TECHNICAL SPECIFICATION

FOR THE

PROPOSED ELECTRICAL SYSTEM

OF

Integrated Campus of ICSP (Main building and Annex building)

GENERAL SPECIFICATION OF ELECTRIC WORK

01.00 GENERAL:

- The work described herein shall in all respects be carried out in accordance with the relevant Standards, current Engineering Practices and Indian Electricity Rules in the most economical manner and to the satisfaction of the Consultant and the Client conforming to the technical requirement and specifications.

- All the instructions of the equipment suppliers and obligations as prescribed in this document shall be strictly adhered to and shall be observed as a matter of procedure.

- The Erection and Commissioning of the equipments/systems covered by this Specification shall be carried out in compliance with the latest Indian Electricity Rules and Standards under Indian condition.

02.00 SCOPE OF WORK:

The Scope of Work of this tender shall include Engineering, Manufacturing, Procurement, Testing, Supply, Unloading at site, Storage at site, Installation, Testing & Commissioning of the electrical works as per the schedule of quantities. Tenderer shall also be responsible for carrying out associated civil works e.g. cutting of brick work, making of slots/chase cutting etc. and making good of them. However, making opening on floor slab/beams/load bearing walls are not under the scope of the tenderer.

However, in case of any additional items, if required to make the systems complete in all respect, shall be included by the tenderer.

Contractor shall be responsible for obtaining statutory clearance, if any, required for execution of the proposed project.

03.00 BASIS OF DESIGN & SYSTEM DESCRIPTION:

Electrical wiring including wires, plates, switch, AC starter, 15A switch/sockets, 5A switch/sockets, fan regulator, telephone and LAN outlet sockets etc in main building, Annex building partial lift shaft wiring including light fittings, lift room wiring, area light wiring, roof wiring, Telephone and LAN wiring, Electrical room to floor PDB and LDB cable laying and connection through vertical cable tray, cable laying through cable trench. Floor and wall mounted panels, DG etc

04.00 EQUIPMENT SPECIFICATION:

04.01 Main L.T. Panel

Construction Feature:

Single front non-draw out design, free standing, compartmentalized floor mounting type.

Panel shall be constructed from sheet steel (CRCA) having thickness minimum 2 mm.

Dust and vermin proof design. The degree of Protection for enclosure shall be minimum IP-52 and shall conform to IS:12063-1987 with 40 KA fault level.

Safety insulating barriers shall be provided in each module to prevent accidental contact with live parts.

Cutouts in the modular door shall have neoprene gaskets ensuring to prevent dust ingress.

Neoprene gaskets shall be used for cable alley door fixing.

All panels of PCC shall be provided with door interlocks. All terminations shall be shrouded in an approved manner. The entire enclosure shall meet with IS:2147/1962. Feeder connections shall be made out of solid insulated copper/aluminium wires or strips with bimetallic clamps wherever required. Internal wiring, bus bar markings etc. shall conform to IS:375/1963. Internal wiring shall have terminal ferrules. Main switch shall be at an easily accessible height and the highest switch operating handle shall not be over 1.75m from floor level. Cable glands need not form part of the switch board as the cost of glands will form part of the cable termination.

Bus bars shall be three phase and neutral and of copper or aluminium or aluminium alloy as specified and shown on drawings and rated for a temperature rise of 30°C over the ambient temperature specified, based on insulated conductor rating (IS:8084-1976). Neutral bars may be of one half the size of the phase bars. The main horizontal bus bars shall be of uniform cross section and rated in accord with the incoming switch. The vertical bus bars for the feeder columns may be rated at 75% of aggregate feeder capacity and shall be uniform in size. Bus bars and interconnections shall be taped with PVC colour coded tape to prevent bar-to-bar accidental shorts. Each bus bar shall be directly

and easily accessible on removal of the front cover. Bus bars shall be totally enclosed, shrouded and supported on non-hygroscopic insulated blocks to withstand thermal and dynamic overloads during system short circuits. An earth bus of size 50% of the phase bar subject to a minimum of 50 x 6 Al shall be provided. Individual switch components shall be connected with the earth bus through copper or aluminium or galvanized steel strip size. All wire connections to bars shall be through lugs, bolts and nuts and spring washers.
Panels shall be installed on a base channel frame and on a concrete pad to be provided by others. All panels shall be meggar-tested and shall not be commissioned till the valves are more than 2.5 megohms phase to phase and 1.5 megohms phase to neutral. All meters on the panel shall be calibrated before commissioning.

The general arrangement and fabrications drawings shall be got approved before taking up for fabrication.

04.08 AMMETERS:

Ammeters shall be of digital type and shall be manufactured & calibrated as per IS:1248. Ammeters shall normally be suitable for 5A secondary current transformers. Ammeters shall be capable of carrying substantial over loads during fault conditions.

04.09 VOLTMETERS:

Voltmeters shall be moving iron type suitable for 3 ph 415V supply having range of 0-500V. Voltmeters shall be provided with protection fuse.

04.10 MINIATURE CIRCUIT BREAKER (MCB) & MCB DISTRIBUTION BOARDS (MCB DB) :

MCB DB's may be of single phase/3 phase suitable for feeding single phase loads, or 3 phase loads, as specified. The unit shall be complete with all standard accessories.

04.11 MOULDED CASE CIRCUIT BREAKER (MCCB) :

Moulded case circuit breakers (MCCB) for 125A breaking capacity at 415V 50 Hz 50K supply wherever required shall conform to IS:13947-1993.
MCCB cover and case shall be made of high strength heat resisting and flame retardant thermo-setting insulating material. Operating

handle shall be quick make break, trip-free type. Operating handle shall have suitable ON, OFF and TRIPPED indicators. Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all three phases. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal/magnetic type provided on each pole and connected by a common trip bar such that tripping of any one pole causes three poles to open simultaneously. Thermal /magnetic tripping device shall have IDMT characteristics for sustained overloads and short circuits.

MCCBs shall be provided with following accessories:

- Under voltage trip.
- Shunt trip.

04.13 CABLES & WIRES :

4 core 70 sq. mm, 35 sq. mm, 16 sq. mm, Power cables should be for use on 433V system. The cable shall be aluminium stranded conductor, PVC sheathed armoured conforming to IS:1554 Part-I.

04.14 TERMINATION OF CABLES :

Termination of cable ends with compression type brass cable gland and crimping type copper cable sockets including PVC tapes etc. as required and supply of all materials for 1.1 KV Gr. PVC armored (Al.) cable.

04.15 CABLE LAYING:

Laying of Al conductor cables in underground trench in single tier formation (horizontal) at 450 mm average depth, including supply of brick and excavation of soil, installation of brick protection on the top of each cable, filling the space between the bricks & cables with sand and the trench with shifted soil, leveling up and restoring the surface duly rammed, including removal of extra earth.
Cable laying in to the cable tray should be tied with cable tie, clamp etc.

4.16 **Internal wiring of rooms , Corridors and other areas:-**

a) Sub main wiring from SLDB to switch board with 2nos x2.5 Sq.mm. & 1 X 1 Sq.mm. PVC insulated copper flexible wire through existing PVC conduit concealed in wall including repair of damage civil work if required

b) Point wiring from switch board to different light, Fan, 5A sockets & Exhaust Fan with 2nos x1.5 Sq.mm. & 1no. X 1 Sq.mm. PVC insulated copper flexible wire through Existing PVC conduit concealed in wall including repair of damage civil work if required.

c) Power point wiring from SPDB/JB's to Power sockets with 2nos x2.5 Sq.mm & 1 X 1.5 Sq.mm. PVC insulated copper flexible wire through Existing PVC conduit concealed in wall including repair of damage civil work if required.

d) AC point wiring from SPDB to Power sockets/ AC Starter with 2nos x4 Sq.mm & 1 X 1.5 Sq.mm. PVC insulated copper flexible wire through Existing PVC conduit concealed in wall including repair of damage civil work if required.

04.17 **D.G. SET :**

Technical specification of Generator:

Generator:	45 KVA
Output voltage:	415V, 3 phase/240V
Frequency:	50/60 Hz
Engine speed:	1500/1800 r.p.m.
Power factor:	0.8

The generator shall be of auto start type with Shifty Shut down system and AMF panel.

Engine:

Engine shall be turbo-charged, water cooled with minimum four cylinders. The engine shall be direct injection type diesel engine with fixed speed governor fitted with replaceable oil, fuel and air filter

assembly. Engine shut down protection shall be provided for low oil pressure, high water pressure and over-speed.

Governor

Governor shall be suitable for 45 KVA.

Electrical system

Minimum 45 KVA Diesel Generating set shall be provided with 24 volts dc battery for energizing to run shutdown solenoid, axial type starter motor and engine mounted charging alternator. High capacity maintenance free dry charged lead acid starter battery shall be fitted in a skid mounted battery rack complete with heavy duty cables and terminals.

Filtration system

Cartridge type dry air filters with restriction indicator shall be provided with cartridge type fuel filters and full flow lube oil filters. All filters shall have replaceable cartridges.

Exhaust system

Heavy duty industrial capacity engine exhaust silencer (approximately 10 db after reduction) shall be supplied loose.

Cooling System

Skid mounted radiator and cooling fan complete with protection guards shall be designed to cool the engine in ambient temperatures up to 52ºC (125ºF).

Alternator:

Screen protected and drip-proof, self exciting, brushless self-regulating alternator shall be close coupled to the engine by a steel flange housing and shall be driven through a flexible coupling. The alternator shall have drip proof air ducts with tropically insulted windings to class H. Voltage regulation under full load shall be plus or minus 1.5% with fully interconnected damper windings.

Insulation Characteristics

The insulation system shall be of Class H. All windings shall be coated against moisture and condensation.

Control Panel:

A sheet steel panel shall be mounted on the generator and the same shall be complete with volt meter and voltage selector switch, ammeters, frequency meter, hours run meter, oil pressure gauge, engine temperature gauge and battery charge ammeter. Engine protection shall be provided with module with key start/stop switch and LED displays shall be provided for engine functions.

Mounting Arrangement:

General arrangement:

The engine and alternator unit shall be mounted on a steel fabricated base frame with an integral fuel tank for daily service. Fuel consumption at full load shall be 86-92 lt./hr. The engine shall be totally enclosed in an acoustic canopy. The reducing noise levels shall be upto 85db at 1mtr.

Base frame:

The complete generating set shall be mounted on a heavy duty fabricated steel base frame.

Coupling:

The engine and alternator shall be directly coupled by means of a flange. The engine flywheel and alternator rotor shall be of flexible coupling type.

Anti-Vibration Mounting Pads

Anti-vibration pads shall be affixed between engine / alternator and the base frame thus ensuring complete vibration isolation of the rotating assemblies and enabling the machine placed on an uneven surface without detrimental effects.

Safety Guards:

The fan, fan drive and battery charging alternator drive shall be fully guarded for personnel protection.

Fuel System

The base frame shall have a fuel tank with a total capacity to ensure the diesel generator set to run on 100% full load for a minimum of 8 hours. The tank shall be supplied in complete with contents indicator, fuel fill cap with breather, fuel feed and return lines to engine and drain plug.

. **Quality Standards:**

General

All units shall be fully load tested before dispatch and shall be finished with a superior long lasting industrial paint and shall come complete with operator manuals, wiring diagrams and test certificates.

05.00 EARTHING:

Supply and installation of earthing station shall be with 50 mm dia galvanized iron pipe 3.64 mm thick x 3 meter long, 13 mm dia 100 mm long G.I. Double nuts & washers, driven to an average depth of 3 mtrs. Below the ground level and restoring the surface duly rammed. Inspection pit for earthing station shall be constructed with 250 mm thick brick work over 100 mm thick PCC including all inside and outside plastered, inside of the top neat cemented. Heavy duty C.I. manhole shall be provided with cover complete with supply of all materials. All equipment and material of construction, except where specified herein, shall conform to the Indian Electricity Act & Rules and Indian Standard Specifications (with their latest amendments and/or latest revisions).

Some of the relevant IS, which shall be applicable, are listed below :-

PVC insulated cables for working Voltages unto and including 1100V.	IS : 694
PVC insulated (heavy duty) electric cables for working Voltages upto and including 1100V.	IS : 1554
Code of practice for installation and Maintenance of power cables.	IS : 1255
Code of practice for earthing.	IS : 3043
Code of practice for selection, installation and maintenance of switchgear and control gear.	IS :10118 & 5097
Installation and Maintenance of Switchgear.	IS : 3072

All Acts, Rules, Codes, etc. referred to herein mean the latest in force.

Indian Electricity Act. 1910 and Rules issued there under.

06.00 CODES & STANDARDS :

i)	PVC insulated cables for working voltages upto and including 1100V	IS:694
ii)	PVC insulated (heavy duty) electric cables for working voltages upto & including 1100V	IS:1554
iii)	Cross linked polyethylene insulated PVC sheathed (XLPE) cable	IS:7098
iv)	Code of Practice for installation & maintenance of power cable	IS:1255
v)	Code of Practice for earthing	IS:3043
vi) &	Code of Practice for installation & maintenance of switchgear & control gear	IS:10118 IS:5097
vii)	Installation & maintenance of Sq. gear	IS:3072
viii)	Installation & maintenance of Transformer	IS:1886 & IS:10028
ix)	General requirements of switchgear and control gear for voltages not exceeding 1000V	IS:4237
x)	A.C. circuit breaker upto 11000V	IS:2516
xi)	Indian Electricity Act 1910 and I.E. Rules (1980).	

Tenderer shall note that wherever no standards are available, accepted commonly used engineering practice/norms shall be followed.

All acts, rules, codes etc. referred above mean the latest amendment in force.

The contractor shall ensure that all installations conform to Local/Statutory Regulations and requirements. In case of any deficiency/discrepancy or contradictions found, these shall be immediately brought to the notice of the employer and same shall be got modified before execution of the work.

It is the sole responsibility of the contractor to obtain the statutory approval as required from the electrical inspector/appropriate authority required for installation as well as operation of the installed system. Owner shall only provide necessary documents required for obtaining such clearance.

07.00 Preferred Makes of different equipments

1.	**LT CABLES:**	GLOSTER/NICCO/ HAVELL'S/PLOY-CAB
2.	**MCCB:**	L&T/GE/SCHNEIDER/LEGRAND
3.	**MCBs/DB'S:**	SIEMENS/HAGGER DOUBLE DOOR TYPE/LEGRAND
4.	**RELAYS/CONTACTOR:**	ALSTHOM/ABB/LEGRAND/ SCHNEIDER/L&T
5.	**AMMETERS**:	AEE/L&T/OSCO
6.	**VOLTMETERS:**	AEE/L&T/OSCO
7.	**CABLE & WIRES:**	GLOSTER/NICCO/FINOLEX / POLY-CAB
8.	**Flexible wire:**	HAVELLS/ FINOLEX
9.	**SWITCHES & SOCKETOUTLETS:**	L&T/ GE
10.	**D.G. SET**	JAKSON/CATTERPILLER/KIRLOSKAR
11.	**SWITCHES:**	CRABTREE/ANCHORE/HAVELLS STANDARD
12.	**CABLE SOCKETS:**	DWELLS/KLIPON
13.	**ELECTRICAL CONTROL PANEL:**	CPRI APPROVED AND ISO CERTIFIED COMPANY

08.00 Pre-commissioning Testing

1. L.T. Cable

   Insulation resistance measurement between phases & individual phase & earth by 1000V megger before and after laying & termination.

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2. Insulation resistance test by 1000V megger of all individual L.T. panels/ L.T. cables.

3. Earth resistance valve of individual earth stations & earth grids by earth testing megger.

4. Test form in prescribed format of Directorate of Electricity.

09.00 SAFETY CODE

GENERAL

Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with relevant safety regulations as per Factor, Act and any other statutory Acts, Rules, Regulations etc., prescribed by controlling Authorities, Legislation, etc., Safety rules as per ISS shall be observed.

FIRST AID

Contractor shall maintain at his cost, first aid facilities for its employees and those of its sub-contractors.

Contractors shall make outside arrangements for ambulance service and for treatment of injuries, including hospitalization, wherever required.

All critical injuries/accidents shall be reported promptly to the Employer and such other Governing Authorities. A copy of Contractor's report covering all accidents shall be furnished to the Employer.

CONTRACTOR'S BARRICADE

Contractor shall erect and maintain barricades required in connection with operation to guard or protect :-

a) Excavations

b) Hoisting areas

c) Areas adjudged hazardous by inspectors of the Employer or Statutory Authorities.

Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at night.

SCAFFOLDING

1) Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground or from solid construction except in the case of short duration work which can be done safely from ladders. Where a ladder is used, it shall be of rigid construction made either of good quality wood or steel. The steps shall have a minimum width of 450 mm and a maximum rise of 300 mm. Suitable hand holds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than ¼ to 1 (1/4 horizontal and 1 vertical).

2) All personnel of the contractor working within the plant site shall be provided with safety helmets. All welders shall wear welding goggles while doing welding work and all metal workers shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.

3) Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.

4) All trenches, 1.25m or more in depth shall all times be supplied with at-least one ladder for each 30m in length or fraction thereof. The ladder shall be extended from bottom to the trench to at least 1m above the surface of the ground. Sides of trenches which are 1.5m or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated material shall not be placed within 1.5m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances under mining or undercutting shall be done.

5) The Contractor shall take all measures on the site of the work to protect the public from accidents and shall be bound to bear the expenses of defence of every suit, action or other proceedings that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any such

persons so that which may with the consent of the contractor, be paid to compromise any claim by any such person.

a) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.

b) All practical steps shall be taken to prevent danger to persons employed from the risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

IN CASE OF ANY CONFUSION TENDERER MAY VISIT THE CAMPUS FOR CLARIFICATION BEFORE GIVING QUOTATIONS