers, LIUs, Trans-receivers, Fiber patch cord etc. of individual buildings/Blocks/ floors. LAN Infrastructure at different based networking would be done for all suitable locations on all Floors of the building.
- o. Wireless access points for Wi-Fi connectivity are proposed at various locations , full coverage interior side of building etc. as per site requirement etc.
- p. The IP EBAX system shall have capacity as per site requirement. Expendable all other locations shall have telephone points like workstations and other suitable locations as per drawing Node matrix. The EPBAX system shall have all Analog/ Digital cards suitable as per the requirements.

B. MINIMUM QUANTIFICATION:

The calculation of the data, voice and Wi-Fi points should be done with reference to the final approved architectural and interior planning of the campus and requirement of all services that so ever requires the TCP-IP point. The complete solution and system has to be defined and designed with respect to that calculation. Moreover the documents have described the minimum quantity of the data voice and Wi-Fi points.

A minimum 20% spare capacity shall be provisioned in each switch and at least two spare fibers per backbone link for future expansion.

PUBLIC ADDRESS SYSTEM (PA SYSTEM):-

PA system shall be provided as required. Speakers in the Ceiling/Wall shall be provided in corridors, lobbies and other common areas as per NBC2016/relevant IS codes.

- a. Box type speaker shall be provided in the entrance lobby.
- b. Horn type speaker are suggested in the Ground Floor Exit & Entrance.
- c. Recessed speakers in the false ceiling areas.
- d. Proper zoning are to be done considering the user requirement, critical areas & floor etc.
- e. Control console shall be located in the fire control room with pre amplifiers, amplifiers, CD, DVD/Pen-drive, FM Player & gooseneck microphone.
- f. System shall have the facility to make announcement on all floors simultaneously or on individual floors.
- g. Wiring shall be done with twin twisted tinned copper wire in the conduit.
- h. All cabling shall be fire survival (IS 16118) type with LSZH sheath. The system shall be integral with Fire alarm panel and with the BMS also as required. (Refer – Fire Fighting DBR for detail Specification).

SIGNAGE SYSTEM: -

LED Exit/Entrance sign board with concealed in false ceiling, complete in all respect as per drawings, & manufactures specifications with normal Illuminated signage for Toilets, common area, reception pre-function area etc. Illuminated Signage system should be OEM standard shall be adopted in all facility buildings, Lobby, stairs, fire Stairs, Toilets, common area, Conference Hall, Reception, etc. Along with Name plate illuminated signage. The Signage systems shall be electrically operated with minimum 2 hrs batteries backup.

As approved by Engineer-in-charge.

NOTE :-

1. THE FINAL SELECTION OF EQUIPMENT LIES IN THE OWNER ON RECOMMENDATION OF CONSULTANT. THE CONTRACTOR WILL SUGGEST MINIMUM TWO MAKES OUT OF THE APPROVED LIST OF ABOVE.

2. 2. IN RESPECT OF MATERIALS FOR WHICH APPROVED MAKES ARE NOT SPECIFIED AS ABOVE, THE SAME SHALL BE DECIDED BY THE CLIENT AND SHALL BE AS PER SAMPLE GOT APPROVED FROM CLIENT BEFORE PROCUREMENT.

14. GRID-INTERACTIVE ROOFTOP SOLAR PV SYSTEM (8 kWp)

- **ROOF TOP SOLAR:-**

Grid Connected Input and Output supply shall be taken from the solar system, civil work shall be extra as mentioned below, and Solar panel must be MNRE approved. Shop drawing with data sheet shall be provided by the EPC Contractor for approval from department & Engineering In-charge. **ECBC latest norms to be followed.**

Design, fabrication, Supply, Installation, Testing and Commissioning of Roof Top Solar Photovoltaic System Power Generation Plant having minimum generation capacity **8Kwp** using suitable rating Multi/Mono Crystalline Silicon PV Cells/ Modules & accessories conforming to IEC 61215 Ed-2 or latest & IEC 61730 part-1 & 2, Grid Connected Solar Power Plant Solar System with all below items. Roof Top Solar can be installed on the roof of Quartermaster Store and it can be centrally operated for following buildings and for that all necessities arrangements are to be done by EPC Contractor.

System will IEC complies as per MNRE Guide lines. The Systems include following Items/Equipment, Module Technology-Poly Crystalline, Considered Indian modules SCADA, WMS and Power Management Tool, Module Mounting Structure, civil part. BOS for **8kWp** (System Copper Cables, Junction Box, Surge Protection, ACB, MCCB, AC-DC DB, Earthing System etc.) along with Design.

The general assumption for SPVS design shall be as below:

- a) Inverter Efficiency =95%
- b) Battery Efficiency =95%
- c) Solar Efficiency =80%
- d) Solar availability = 6cat hrs/day
- e) Latest version of the specification shall be referred to.

The support structure, design and foundation shall normally be designed to withstand wind speed upto 169 km ph. The module shall perform satisfactorily and withstand gust up to 200 Km/h from backside of panel. Geographical data of data may be considered for design to get optimum generation of Solar PV System. It is proposed to install the solar panel to generate the electrical power. The solar panel shall be provided as per government regulation.

• **REFERENCESTANDARDS:**
(TABLE)

IS:12834:1988(reaffirmed 2000)	Solar Photovoltaic Energy Systems – Terminology
IEC : 61215 Ed 2 or Latest	Crystalline silicon terrestrial photovoltaic (PV) modules– Design qualification and type approval
IEC: 61730 Pt. 1 &2	Photovoltaic (PV) module safety’ qualification – Part 1: Requirements for construction Part 2: Requirements for testing
IEC: 61701	Salt mist corrosion testing of photovoltaic (PV) modules.
IEC:60904-1(2006)	Photovoltaic Devices- Part-IS: current-Voltage Characteristic. Measurement Of Photovoltaic
IS: 9000	Basic environmental testing electrical items. procedure for Electronic
	And
IEC:60068	Environmental testing
IEC 61723 Ed1.0	Safety Guidelines for grid connected photovoltaic systems mounted on the buildings.

Note: Latest version of the specification shall be referred to.

- **Scope of Work (SITC)**

1. Design & Approval: Submit layout, SLD, and energy generation report for approval.
2. Supply: Procure all listed components as per technical specs.
3. Installation:
 - Civil works for structure foundation.
 - Mechanical erection of structure and modules.
 - Electrical wiring, cabling, and termination.
4. Testing & Commissioning:
 - Insulation Resistance (IR) Test, Voc/Isc measurement.
 - Performance verification and grid synchronization.
5. Liaison: Handle all DISCOM liaison for net metering approval and installation.
6. Handover: Provide As-Built drawings, O&M manuals, warranties, and operator training.

15. USER REQUIREMENTS AND TECHNICAL SPECIFICATIONS:

Additional technical specification for Electrical works:

Note: The following information given is indicative only. Execution shall be carried out as per functional requirement and design approved by engineer-in-charge.

1. All internal electrical works shall be carried out with MS conduit. All switches, sockets, AC Starter, IP Phone socket, Data sockets, stepped type electronic fan regulators, bell push and accessories along with matching mounting boxes shall be of modular type.
2. All lighting fixtures should be LED type having efficacy more than 100 Lumen / Watt for bigger areas and more than 90 lumen/watt for toilet and 52 ispatch 52, CRI >80, THD <10%, LM 80 test report from NABL accredited lab should be submitted by the agency. Driver should be BIS certified. Colour temperature may be 3000/4500/6000/K as per site requirement.
CIMFR Certified LED flameproof batten suitable for Lab testing area.
3. Required illumination level for general lighting shall be achieved as per CPWD/NBC/guidelines. Wherever range of illumination for space is mentioned, higher side of Lux level must be taken for design purpose.
4. Arrangement of luminaries in various areas of buildings shall be done on the basis of Illumination level as specified in CPWD specification Internal 2013 / NBC 2016.
5. Ceiling fans will also be provided as required. The size of ceiling fans shall be 1400/1200mm with ISI marked / 4 Star rated. Optimum size and number of ceiling fans for rooms of different size shall be as per provision laid down in CPWD specifications for

internal E.I.work- 2013. Minimum air delivery and service value shall be as per the above specification.

6. Wiring for Intercom / Telephone shall be terminated in suitable size of G.I. Junction box and RJ11 socket. All the other end of wiring shall be terminated in krone box at each floor and in the EPBAX room. The wiring shall be suitably tagged/marked mentioning the location of each point.
7. Wiring for LAN shall be terminated in suitable size of G.I. Junction box and RJ-45 socket. All the other end of wiring shall be terminated in Patch panel including rack of Each block/floor and suitable wiring shall be done between all patch panel to server room.
8. 8 Wiring for CCTV in MS conduit shall be provided as per the design and to be terminated in G.I. Junction box.
9. Minimum size of copper conductor for power wiring shall be 4 Sq. mm and for light and Fan points wiring shall be 1.5 sq. mm.
10. Essential & non-essential DBs shall be separate. The size of both type of DBs shall be same irrespective of number of circuits connected from the DBs.
11. The wiring and conduit route plan/drawings shall be submitted by the contractor and shall be got approved from the Engineer-in-charge.
12. To facilitate drawing of wires, 18 SWG GI fish wire shall be provided in recessed conduit. Conduits laid for other services, like fire alarm, PA system etc., where wiring is not done along IEI works, fish wire shall be invariably drawn.
13. The connection between incoming switch / isolator and bus bar shall be made with suitable size of thimble and cable.
14. Size of distribution board shall be as per number of light / power circuits. All distribution boards shall be double door type. RCBO of suitable rating shall be provided as main incomer in all DBs and to be get approved from Engineer in Charge.
15. In vertical DBs used for power distribution main incomer shall be MCCB of suitable rating breaking capacity.
16. LT panel including fire suppression system shall be cubicle type with IP 42 protection class and fabricated from CPRI approved fabricator as per accepted list attached and shall be equipped with digital type measuring instruments like ammeter, voltmeter, frequency meter. watt meter, multi-function meter etc. as per drawing approved by

Engineer - in – charge.

17. Each floor Panel shall be fabricated from 2 mm thick M.S. sheet powder coated with 7 tank process and shall be equipped with 4 pole MCCBs. MCBs. Bus bar, digital multifunction meter, LED indicating lamp extended rotary handle and all accessories as required.
18. MCCB, if used as incomer then it should have earth fault protection and time delay. Earth leakage modules are not acceptable.
19. The breaking capacity of MCCB for all types of panel boards except DBs shall be as per fault level of that location. The rated service breaking capacity should be equal to rated ultimate breaking capacities (LCS-LCU). Where LCS is service breaking capacity and LCU is ultimate breaking capacity and they should be of approved make. MCCBs above 200A shall be provided with micro processed relay with suitable fault level with adjustable O/L, S/C. protection and up to 200A with Thermal Magnetic release of suitable fault level having adjustable settings for O/L and S/C.
20. All types of panels shall be fabricated from CPRI approved firms and strictly as per CPWD specifications. The drawing of panel boards must be got approved from Engineer - in -charge before fabrication work. The panel board shall consist of MCCB as incomer and outgoing, copper bus bar, digital type ammeter. voltmeter OR multifunction meter. selector switches. LED type indication lamps etc as per standard sound engineering practice.
21. Rising mains: Upward transmission of power inside the buildings shall be done with the sandwiched compact type rising mains with copper busbar i/c all accessories i.e adapter box, cable end box, tap-off box with MCCB. Rising mains shall be provided separately for essential. non-essential & UPS. Rating of rising mains shall be decided as per maximum load of the building and future expansion and as approved by Engineer -in -Charge. Rising mains shall be conforming to IS 8623/ IEC61439 as amendment up to date.
22. While laying conduits for fire alarm system, sufficient junction outlets are to be provided as per the direction of the Engineer-in-Charge for detectors as required.
23. After completing the work. necessary test results as envisaged in CPWD General Specifications Part-1 (Internal)-2013 & Indian Electricity Rules 1956, shall be recorded and submitted to the department.

24. Lightning arresters shall be provided for building as per IS; 2309-1989 as amended up to date and CPWD specifications for internal work - 2013 & aviation lights (LED Type) shall also be provided.
25. For accommodating various size of cables incoming to the building. Medium class G.I. pipe of suitable size shall be provided.
26. Earthing: Earthing system comprising of earth electrode, earth conductor, earth bus. protective conductor etc for building shall be as per provision laid down in CPWD specifications part - 1, 2013. Earthing system should be designed such as to maintain earth resistance as specified in CPWD specifications. Earth resistance shall be checked / tested in harsh climatic conditions.
27. In other areas which are not covered in above paras following minimum provision shall be provided in the building: -
28. In corridor area for each 30 sq mtr area 1 no. 15 amp power plug, 2 nos 5 amps light plugs outlets.
29. In other area, for each 10 sq mtrs area 1 no, 15-amp power plug, 2 nos 5 amps light plugs and 2 nos computer outlets comprising of 1 no, 15-amp switch and 3 nos 5 amps sockets along with telephone and LAN shall be provided.
30. Near each computer outlet one number RJ 45 socket and one number RJ 11 socket shall be provided. Entire wiring for networking along with all necessary components like CAT-6A wire, Patch panel, Rack etc. are in the scope of work. The system shall be got approved by the Engineer-in-charge.
31. Heavy duty Metallic exhaust fan with louvers as per the requirement of ventilation shall be provided in each toilet.
32. External lighting--For compound lighting, suitable size of Octagonal poles with bracket and LED street light fitting shall be provided and Illumination to be maintained as per NBC

Note:-

- (i) Any amendment will be done by Engineer-in-charge as per site requirement.
- (ii) All type of TDS will be approved by Engineer-in-charge.

MAKE LIST		
1. ELECTRICAL WORK		
A	Internal Electrical Works	
1	MS BLACK ENAMELED/ GALVANIZED ERW CONDUITS.	BEC, AKG, STEELKRAFT, NIC, RM CON
2	M.S. CONDUIT ACCESSORIES	BEC, AKG, STEELKRAFT, NIC, RM CON
3	GI PIPES	JINDAL, TATA, AKG, BEC, NORPAC
4	PVC CONDUIT & ACCESSORIES	BEC, AKG, POLYCAB, HAVELLS, NORPAC, MALHOTRA
5	COPPER CONDUCTOR PVC INSULATED WIRES (FRLS)	RR CABLE, FINOLEX, POLYCAB, KEI ,HAVELLS
6	MODULAR SWITCHES, SOCKET OUTLETS & WIRING ACCESSORIES WITH MOULDED COVER PLATE	LEGRAND (ARTEOR/ STYLUS), SIEMENS, (WCGA) SCHNEIDER, (ZENCELO) LK (ENTICE) ABB (/IVIE), HAVELLS (MURANO)
7	HEAVY DUTY METAL CLAD SOCKET OUTLETS WITH MCB IN MS HOUSING	SCHNEIDER, HAGER, HAVELLS, ABB, LK, Legrand, HAGER
8	WEATHER PROOF SOCKET OUTLETS WITH MCB	SIEMENS,SCHNEIDER,ABB,LK,LEGRAND, HAGER
9	MINIATURE CIRCUIT BREAKER	SCHNEIDER, SIEMENS, ABB, LK, Legrand
10	EARTH LEAKAGE CIRCUIT BREAKER	SCHNEIDER, SIEMENS, ABB, LK, Legrand
11	TIMERS & CONTACTORS TO BE MOUNTED IN DB	SIEMENS, HAGER, LEGRAND,ABB,LK,SCHNIEDER

12	MCB DISTRIBUTION BOARDS IN SHEET STEEL HOUSING (DOUBLE DOOR)	SCHNEIDER, SIEMENS, ABB, LK, Legrand
13	HDPE CONDUITS & ACCESSORIES	DURALINE, RELIANCE, AKG,
B	DISTRIBUTION	
14	KWH METERS (ELECTRONIC DIGITAL TYPE)	LK, SECURE, LEGRAND, SCHNEIDER
15	SINGLE PHASE PREVENTER	LK, MINILEC, LEGRAND.
C	LOW TENSION SYSTEM	
16	TELEPHONE WIRES	LEGRAND/ HAVELLS LAPP, POLYCAB, R.R.KABEL
17	TELEPHONE TAG BLOCK	KRONE, POUYET, TVS, D LINK
18	TV CO-AXIAL CABLE	AKG/ LEGRAND/ HAVELLS LAPP, RPG,
19		SKYTONE, BATRA HENLAY, GM, R.R.KABEL
D	CABLES & ACCESSORIES	
20	CABLE LUGS	DOWELLS, JAINSON, Multi, Capital, Comet
21	CABLE COMPRESSION GLANDS	PEECO, COMET, Dowells, Jainson, Lapp
22	CABLE TRAYS/ CABLE LADDERS	LEGRAND/OBO SLOTCO, RICCO/RISHA CONTROL, Venus, Storrax, Pilco
23	ENERGY MONITOR/TRIVECTOR METER	NEPTUNE-DUCATI, LK, TRINITY, C&S
24	VOLTMETER, AMMETER	LK RISHAB, SIEMENS, AE, C&S
25	FIRE SURVIVAL CABLES	HAVELLS/LEGRAND/POLYCAB/FINOLEX/ KEI, R.R.KABEL

G	MISCELLANEOUS	
26	CEILING FANS (BLDC 5 Star BEE)	CROMPTON, HAVELLS, ORIENT, BAJAJ, ABOMBERG
27	EXHAUST FAN	CROMPTON, HAVELLS, ORIENT, BAJAJ
28	LED LAMP	TISVA, LT, PHILIPS, WIPRO, HAVELLS, JAQUAR, REGENT,
29	XLPE L.T. CABLE,1.1 KV GRADE(FRLS)	HAVELLS/LEGRAND/POLYCAB/FINOLEX/ KE I, R.R KABEL
30	LIGHT FIXTURES	TISVA, LT, PHILIPS, WIPRO, HAVELLS, REGSNT, JAQUAR, BAJAJ

31	RUBBER MATS	SYNTAX, TYCOON(ISI), ELASTOMERIC OR EQUIVALENT
32	TAPE OFF	CAT VISION, SHYAM
33	PVC PIPE	AKG/FINOLEX/ASTRAL SUPREME, MALHOTRA
34	CHANGEOVER SWITCH	L&T, SCHNEIDER, ABB, SIEMENS,LEGRAND
35	RACK	LEGRAND. RITTAL, APW, D-LINK, ELIXIR, NETRACK

36	EXTERNAL LIGHTING FIXTURE	PHILIPS, WIPRO, HAVELLS, CROMPTON, BAJAJ, LT
37	MAIN LT PANELS	ADLEC / TRICOLITE/ SPC ELECTROTECH, SCHNEIDER, LK, LEGRAND, ABB
38	MCCB (ICS=100%ICU AT 415V)	LEGRAND (DPX3), LK (DSINE), SIEMENS (3VA), SCHNEIDER (NSX), ABB (FORMULA /TMAX)
39	ACB(3/4 Pole)	L&K /ABB/Siemens/Schneider
40	LT & HT Jointing kit/ Termination	Raychem/M-seal/Birla-3M

ELV- TELEPHONE/ CCTV/ DOOR ACCESS& MISC. SYSTEMS

40	IT Passive System / Cat 6 A Cables / Jack Panel/ Face Plate / IO / Fiber cable / Patch Cords / Fiber LIU etc.	COMMSCOPE / 3C3 / BELDEN / R&M/ DLINK/ TYCO
41	IT Active System / Switch L2, L3 / Wireless Access point / Controller/ Router	CISCO / JUNIPER(HP) / ARISTA /HP / ALCATEL
42	Internet Firewall	CISCO / JUNIPER / ARISTA / PALO ALTO / HP
43	Digital/ IP based EPABX	ALCATEL LUCENT / NEC / CISCO / PLOYCOM, TADIRAN
44	CCTV Cameras Dome/ Bullet/PTZ / NVR	AXIS / IDIS / MOBOTIX / SONY / CISCO / IMPULSE / HONEYWELL/ BOSCH, PELCO
45	Hard Disk	SEAGATE / WD / TOSHIBA
46	Access Control System	BOSCH/ HONEYWELL / SCHNEIDER
47	PTZ Camera 20 X / 30 X	BRONX / PANASONIC / SONY/ PELCO
48	Webcasting & Recording Server	LUMENS/ PANASONIC / CISCO
49	Wireless Microphones / Wired Mics / Antenna System / Ceiling Microphone	SHURE / SENNHIESER / DPA/ HARMAN/ YAMAHA/ BOSE
50	Mixer / Digital Mixer	ALLEN HEATH / YAMAHA / MIDAS/ BOSE
51	Wireless Conference System / Contoleer / Chairman Unit / Delegate System	BRONX /TELEVIC / BOSCH / BOSE/ POLYCOM

AIR CONDITIONING

52	Refrigerant Piping	MANDEV, MAX FLOW, KEMBLA, RAJCO
53	Drain Piping	SUPREME, POLYPACK, PRAKASH
54	Cabling	POLYCAB, HAVELLS, KEI, FINOLEX
55	Cable tray	NEDDO, UNIVERSAL, MECANO, D&D
56	Split Type AC	BLUE STAR/ DAIKIN/ HITACHI/ MITSUBISHI/ TOSHIBA, O-GENERAL

SOLAR ROOFTOP SYSTEM

57	Solar PV modules	ADANI/ TATA/ BHEL/VIKRAM/WAAREE
58	Solar Inverter	DELTA/ SMA/ ABB/NUMERIC by SCHNEIDER / APC
59	Data monitoring system	HP/ DELL/ LENOVO/ IBM/ ACER
60	<p>Mounting structure</p> <p>1. Fabricated from hot-dip galvanized steel (IS 2062) with a minimum zinc coating of 550 g/m². All fasteners (nuts, bolts, washers) shall be of SS 304 grade.</p> <p>2. Design shall be certified for wind speed of 169 km/hr or more whichever is suitable for seismic zone - [Zone IV.]</p>	