

**CO-OPERATIVE ACADEMY OF PROFESSIONAL
EDUCATION**

1ST FLOOR, CO-BANK TOWERS, VIKAS BHAVAN P.O., TRIVANDRUM

**ELECTRIFICATION OF DEPARTMENT BLOCK, ACADEMIC BLOCK
AND LIBRARY/CGPC BLOCK AT COLLEGE OF ENGINEERING,
KIDANGOOR**

TENDER DOCUMENTS

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Co-operative Academy of Professional Education

Tender Notification No.W-23/2011/CAPE Dt: 22.10.2011

Sealed Tenders are invited from reputed financially sound Class 'A/B' Electrical contractors having valid license for carrying out all medium voltage Installation work issued by the Kerala State Electrical Licensing Board for carrying out the electrical wiring work with approved materials conforming to BIS standards and other Statutory Rules and Regulations at Collage of Engineering, Kidangoor, Kottayam, as per the detailed specifications covered in the schedule attached herewith

Offers in sealed cover superscribing 'Tender for Electrification' shall be sent so as to reach the office of the undersigned on or before 13.00 Hrs on 10.11.2011

The offer should contain an EMD of Rs. 88,500/- (2.5% of cost) and registration cost of Rs. 6,000/- by way of DD from SBT in favor of the Director CAPE payable at Trivandrum and Preliminary Agreement in Rs.100/- Kerala Stamp paper.

The tender shall be opened at 15.00. hours on 10.11.2011
The probable amount of the work is Rs. 35,40,000/-

The Director,
C.A.P.E,
Co.op Bank Tower,
Vikas Bhavan P.O,
Thiruvananthapuram.

TECHNICAL SPECIFICATION
COLLAGE OF ENGINEERING, KIDANGOOR,KOTTAYAM.

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SECTION I

General Requirements

1. Scope of Work:

1 General:

The scope of work shall be generally as given in the Tender Schedule and in the drawings for the electrification work. The intention of the specification, Tender Schedule and the drawings is to give finished work of approved and standard quality and all duly tested and commissioned. All minor items of details usually not shown or indicated but necessary for the completion of the system, including testing, commissioning and handing over shall deem to have been included in the work and in the rates quoted by the contractor.

2. The work is divided under following.

- a. The entire internal electrification work shall be with Fire Retardant Cu wires in concealed PVC conduits with necessary accessories and Modular switch boxes and modular accessories ,classified as group B in the KPWD specifications.Pipes will be laid during concreting and drops will have to be concealed later.
- b. The Supply and Erection of lighting luminaries, ceiling fans, exhaust fans etc.
- c. The complete earthing system including earthing stations, earth conductors, earth bus and their connections.
- d. Providing power supply, one meter panel is proposed to take supply for the common areas. For the entire building pipe layout is made taking into consideration of lux levels specified in the national building code. For the common areas 150 lux and for the working station 400-500 lux is taken.Basedd on that, points are arrived at. Every 100 Sqft one ceiling fan is proposed
- e. One three phase vertical Distribution board will receive supply. Six nos Single phase Distribution boards, 12way enclosure with Double pole MCB isolator and Double pole ELCB of 30mA sensitivity as incoming and 8nos circuits .Four numbers distribution boards are ground floor and two numbers are for first floor as shown in the schematic diagram.

- f. For distant Distribution boards 2X6 sqmm armoured cable and for the nearest distribution boards 2 X4 sqmm armoured cables are proposed.
- g. Independent 6A sockets are for connecting Emergency lamps in the staircases.

10 Liaison and Co-ordination work:

- 10.1 All liaison and co-ordination work with KSEB, Electrical Inspector or any other statutory body and agency will be contractor's responsibility and expenses towards the same will be met by the owner. This liaison work will include all activities in all stages starting from making application to KSEB and/ or other agencies and up to and including release of required permanent electric connections for this project. The owners will pay the official fees, deposits and such other payments, which are to be paid in the name of the owners.
- 10.2 After connection regular supply by KSEB the installation shall be again checked by the contractor.
- 10.3 The contractor shall carry out all minor civil works connected with the electrical job. The contractor shall repair and make good the damages caused by him to the civil structure while executing the electrification work. The foundations for the panel board, and distribution pillars, grouting of frames in the wall, erection of D.B./switchboards on the wall etc. are all to be carried out by the contractor.

3. Abbreviations:

The following abbreviations have been used in the specifications, drawings and bill of quantities.

BIS :	Bureau of Indian Standards.	E	: Earth conductor.
ISS :	Indian Standard Specifications.	AL	: Aluminum conductor.
Cu	: Copper conductor.	MSB	: Main Switch board.
GI :	Galvanized Iron.	MS :	Mild Steel
MV :	Medium Voltage.	V :	Volts.
LV :	Low Voltage.	SP :	Single Pole.
AMP :	Amperes.		
. CI :	Cast Iron.		
MCB :	Miniature Circuit Breaker.		
DB :	Distribution board.		

4. Regulations and standards:

The installation shall conform in all respects to Indian Standard code of Practice for Electrical Wiring installation IS 732-1963 and IS 2214-1963. It shall also be in conformity with the current Indian Electricity Rules, Indian Electricity Act. National Electric Code and Regulations of the Local Electrical Supply Authority in so far as these become applicable to the installation. Wherever this specification calls for a higher standard of

material and/or workmanship than those required by any of the above regulations then this specification shall take precedence over the said regulations and standard. In general, the materials equipment and workmanship not covered by the above shall conform to the relevant Indian Standards.

5. Approvals and tests:

The contractor shall get approval for the work from KSEB and Electrical Inspector. On completion of the work the contractor shall obtain and deliver to the Consultant certificates of final inspection and approval by the local electric supply authority and electrical inspector. The consultant/client have full powers to test the materials or work or arrange to be tested by an independent agency at the electrical contractor's expense in order to prove their soundness and adequacy. Only approved materials in the list given will be allowed.

6. Actual route of cables / Conduits etc:

The locations of the DB's, light/fan points, power points and routing of the conduits, wires and cables as shown on the drawings are only indicative. Therefore the actual route and locations may differ from the plans according to the working drawings for civil construction and site conditions.

7. Drilling and cutting:

The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of mains and conduits that are found necessary during the work, to the complete satisfaction of the owner's representative.

Cutting of walls or other parts of the building for the complete and proper installation of the electrical equipments shall be the responsibility of the electrical contractor. However **Beams, girders and other principal structural members** shall not be cut or drilled. Any damage to finished surfaces shall be made good by repair or replacement at the contractor's expense. The contractor shall possess and make use of necessary tools and equipment for cutting grooves on walls.

8. Material and equipment:

All material and equipment shall conform to the relevant standards and shall be of the approved make and design. Unless otherwise called for, only the best quality materials and equipment shall be used. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all the materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the consultant.

All materials of the same kind of service shall be identical and made by the same manufacturer. The Consultant shall approve any deviation to this rule. Pipes, switches, sockets, ceiling roses wires shall bear ISI markings.

9. Voltage:

Except for supplies to specialist equipment, the normal utilization voltages shall be 3 phase, 4 wire, 50 Hz, 415 volt between phases, 240 volt between any phase and neutral, with a solidly earthed neutral.

10. Manufacturers:

Where manufacturers have furnished specific instructions relating to the materials proposed to be used in this job, covering points not specifically mentioned in these documents, these instructions are to be followed.

Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

11. Rating:

Rating of all items shall be appropriate for the conditions on the particular site on which the item will be used. All the equipment shall be fit for continuous work under the heaviest conditions of site and shall be rated for the following condition.

- Outdoor temperature 45°C
- Temperature under shade 40° C

12. Inspection and testing:

The owner's representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times during manufacture of items for this contract. Tests on site of complete works shall demonstrate, among other things.

1. That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.
2. That all items operate efficiently and quietly to meet the specified requirements.
3. That all circuits are correctly fused and protected and that protective devices are properly coordinated.
4. That all non-current carrying metal work is properly and safely grounded in accordance with the specifications.

The contractor shall provide all necessary instruments and labour for testing shall make adequate records of test procedures and readings, shall repeat any tests requested by the Consultant/client and shall provide test certificates signed by a properly authorized

person. Such test certificates shall cover all works. If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or retesting will be considered. The Consultant/client's decision as to what constitutes a satisfactory test shall be final. The above general requirements as to testing shall be read in conjunction with any particular requirements specified for testing and commissioning.

13. Allowance for future growth:

To allow for future increases in electric load it is desirable that all mains and DB shall be provided with spare capacity / ways. The no. of spare ways shall be discussed and finalized with the clients before placing order these materials.

14. Test certificates:

The contractor shall submit test certificates for all the electrical material/system. These shall be issued by a government recognized inspection office certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications and accepted standards.

15. Samples and catalogues:

Before ordering the material necessary for these installations, the contractor shall submit to the Consultant/client for approval a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, boxes etc. along with the catalogues. For big items such as switchboards the submission of shop drawings and catalogues shall be enough. After the selection by the Consultant/client the contractor shall arrange inspection and testing at the manufacturers factory or assembly shop for final approval. No material shall be procured prior to the approval of the Consultant.

16. Vendor and shop drawings:

The contractor shall prepare and submit to the consultant/client for his approval two sets of detailed drawings of all distribution boards, switch boards, outlet boxes, special pull boxes, and other like wise materials and equipments to be fabricated by the contractor or other vendor.

Before starting the work, the contractor shall submit to the Consultant for his approval in the prescribed manner, the shop/execution drawings for the entire installation, specially the main connection and junctions, the route of Conduits and cables, no and size of wires to be drawn through the conduits, location of all the outlet points and switch boards and distribution boards and any other information required by the Consultant/client. The Consultant/client reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they don not offer the most satisfactory performance or accessibility for maintenance.

17. As built drawings:

At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to the consultant/client layout drawing drawn at appropriate scale indicating the complete system “as installed”. These drawings must provide.

1. Run, location and size of conduits and inspection, junction, and pull boxes, along with the location of sockets and switches containing the light and power outlets.
2. Location and details of DB's, main switches, switchgears and other particulars.
3. A complete wiring diagram as installed and scheduled drawings showing all connection in the complete electrical system.
4. Location of all earthing stations, route and size of all earthing conductors, Route and particulars of all cables, cable chambers, RCC pipes etc.

18. Safety of materials:

The contractor shall provide proper and adequate facilities to protect all the materials and equipment including those issued by the owner against damage from any cause whatsoever.

19. Completion certificate by Contractor.

On completion of the electrical installation (or extension to an installation) the contractor countersigned by the supervisor shall furnish a certificate, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local supply authority. The contractor shall be responsible for getting the electrical installation inspected and approved by the local concerned authorities, including electrical inspector.

20. Staff:

The contractor shall employ a competent fully licensed, qualified full time electrical engineer to direct the work at site, to receive instructions from Consultant/client and to correlate the progress of work in conjunction with all relevant requirements of the supply authority. All employees shall have insurance and shall take all safety measures during the working at site.

SECTION - II

Medium Voltage Distribution System

1. Wiring for lighting and power:

This specification covers, system and method of wiring, definition of point wiring, and supply, installation, connection, testing and commissioning of point wiring for light points, fan points, convenience socket outlet points, power socket outlet points, bell outlet points, etc. Wiring shall be with copper conductor PVC insulated wires drawn in rigid PVC conduits on walls, ceiling, etc. Wiring shall be from meter rooms to distribution boards, from DB to switch boards and from switchboard to outlet points. The method of wiring for this particular work shall be as mentioned under tender schedule.

2. System of wiring:

Medium voltage distribution system shall be applicable for wiring three phase, 4 wire, 415V, 50Hz, AC supply and single phase, 2 wire, 230V, 50Hz, AC supply.

3 Applicable standards:

- 1 IS: 732 Code of Practice for Electrical wiring installation (system voltage not exceeding 650 V).
- 2 IS: 1646 Code of Practice for fire safety of buildings (General)
Electrical Installation.
- 3 IS: 9537 (Part II) Rigid steel conduits for electrical wiring.
- 4 IS: 694 PVC insulated cables
- 5 IS: 1293 3 pin plugs and sockets.
- 6 IS: 8130 Conductors for insulated electric cables and flexible cord
- 7 IE: Rules Indian Electricity Act And Rules
- 8 IS: 5133 Boxes for enclosure of electrical accessories Part 1: Steel& CI
boxes.
- 9 IS: 371 Ceiling roses (Second revision)
- 10 IS: 4615 Switch socket outlets (non interlocking type)
- 11 IS: 3854 Switches for domestic and similar purposes.

4. General Requirements:

- 1 Before the conduits are installed the exact route shall be marked at the site for approval and the actual work shall be undertaken only after approval.
- 2 Load Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

3 Definition of point wiring:

A point shall consist of the branch wiring from the switchboard together with a switch and point control boxes as required, as far as and including the wiring accessories such as ceiling fan box or socket outlet point or suitable termination. A point shall include, in addition, the earth continuity conductor/wire from the switchboard to the earth pin/stud of the outlet/switch box.

5. **Scope of work:**

The medium voltage distribution system wiring shall be carried out in the under mentioned manner:

- a) Supply, installation, fixing of conduits and necessary accessories, switch boxes, outlet boxes and pull / junction boxes.
- b) Supplying and drawing of wires of required size including earth continuity wire.
- c) Supply, installation and connection of switches, sockets, cover plates, switch plates, concealed fan hook boxes / fan hooks as specified etc.
- d) The point shall be complete with the branch wiring from the switchboards to the outlet point, conduits and casing capping with accessories, control switch, socket outlet boxes, ceiling roses, batten/angle holder, connector etc.

6. **Boxes:**

6.1 Junction boxes:

All the boxes for junction boxes, pull boxes used in conduit wiring system shall be fabricated from 1.5 mm thick mild sheet steel with two coats of enamel paint of approved shade or powder coated as specified. The boxes shall have smooth external and internal finished surface. Separate screwed earth terminal shall be provided in the box for earthing purpose. All boxes shall have adequate no of knock out holes of required diameter for conduit entry.

The boxes shall be provided with a minimum of four fixing lugs located at the corners for fixing the covers. All fixing lugs shall have tapped holes to take machined brass screws. The boxes shall be sufficiently strong to resist mechanical damage under normal service conditions. Wherever different phase conductors are brought into the same enclosure, phase barriers shall be provided. The boxes shall have removable covers at top and bottom if specified. PVC deep junction boxes are to be used in slabs.

6.2 Switch boxes and Outlet boxes:

Switch boxes to receive switches, socket outlets, power outlets, and fan regulators etc. shall be 16 SWG cadmium plated GI/MS boxes as manufactured by the switch manufacturer for erection of plate of modular type switches.

The depth of the switchboard boxes shall be 50 mm and the size shall be selected so as to accommodate required number of switches, sockets and fan regulators without overcrowding the box.

6.3 Fan Regulator:

Fan regulators (Electronic step regulator) shall be incorporated in the front plate of switchboard and shall form a single unit under one front plate for switches erected on GI boxes.

10 Cables

7.1 All cables / wires used for internal wiring shall be Fire retardant PVC insulated single core stranded conductor as specified and of 1100 volts grade and with copper conductors.

7.2 The conductors shall be plain annealed circular copper conductors. The minimum number and diameter of wires for circular stranded conductor shall be as per relevant IS specifications. The insulation shall be PVC compound complying with the requirements of IS specifications and the thickness of PVC insulation shall be as set out in the relevant standards.

7.3 All wires shall be colour coded as follows.

Single phase	:	Red
Three phase	:	Red, Yellow and Blue
Neutral	:	Black
Earth	:	Green on Green/Yellow (insulated)
Control (if any)	:	Grey

7.4 The wires shall be supplied in sealed coils of 100 Mts length and bear the manufacturer's name, trademark, ISI mark, voltage grade etc.

7.5 Bunching of cables:

a Wires carrying current shall be so bunched in the conduit that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

b. The number of insulated wires/cables that may be drawn into the conduits shall be as per the following table. In any case conduits having less than 20 mm dia shall not be used.

c. Bunching of cables in conduits:

Max permissible no. of 1 core cables that may be drawn through different conduits:

Cable size (sq.mm)	Size of conduits (in mm)			
	20	25	32	40
1.5 (stranding)(22/. 3)	7	15	24	-
2.5 (36/. 3)	5	11	17	-
4.0 (56/. 3)	4	8	13	-
6.0 (2	4	6	7
16.0	-	3	4	6

8. Drawing of conductors:

- 8.1 No wire shall be drawn into any conduit, until all work of any nature that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture dust and dirt or any other obstruction by forcing compressed air through the conduits. The drawing and joining of copper conductor or wires shall be executed with due regard to the following precautions.
- 8.2 While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks, which may cause breakage of conductors. There shall be no sharp bends in the conduit system.
- 8.3 Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing.
- 8.4 Strands of wires shall not be cut for connecting to the terminals. The terminals shall have adequate cross section to take all the strands.
- 8.5 All looped joints shall be soldered and connected through terminal block/connectors. the pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.
- 8.6 Conductors having nominal cross-section area exceeding 2.5sq. mm shall be provided with crimping type cable sockets.
- 8.7 At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass Nuts & Bolts shall be used for all connections.
- 8.8 Only certified wiremen and cable jointers shall be employed to do jointing work.
- 8.9 For all internal wiring PVC insulated wires of 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in looping system and no joint shall be allowed in the length of the conductors.
- 8.10 General wiring installation shall be as under.

- a. Sub-main wiring
Wiring from meter room or main panel board to the distribution boards.
 - b. Circuit wiring
Wiring from DB's to point control boxes for lighting fan 6A sockets call bells etc. and from DB to the power sockets in the case of power wiring.
- 8.12 The sub-main wiring shall be either three phase, four wire or single phase, tow-wire system. Each sub-main wiring circuit shall also have its own earth continuity wire. The no and size of earth continuity wire shall be as per detailed drawings or as specified.
- 8.13 The circuit wiring shall generally be in single-phase system. However a maximum of 3 to 4 single-phase circuits belonging to the same pole/phase could be installed in the same conduit or raceway Each circuit wiring shall be provided with suitable earth continuity conductor as per standard specifications.
- 8.14 Not more than 10 light points/fan points shall be grouped on the one lighting circuit. The load per circuit shall not exceed 800 watts. The minimum size of conductor for wiring of lighting circuit shall not be less than 1.0 Sq.mm. Power circuit wiring shall not have more than two sockets connected to one circuit.

9. Joints in wiring:

The wiring shall be by looping system, and hence all joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside conduits and junction boxes. Conductors shall be continuous from outlet. For unavoidable joints due to any reason prior permission shall be obtained before making such connection. Joints by twisting conductors are prohibited.

10. Switches, sockets and accessories:

10.1 Switches:

- a. Switches shall confirm to IS 3854, IS 1293, IS 6538 and IS 4615. Switches shall be single pole, single or two-way as shown on the drawings.
- b. The switches shall be rocker operated with a quite operating mechanism with bounce free snap action mechanism enclosed in an arc resistant chamber. .
- c. Switches at the same location shall be ganged to form a single unit under one cover plate. Where fan regulators are to be provided with the switchboards the same shall be incorporated.

10.2 Sockets:

- a. The sockets shall conform to IS 1293. Each socket shall be provided with control switch of appropriate rating. The sockets shall be moulded type, rated for 250 volts, and either of full 6 Amp or 16 Amp, capacity, as mentioned.
- b. Sockets shall be of three-pin type, the third pin being connected to earth continuity conductor. The socket shall be flush type. The sockets installed in machine room plant room or wet/damp area shall be metal clad weatherproof type. The socket shall have fully sprung socket contacts and solid brass shrouded terminals to ensure positive electrical connections.
- c. If specified, the sockets shall be provided with automatic shutters, which open only when earth pin of the plug inserts in the socket and provided with three pin plug top suitable to the socket and of the same make as socket.
- d. All 6A sockets, 16A switched sockets, DP switches, connector boxes etc. shall be as specified and with the finishing and make same as lighting switches. These shall be erected on the boxes as specified in drawings.

10.3 Lamp holders, Ceiling roses etc.:

Accessories for light outlets such as lamp holders, ceiling roses, etc. shall be white in colour and in conformity with requirements of relevant IS specification. Ceiling roses shall be 3-plate type wherever specified. Angle and batten holder shall be erected on the junction boxes erected on wall/ceiling.

10.4 Installation of switch, socket and accessories:

- a. Connection to be made only after testing the wires for continuity /cross phase etc with the help of a megger.
- b. The switch controlling the light point or fan shall be connected on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B. the third pin of the socket shall be connected to the earth continuity conductor of the circuit.
- c. Outlets shall be terminated into ceiling rose for ceiling mounted points. For other wall light points the outlets shall be connected into an angle holder. For wall plug sockets the conductors may be terminated directly into the switches and sockets.

11. Earthing:

All earthing systems shall be in accordance with IS 3043 code of practice for earthing the type and size of earthing wire shall be as specified separately and in BOQ and drawings.

12. Testing and commissioning of installation:

Before a completed installation is put into service, the testing of the installation shall be done as per IS 732.

12.1 Insulation Resistance:

- a. The insulation resistance shall be measured by applying 500 volt. megger with all fuses in places, circuit breaker and all switches closed.
- b. The insulation resistance of an installation shall be required to have a value greater than one-mega ohms.
- c. The insulation resistance shall be measured between.

- 1 Earth to phase
- 2 Earth to Neutral
- 3 Phase to Neutral

12.2 Earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker, measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

12.3 Polarity or single pole switches:

- a. A test shall be made to verify that every non-linked, single pole switch is connected to one of the phase of the supply system.
- b. In, a two-wire installation a test shall be made to verify that all non-linked single pole switches have been fitted in the same conductor throughout and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply.
- c. In a three wire or four wire installation a test shall be made to verify that every non-linked single pole switch is fitted in a conductor and which shall be labeled or marked for connection to one of the outer or phase conductor of the supply.

SECTION -III

MCB DB, MCB and RCCB

1. Miniature Circuit Breaker Distribution boards:

- 1.1 Miniature circuit breaker distribution boards shall conform to IS 2675, IS 8623 and shall be suitable for operation on three phase, 4 wire, 415 V, 50 Hz, AC supply or single phase 2 wire 230 V 50 Hz, AC supply.

- 1.2 The MCB distribution board shall be in sheet steel enclosures with removable type cover with additional door for protecting accidental operation.
- 1.3 Enclosure and door shall be made out of CRCA sheet steel and powder coated and of approved shade. The interior shall be off white finish. The DB shall be totally enclosed with dust and vermin proof construction and shall be of domestic pattern. The DB boxes shall be as supplied by the original manufacturer.
- 1.4 Where distribution boards are specified to be complete with an isolator as incomer, the isolator shall be double pole for SP and N distribution boards and 4 pole for TP and N distribution boards.
- 1.5 Where distribution boards are specified to be complete with MCB + ELCB as incomer, the MCB + ELCB shall be double pole for SP and N distribution boards and 4 pole for TP and N distribution boards.
- 1.6 Bus bars shall be tinned copper. The internal connections in the DB shall be by using stranded copper conductor, PVC insulated wire with copper lugs crimped at both ends. Neutral busbar and earth busbars shall also be provided in the enclosure. Neutral busbar shall have equal rating of phase busbars.
- 1.7 Distribution boards shall be provided with circuit identification by means of directory on the front cover. Upon completion of the works, the contractor shall provide and fix accurate framed circuit lists for all distribution boards. These shall consist of Perspex envelopes, fixed securely by an approved method on the inside face of each distribution board front cover into which shall be inserted a neatly typed list of circuits, indicating the number of circuits, phase, cable, size, number of points connected, circuit rating and the loading.
The contractor, shall also provide and fix by means of brass screws tapped into the D.B. cover, labels, with black letter on a white background for all distribution boards, MCB + ELCB, Isolator etc. The engraving on the labels and the inscription on the circuit lists shall be approved by the Consultants before the work is carried out.
- 1.8 All incoming terminals shall be fully shrouded.
- 1.9 The conduit entry plates shall be removable type and shall be provided at top and bottom. All the conduits shall be properly terminated using glands, grips, check nuts, female adapters with bush etc.
- 1.10 Wiring shall be terminated properly using crimping type copper plugs/sockets. Identification ferrules shall be provided on all wires.
- 1.11 Two No. earth terminals shall be provided on each Distribution Board.

Recessed mounted DB shall be erected in the chase/cut portion of the wall. The cutting on the walls shall be done while constructing the wall and shall be of adequate size to comfortably accommodate the DB. The cut portion shall be smoothed and

made plain and shall be fine finished. The DB shall be fixed in this chased portion with suitable clamps and bolts. The top cover of the DB cabinet shall be projecting out of the wall surface and free from any obstruction so as to open the same smoothly.

2. Miniature Circuit Breakers:

- 2.1 MCBs shall be manufactured in accordance with IS 8828 having a short circuit breaking capacity category 10000 Amps at both 240 volts 50Hz. and 240/415 V, 50 Hz and complying with the test requirements for both reference calibration temperatures of 20 degree C and 40 degree C.
- 2.2 All miniature circuit breakers shall be rated to withstand the fault currents of the circuits they protect without causing any interference in any other protective device associated with the distribution system. At the same time the design of the circuit breakers shall be such that, it will protect the circuit for which it is intended and not cause or allow other protective devices to operate when fault conditions apply.
- 2.3 Miniature circuit breakers shall be capable of carrying its full rated current continuously without tripping out.
- 2.4 All the miniature circuit breakers shall be fitted with a magnetic undelayed tripping mechanism.

3. Residual Current Operated Circuit Breakers (RCCB)

- 3.1 RCCBs shall be manufactured in accordance with IS 12640 and IS 8828 having a short circuit breaking and earth fault protection up to 10 KA at both 240 Volts 50 Hz and 240/415 V, 50 Hz and complying with the test requirements as per IS 2640.
- 3.2 All RCCB shall be high sensitive and calibrated rating. This means that a 30 mA sensitivity RCCB should trip when the residual current is in the range of 15 to 30 mA and a 300 mA RCCB should trip when the residual current is in the range of 150 to 300mA.
- 3.3 The RCCBs shall be truly current operated, which means that it shall be totally independent of the main voltage for tripping. RCCB must operate for nominal voltage well below the maximum safe value of 10 volts. RCCB shall interrupt the circuit within 30 millisecond at a leakage current of 30 mA.
- 3.4 RCCB shall be provided with a neutral advance mechanism. RCCB shall be functioning even in the event of failure of neutral and/or any one or two of phase supply conductor. RCCB shall be provided with trip free mechanism ensuring that the device cannot be reclosed / resent if the fault persists. RCCB shall be functioning even in the case of interchange of load and supply side connections.
- 3.5 Test button shall be provided to check the correct operation of the unit.
- 3.6 RCCB shall be designed for a very long life of a minimum of 20,000 operations and shall be capable of withstanding inrush current of 4 to 8 times the rated current. For the proper functioning the RCCB should not require any connection of earthing on the device.

- 3.7 The device should have high tripping accuracy of less than 5% of rated tripping current. The RCCB shall be provided with clear indication to show whether the tripping is due current leakage or overload/short circuit.

SECTION - IV

Earthing

1. Scope:

This specification covers supply of necessary materials, and erection at site, of complete earthing system including earth pits at the locations indicated, earth conductors from earth pit to the respective equipments, switchgears, pillars etc. and making connections, testing at site, commissioning and handing over.

2. Applicable Standards:

The entire work of earthing system, shall confirm to IS 3043, Indian Electricity Act and Rules and relevant regulations.

3. General requirements:

- 3.1 The earthing shall generally be carried out in accordance with the requirements of Indian Electricity Rules 1956 as amended from time to time and relevant regulations. Following IE rules are particularly applicable. IE Rule Nos. 32, 51, 61, 62, 67, 69, 88(2) & 90.
- 3.2 All earth connections shall be carefully made, visible for inspection, and the testing of individual earth electrode shall be possible.
- 3.3 All materials, fittings etc. used in earthing shall conform to IS specifications and in the absence of which the approval of competent authority shall be obtained.
- 3.4 The earthing electrode shall be at a minimum distance of 1.5 metres away from the outer face of the building wall. A minimum clearance of twice the depth of the electrode shall be maintained between two earthing stations.
- 3.5 A brick masonry chamber to facilitate easy identification and for carrying out periodical tests and inspection shall be constructed on top of the earth pit.
- 3.6 All metal conduits, trunkings, cable sheaths, HT and MV switchgears, Transformers, distribution boards, meters, light fixtures, fans, and all other metal parts forming part of the work shall be bonded together and connected to earthing network as specified.
- 3.7 Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after passage of fault currents.
- 3.8 Joints shall be soldered, tinned and double rivet. All the joints shall be mechanically, electrically continuous and effective. Joints shall be provided against corrosion.

4. Earth Electrodes:

- 4.1 The materials of earth electrode and earth conductors shall be galvanized iron unless specified otherwise in Bill of Quantities, specifications or drawings.
- 4.2 The earth electrodes shall be free from paint, enamel, grease etc.
- 4.3 The earth electrode shall be embedded as far as practicable in a moist soil and below permanent moist level.
- 4.4 The earth electrode shall not be installed in the proximity of a metal fence.

5. Types of earth electrodes:

The earth electrodes shall be either a pipe electrode or plate electrode, the details of which are as given in the following sections of specifications, drawings and BOQ.

6. Pipe electrode:

- 6.1 Pipe electrode shall consist of 2.5 meter long single piece G.I. pipe of min. 40 mm dia, as specified and shall be cut tapered at the bottom. 12mm dia. holes shall be drilled with 75 mm spacing between the holes and in a staggered manner as indicated in IS 3043.
- 6.2 The electrode shall be buried vertically in a specially prepared earth pit of size 35 cm x 35 cm and the earth pit shall be filled with alternate layers of charcoal, salt and fine washed sand for a minimum thickness of 150 mm. A funnel with wire mesh inside shall be fixed to the top of the GI pipe for watering purpose.
- 6.3 A masonry chamber with a cast iron cover hinged to the cast iron frame embedded in the top portion of the masonry shall be constructed on top of the GI pipe to house the funnel and the earth connection. The approximate size of the chamber shall be 300 mm x 300 mm and 300 mm deep.
- 6.4 The earth conductor from electrode shall be taken out of the masonry chamber through a protecting pipe embedded in the masonry.
- 6.5 The top of the masonry chamber shall be 50 mm above the finished ground level.
- 6.6 Distance between Pipe electrodes shall be 5mts.

7. Earth conductor:

All earthing conductors shall be of high conductivity copper and or GI as specified and shall be protected against mechanical injury or corrosion. The connection of earth continuity conductors or earth bus and earth electrode shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cable trays or conduits and cables by using suitable clamps made of non-ferrous metals.

8. Testing:

On completion of the entire installation, the earthing network shall be tested for their resistance to earth in accordance with IS 3043. All meters, instruments & about required for the test shall be provided by the contractor. The test results shall be submitted in triplicate to the owners for approval. The following tests shall be conducted.

- a. Earth resistance of electrodes

- b. Impedance of earth continuity conductors.
- 10 Effectiveness of earthing.

SECTION - V

LT (1.1 KV Grade) Cables

1. Scope:

This specification covers supply, testing at works, supply at site, installation, termination, jointing, connection, testing at site, commissioning and handing over of 1.1 KV grade Cables.

2. System:

The 1.1 KV grade cables are to be used in under ground distribution system with normal system voltage of 415 V, 50 Hz, 3 phase, 4 wire system.

3. Applicable standards:

Cables to be supplied under this specifications shall be with Copper or Aluminium conductor as specified in drawing or Bill of Quantities, PVC insulated and PVC sheathed, armoured and with an outer PVC protective sheath, heavy duty type and shall conform to.

IS 1554 (Part 1) 1976.	PVC insulated electric cables.
IS 1753:	Aluminium conductors for insulated cables
IS 3961:	Recommended current ratings for cables.
IS7098	XLPE

4 General requirements:

- 4.1 All cables shall be new without any kinks or visible damage. The manufacturers name, insulating material, conductor size and voltage class shall be marked on surface of the cable at distance not exceeding 1M.
- 4.2 Procurement of cables shall be on the basis of the actual site measurements and the quantities given shall be regarded as a guide. Before procurement of the cables, the contractor shall submit the cable lengths and after approval of the same place orders for the cables.
- 4.3 Cables shall be tested at factory as per IS requirement. The tests shall incorporate routine tests, type tests and acceptance test. The certificate for type test shall be produced by the Contractor.
- 4.4 The cables shall be one of the makes mentioned in the list of approved materials and with ISI mark.

- 4.5 The cables shall be supplied and delivered at site in original cable drums with manufacturer's name, cable size, type and length all clearly indicated on each drum.
- 4.6 The unit rate shall include loading, unloading, transport, storage, handling, unwinding the cable from cable drums and laying in the cable trench or erected on cable trays etc.
- 4.7 The cables shall be laid by skilled and experienced labor.
- 4.8 Where the cable route intersects roads, streets or pathways, RCC spun pipes shall be laid in the trenches to serve as cable ducts. The pipes shall be joined by RCC spun collars. The RCC pipes shall project at least 150 mm on either side of road crossing.
- 4.9 The cable loops shall be kept at both ends of the cable length Minimum 3 metres long loop shall be provided.
- 4.10 The contractor shall take care to see that the cables received at site are apportioned to various locations to ensure maximum utilization and cable joints are avoided. This apportioning shall be got approved before the cables are cut to lengths. Straight joints are permitted only under exceptional circumstances.

5 Storage and loading, unloading of cables:

- 5.1 Cable drums shall not be stored one above the other. Sufficient space between cable drums shall be left for air circulation and the drums shall stand on battens placed directly under the flanges.
- 5.2 Cable drums shall be stored preferably on a plain ground without having any hard stones or any other sharp materials projecting above the ground surface. The drums shall be stored preferably in the shed or otherwise they shall be covered by tarpaulin.
- 5.3 Drums shall be stored and kept in such a way that bottom cable end does not get damaged.
- 5.4 Drums shall be rotated only in the direction marked on the drum.
- 5.5 Loading and unloading shall be done with material handling equipments only.

6 Cable trenches (excavated):

- 6.1 The cable trenches shall be excavated 75 cms below the finished ground level and shall have a minimum width of 350 mm for laying of single cable. When more than one cable are laid in the same trench, the width of the trench shall be increased such that the spacing between the cables is 200 mm and the end cables are at minimum 100 mm from the side of the trench. At the turning of the cable route the trench shall be dug with radius equal to 15 times the cable diameter.
- 6.2 The trenches shall be cut square with vertical side walls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed and leveled. The bottom of the cable trench shall be prepared with 100 mm sand bed for laying the cables.
- 6.3 The cables shall be laid in trenches over the rollers. After the cable is laid and straightened it shall be covered with sand, and bricks shall be placed on top and at the side of the cable.
- 6.4 Wherever specified, half round RCC pipes shall be placed above the cables.
- 6.5 The cable trench then shall be refilled with excavated materials after removing the stones and other sharp materials and the refilled materials shall be compacted with light ramming.

- 6.6 Approved Cable markers made of Aluminum or CI with 15 cms crown shall be provided along the route of cables at a spacing of 25 - 30 meters and also at both ends of crossings or at the cable turning point. The class, type, No. of cables shall be indicated on markers.
- 6.7 Cable shall be laid in Hume pipes at all road crossings and in GI pipes at the wall entries or at the crossing of the drains/gutters.

7 Cable Termination. :

- 7.1 All cable terminations shall have tinned copper compression lugs.
- 7.2 Cable termination shall be done in cable end box or in terminal box or in pillars etc. The end terminations shall be insulated with a minimum of six half lapped layers of PVC tape.
- 7.3 Cable terminations are to be made with flange type brass cable glands so as to grip inner and outer PVC sheaths and also the cable armour. Cable gland shall be bonded to the earth.
- 7.4 The cable conductor ends are to be connected by crimping tinned heavy duty copper lugs. Hydraulic crimping tool shall be used.
- 7.5 Every connection at a cable termination shall be mechanically and electrically sound and protected against mechanical damage and any vibration liable to occur shall not impose any harmful mechanical damage to the cable conductor.

8 Rates :- Rates are as per 2010 KPWD Schedule.

**Terms & Conditions for the Electrification work as per schedule
accompanying the tender / work order**

1. Only approved make of materials accepted as per list appended shall be used for the work. All other materials not mentioned in the list specifically shall conform to relevant IS standards.
2. M.V. installation shall conform IS. 732.
3. Earthing shall conform IS 3043 / 1988.
4. All wires shall be colour coded as below:
 - a) Single phase - Red.
 - b) Three phase - Red, Yellow, Blue.
 - c) Neutral - Black.
 - d) Earth - Green.
5. The final rates for the various items of work and materials if any coming under your scope of supply will be as detailed in the schedule.
6. The work shall be commenced immediately and carried out strictly in accordance with a time schedule prepared by you and approved by our consultants.
7. It shall be the responsibility of the contractor to prepare detailed drawings as per the design and guidelines given by the consultant and to submit the scheme for necessary approval under Rule 63 of IER 1956 from the Electrical Inspectorate. The contractor shall keep close liaison with the Electrical inspectorate and KSEB to expedite formalities like measurement of soil resistivity, scheme approval, power allocation and sanction for energisation.
8. The schedule in general contains almost all the work and the material required for the work. In case any additional work / modification is found necessary during the actual execution of work it shall be carried out only with prior approval of the Consultant / Client and on mutually agreed terms.
9. The client shall bare all expenses towards statutory fees and charges leviable by the Electrical inspectorate and KSEB. Such fees shall be paid by the contractor and the amount spent by the contractor shall be reimbursed by the client on production of vouchers / receipts.
10. Terms of payment:

The contractor shall submit the bills towards the charges for the completed work and 75% payment of these bills will be made to the contractor after duly recommended by the Consultant, 15% on completion of work and energisation. The remaining 10% of the total bill amount will be deducted towards retention.

11. It shall be the responsibility of the contractor to carry out to the satisfaction of the client and consultant all necessary pre-commissioning tests before preparing the completion certificate for submission to the KSEB.
12. The contractor shall comply with the provisions of IER 1956 and Licensing Board Rules in regard to the execution and completion of the work.
13. The work shall be completed in all respects in accordance with the schedule within a period of two months from the date of finalizing the tender
14. The contractor shall furnish a guarantee for a period of one year from the date of commissioning of the installation, for all the works carried out as per this tender and shall undertake to replace/repair any equipment or materials supplied by them during this period of guarantee free of cost. The contractor shall furnish a Bank guarantee equivalent to 5% of the total value of the contract.
15. Any alteration or rectification of works of the existing installations suggested by Electrical Inspectorate shall be treated as extra items.
16. A copy of this shall be signed and returned to the Client as a token of acceptance.
17. The contractor should sign on all pages of tender documents
18. The successful bidder to whom the work is awarded should furnish 5% of the quoted value or Rs One lakh which ever is less towards security deposit in the form of DD from a nationalized bank.
19. Retentions of 10% of the gross amount of each running bill will be deducted as retention. 5% of retention amount along with security deposit will be released on commissioning of work. The balance retention amount will be released after completion of the guarantee period of one year.
20. The amount towards Earnest Money Deposit, Security Deposit and retention will not carry any interest.

Client

Contractor

**APPROVED MATERIAL FOR THE WORK
AT COLLAGE OF ENGINEERING, KIDANGOOR.**

Sl.no	Items	Makes preferred
1.	LT Switches/SDF	L&T / HPL / C&S/
2.	PVC Wires	RR Kabel/Finolex/V guard
3.	Distribution Boards	MDS/L&T/HPL/Goldplus
4.	MCCB	L&T/LEGRAND /C&S/GE
5.	MCB & ELCB	L&T/ LEGRAND/ HPL/ Goldplus
6.	LT Armoured cables	Nicco/ Finolex/Vguard/Gloster/ Polycab
7.	PVC Conduits	Precision/Circle Arc/Balco/Konseal
8.	MS Conduits and accessories	BEC or Other ISI branded Products.
9	Industrial Plug	C&S/ HPL/Legrand/BCH
10.	Switches Modular type	Crabtree/MK/Mosaic
11.	Indicating Meters	AE/Meco
12.	KWH, KW Meters	HPL/SIMCO/Havells/L&T
13.	Current Transformers	Kappa/Intrans
14.	Crimping Sockets	Dowells/Jainson
15.	Ceiling Fan	Crompton/Bajaj/Havells(star rated)
16.	Exhaust fan	Crompton/Bajaj/Kaithan
17.	Light Fittings	Philips/Crompton/Bajaj/ Havells
18	Surge Protector	Hager/Moeller/OBO Bettermann/

Client

Contractor

