MINISTRY OF HEALTH & FAMILY WELFARE

GOVERNMENT OF INDIA, NEW DELHI

Tender No. MoHFW/ME/RIAHS-COIMBATORE/HLL/ID/2013/31

Request for Proposal (RFP)
for

CONSTRUCTION OF REGIONAL INSTITUTE OF ALLIED HEALTH SCIENCES (RIAHS) AT COIMBATORE, TAMILNADU

<u>Volume – III</u>
TECHNICAL SPECIFICATIONS

HLL Lifecare Limited
(A Government of India Enterprise)

INFRASTRUCTURE DEVELOPMENT DIVISION,
"ADARSH", T.C 6/1718(1),
VETTAMUKKU, THIRUMALA PO,
THIRUVANANTHAPURAM- 695 006.
PHONE - 0471 2365872/ 73
FAX - 0471 2368144

(April, 2013)

INTRODUCTION

These Specifications and Conditions define the basis for the construction outputs that HLL Lifecare Limited requires the Contractor to provide in respect of the construction of Regional Institute of Allied Health Sciences at Coimbatore.

The work in general shall be carried out in conformity with the CPWD specifications for works 2009 Vol. I and Vol. II, CPWD General Specifications for Electrical works Part –I Internal (2005), Part III Lifts & Escalators (2003), Part –IV Substation (2007), Part – V Wet riser & Sprinkler Systems (2006), Part VII DG Sets (2006) and Specifications for Heating, Ventilation & Air Conditioning (2004) along with correction slips issued up to the date of receipt of tender.

This volume provides only additional specifications and specifications for works for which no CPWD Specifications have been published

The following standards shall apply unless otherwise stated:

- The Relevant CPWD Specifications for Works
- The standards set out in National Building Code of India 2005
- The National Electrical Code, 1985
- The Indian Electricity Act 2003
- The Relevant BIS Standards
- The Bio Medical Waste (Management & Handling) Rules 1998
- Requirements of the local Water Supply Company, Electricity Supply Company/Department
- Requirements of the Pollution Control Board, Fire officer and Aviation authorities if applicable

SECTION I

CIVIL, PLUMBING AND SANITARY

SPECIFICATIONS AND CONDITIONS

I. GENERAL:

The work shall in general conform to the CPWD specifications for works 2009 Vol. I and Vol. II with correction slips issued up to the date of receipt of tender. Wherever some aspects of design / construction / material standards are not covered under the above mentioned specification, relevant international standards shall be referred to:-

In case of discrepancy among these standards, the order of precedence shall be as follows

a) Provision in the schedule of Quantities.
b) The Specification given in this section.
c) CPWD specifications.
d) BIS, IRC, BS, ASTM, DIN (in that order)

2.0 FABRICATION

2.1 **General:** All assemblies shall be fabricated and assembled in accordance with the drawings and the requirements of these specifications. Deviations of any nature, without approval of HLL shall not be permitted.

2.2 **Tolerances:** Furnish a schedule of fabrication tolerances for all major wall cladding components. In addition to the fabrication tolerances, provide for and schedule thermal movement including assembly and installation tolerances for all major and/or applicable wall cladding components and/or assemblies.

2.3 **Workmanship**

a. All work shall be performed by skilled workmen, specially trained and experienced in the applicable trades and in full conformity with the applicable

provisions of the listed References and Standards and / or otherwise noted in the drawings or as specified herein.

b. All work shall be carefully fabricated and assembled with proper and approved provisions for thermal expansion and contraction, fabrication and installation tolerances and design criteria.

c. All forming and welding operations shall be done prior to finishing, unless otherwise noted.

d. All work shall be true to detail with sharp, clean profiles, straight and free from defects, dents, marks, waves or flaws of any nature impairing strength or appearance; fitted with proper joints and intersections and with specified finishes.

e. All work shall be erected true to plumb, level, square to line, securely anchored, in proper alignment and relationship to work of other trades and free from waves, sags or other defects.

3.0 Shop Drawing, Inspection and Testing.

3.1 Working and construction drawings.

The contractor shall prepare shop drawings and all work shall be according to approved working drawings. Shop drawings shall give all dimensions and shall incorporate the requirements of the clients / Engineer – In-Charge. Approval of drawings does not relieve the contractor of his responsibility to meet the intents of the specifications. All such drawings for approval shall be submitted in 6 copies to the Engineer – In-Charge. In addition, the contractor shall submit manufacturer's details and get them approved before ordering. This has to be done whether the materials / equipment are one of the approved makes or not.

3.2 Testing and Inspection

The contractor shall carry out tests on different equipment and system in total as specified in various sections of the tender in the presence of the Engineer – In-Charge. in order to enable them to determine whether the plant, equipment and installation in general comply with the specifications. All equipment shall be tested

after carrying out the necessary adjustments and balancing to establish equipment ratings and all other design conditions. The test data shall be submitted in Acceptance Test Form.

3.3 Calibration of instruments and meters.

Instruments required for testing shall be furnished by the contractor for testing with initial requirements of all consumables. All the instruments, meters etc to be used at site and on the system shall have a valid calibration certificate issued by the competent authority. The contractor shall maintain and make available all such calibration certificates.

4.0 Handing over requirements.

The work shall be handed over after satisfactory testing along with 6 sets of the following documents along with CDs (Soft copy).

1. Detailed equipment data in the approved Performa
2. Manufacture's maintenance and operating instructions manuals
3. Set of as built drawings, layouts, piping, ducting, cable routing, cable schedules etc.
4. Approved test readings of all equipment and installations
5. Inspection certificates
6. Warranty / guaranty certificate for all equipments
7. List of recommended spares together with list of suppliers and their contact details.
8. Certificate from the contractor that he has cleared the site of all debris and litter caused by him. However, contractor has also to periodically clear the site from all the debris, which is generated from his part of scope.
9. Undertaking that all the materials supplied by him at site are fully tax paid and shall produce all documentation for satisfaction of the Engineer – In-Charge..

Submission of the above documentation shall form a precondition for final acceptance of the plant and installation and final payments.

5.0 Statutory approvals inspection.

5.1

The contractor shall be fully responsible for meeting all the statutory obligations and local inspectorates wherever applicable to the works carried out by them. The contractor should prepare all working drawings and obtain approval of competent authorities and also have the equipment and installation inspected and got approved.

All obtaining approval fee and deposit towards statutory approval and inspection paid against demand in writing from the appropriate authority will be reimbursed on submission of original receipts. All other expenses for submission and approval of the various and relevant statutory / bodies shall be embodied in the tender prices.

5.2 Licensed plumber.

All work performed by the contractor shall be through licensed plumbing supervisor possessing a valid plumbing contractors license employing Engineers, Technicians, Foremen, Plumbers, Masons, Helpers, etc., as required.

5.3 Fees, permits and notices.

Contractor shall comply with all bye-laws and regulations of local and other statutory authorities having jurisdiction over the works and shall be responsible for the payment of all fees and other charges and giving and receiving of all necessary notices. Contractor shall keep the Engineer-in-Charge timely informed about regulations and requirements of statutory

Authorities and shall obtain the final certificates of inspection and approval from the authorities.

5.4 Specifications and drawings.

The specifications and drawings shall be considered as part of this contract and any work or materials shown on the drawings and not called for in the specifications or vice versa shall be executed as if specifically called for in both.

The tender drawings indicate the extent and general arrangement of the fixtures, drainage system, etc. The drawings indicate the points of supply and termination of work shall be installed as indicated in the drawings. However, any changes found essential to co-ordinate with this work and other trades shall be made without any additional cost. The drawings and specifications are meant for the assistance and guidance of the contractor, and exact location, distance and levels will be governed by the individual building and site conditions. Therefore, approval of the Engineer-in-Charge shall be obtained before commencement of work.

Exact routing and sizes of all piping on all the floors and the vertical stacks, Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall shall also be got approved along with Run of all water supply lines with diameters, location of control valves, access panels, Location of all the mechanical equipments with layout and piping connections etc.

Contractor shall provide six sets of catalogues, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

All “Warranty Cards” given by the manufacturers shall be handed over to the Engineer-in-Charge.

5.5 Manufacturers instructions.

Where manufacturers have furnished specific instructions relating to the materials used in this job and methods of construction that are not specifically mentioned in these documents, such instructions shall be followed in all cases. The contractor shall also furnish six sets of the detailed instruction, operating and maintenance manuals including detailed completion drawings and Fire Safety Plans on a bound copy to approved scale. Further it is the responsibility of the contractor to train the Employer's / Employer’s Authorized Representatives’ personnel in the operation and maintenance of the system.

SECTIOIN II

WATER TREATEMENT PLANT

1.0 SPECIAL CONDITIONS

1.1. EXECUTION OF WORK

The whole of the work as described in the contract (including bills of materials, specification and all drawings pertaining thereto) and as advised by the Employers from time to time is to be carried out and completed in full to the entire satisfaction of the Employers. Any minor details of construction which are obviously and fairly intended, or which may not have been definitely referred to in this contract, but which are usual construction practice and essential to the work, shall be included in this contact.

1.2. MAINTENANCE & TRAINING FOR PERSONNEL

1.2.1 The contractor shall without any extra cost carry out for a period of 12 months after the installation is taken over by the owners, all routine and special maintenance and attend to any difficulties and defects that may arise in the operation of Water Treatment Plant.

1.2.2 The contractor shall associate with the Employers' staff during erection and the maintenance period, in the maintenance/operation of the Water Treatment Plant.

1.2.3 If required, by the Employers, the contractor shall also train members of the Employers' staff at their works/service station without any extra charge.

1.3. CERTIFICATE OF COMPLETION

1.3.1 The contractor shall intimate to HLL in writing as and when the works are completed and put into beneficial uses in order to enable HLL to check certify to take over the plants.

1.3.2 The work shall not be considered as completed and put into beneficial use until HLL have certified in writing that the same has been completed and put into beneficial use.

1.3.3 The defects liability period shall commence from date of such completion or any specific date mentioned therein.

1.4. OPERATIONAL AND MAINTENANCE MANUALS

1.4.1 The contractor shall also furnish the prints of all up-dated handing over along with required set of operating/maintenance manuals / instructions.

1.4.2 The Agency/contractor shall ensure adequate and prompt after sales service in the form of maintenance personnel and spares as and when required ensuring that all spares are easily available during the normal life of the installation. Every effort shall be made to provide zero defect performance during the guarantee period of 12 months (DLP) by undertaking preventive maintenance.

2.0. TECHNICAL SPECIFICATION

2.1. TECHNICAL INSTRUCTION TO TENDERER

2.1.1 SCOPE OF WORK

The Tenderer's scope of work shall cover the following:

Design and engineering of the following:

a) WTP for treating the raw water consisting of pressure sand filters, disinfection system using sodium hypochlorite dosing systems, raw water pump sets, drinking water pump sets including all piping, fittings and valves etc. complete.

Flow meters are to be provided in WTP pump house for flow measurement on the delivery line of drinking water pumps, and also on raw water supply lines from tube wells and / Municipal supply line to fire water sumps.

b) Necessary instrumentation required for smooth running of WTP.

Tenderer shall note that all illumination of WTP and outside area is not covered in this scope of tender.

c) Necessary material handling facilities for WTP shall be provided.

2.1.02 Manufacture, procurement, assembly, shop testing, surface preparation, shop painting, packing, supply at site, storing at site for all equipment / items.

2.1.03 Erection of equipment at site.

2.1.04 Finish paint of equipment at site after erection.

2.1.05 Testing and commissioning of the equipment and whole treatment plant.

2.1.06 Demonstration of performance guarantee.

2.1.07 Furnish all drawings, documents, load data and other information / data like fault diagnosis, operation and maintenance manual, etc., general arrangement and layout drawings, design calculations and equipment specifications, together with as built drawings for all mechanical and electrical installations.

2.1.08 All technological structures, support for equipment, etc. complete. Minor civil works for erection of equipment are also included in the scope of Tenderer.

2.1.09 Supply of spares for normal operation and maintenance of equipment for a period of 2 years to be reckoned from the date of taking over of the equipment by the client.

A list of spares shall be indicated in the offer and these spare parts shall be supplied to the client's store at site prior to commissioning of the equipment. No equipment shall be taken over by the client until these spares are supplied. The Tenderer will be required to replenish at his own expense the stock of spares used up during the performance test and with in guarantee period.

2.1.10 The Tenderer shall include in the scope the requirement of all lubricants, chemicals and other consumables for testing, commissioning and performance guarantee runs.

2.1.11 The Tenderer shall list out in offer and provide a complete new and unused set of all special tools and tackles required for operation and maintenance of equipment. Necessary material handling equipment shall also be part of these tools.

2.1.12 All necessary foundation bolts, puddle flanges, matching flanges and anchoring parts shall be in the scope of the Tenderer.

2.1.13 Any additional work / equipment and material which may not be specially mentioned in the specification but are required to make the equipment complete in every respect in accordance with technical specification and necessary for safe operation and guaranteed performance of the plant shall be covered and provided by the Tenderer.

2.1.14 The Tenderer shall consider in their scope for supply and laying of incoming supply lines for tube well water and municipal water and for which Design Limit (DL) scope as approved by the Engg-in charge.

2.1.15 The Tenderer shall consider in their scope for supply and laying of final treated drinking water line up to the design limit (DL) as approved by the engineer-in charge.

2.1.17 WORKMANSHIP AND QUALITY CONTROL

(i) The equipment supplied shall be new and best of their kind and of latest technology. All materials and equipment shall comply with the latest Indian standards and statutory requirements of the concerned State Governments. In absence of relevant Indian standards/ practices, any other internal standards acceptable to the Engineer-in-Charge may be followed, but the same shall be clearly brought out in the offer.

(ii) The equipment shall be designed to have maximum reliability and ease of operation and maintenance.

(iii) The Tenderer shall avoid offering sophisticated and complicated equipment where simple and proven equipment will achieve the specified requirements.

(iv) Quality assurance plan shall be furnished after placement of order.

2.1.18 CODES AND STANDARDS

(i) All equipment supplied shall be in conformity with applicable codes and standards. All codes and standards used / referred to shall be to their latest edition / version as on the date of the acceptance of the tender.

(ii) All equipments shall conform to the provision of statutory and other regulations in force, such as Indian Explosive Act, Indian Factories Act, etc.

(iii) All electrical equipment shall comply with the latest revision of Indian Electricity Rules and within the statutory requirement of the Government of India and State Government as regards safety, earthing and other provision specified therein for installation and operation of electrical equipment.

2.1.19 DEVIATION, ASSUMPTION AND ALTERNATIVE PROPOSALS

(i) The deviations from specification in any respect shall be clearly defined and indicated by the Tenderer along with reasons in the offer. In case of no list of deviations submitted by the Tenderer, all requirement and provisions of the specification shall be automatically deemed to have been agreed and complied by the Tenderer.

(ii) Any assumption made for calculations or working out details shall be indicated in the offer clearly by the Tenderer.

The Tenderer shall submit an offer which complies with the technical specification. However, the Tenderer, if desires, can submit in addition an alternative offer for a design which may differ from specification. Such alternative would be given careful

consideration provided that adequate supplementary information drawings and data are submitted to permit a complete evaluation of the offer made.

2.1.20 PAINTING

(i) All ferrous metal works shall be provided with corrosion resistant paint treatment applied in accordance with the best trade practice suitable for plant and equipment.

(ii) The paints shall be obtained from reputed manufacturer. The formulation and application procedure shall be as per recommendation of the manufacturer for appropriate exposure conditions.

(iii) All shop painting shall be applied after proper surface preparation and application of suitable primer.

(iv) Final / touch –up painting shall be done at site after erection of equipment.

(v) In case the equipment operating conditions require any other special painting, the Supplier shall indicate the same in the offer.

2.1.21 IDENTIFICATION MARKING

(i) Flow direction shall be marked on the various fluid piping in contrast colour shade.

(ii) Equipment part number / name shall be marked on all equipment parts and machinery. Match-marks, wherever necessary, shall be provided for facilitating erection.

2.1.22 INSPECTION AND WORKS TESTING

(i) The plant and equipment will be subjected to inspection and witnessing of tests by the Engineer-in-Charge. The supplier shall inform the Purchaser / his

Consultants at least fifteen days in advance of the date when the plant and equipment will be made available for shop inspection and testing.

(ii) The Engineer-in-Charge shall be allowed to use free of cost all the testing facilities available with the Manufacturer for the purpose of testing.

(iii) Necessary tests, for which adequate facilities are not available with the Supplier / sub – contractor, will be carried out at mutually agreed testing laboratories at the cost of contractor.

(iv) Inspection and works testing shall be carried out based on approved drawings and specifications and as per relevant standards.

(v) Copy of the order on the sub-suppliers, comprising all the detailed specification and bill of materials shall be provided to the Engineer-in-Charge along with or before inspection call.

(vi) The Supplier shall inspect the equipment / part before offering to the Engineer-in-Charge for inspection and satisfy himself with regard to the quality and quantity and issue an internal inspection certificate along with manufacturer's test certificate to the Purchaser.

(vii) The Supplier shall not dispatch the materials from his works unless it has been inspected, tested and accepted by the Engineer-in-Charge unless specific approval for the same is given by Engineer-in-Charget. In either case, the material shall be dispatched by supplier only after issue of dispatch clearance by Engineer-in-Charge.

(viii) The Engineer-in-Charge shall have the full right to accept or reject the materials, if during inspection and testing, the materials are found not conforming to specification and / or standard.

(ix) Inspection by the Engineer-in-Charge shall not relieve the Supplier of his liability for rectifying defects which may subsequently appear or be detected during or after erection. After rectification, the testing of the plant and equipment shall be repeated to the satisfaction of the Purchaser.

2.1.23 PACKING, DISPACTCH, HANDLING & TRANSPORTATION

(i) Packing and weather proofing shall be subject to approval of the Engineer-in-Charge. This approval will be general and may not be required every time for an article or group of articles to be dispatched. However, the Engineer-in-Charge reserves the right to examine the packing for any particular consignment at Supplier's/Manufacturer's works before dispatch.

(ii) The Supplier shall be entirely responsible for the insurance, shipment, handling and transportation of all equipment, construction tools, labourers and materials including unloading at destination, transporting to site, off-loading, storing and protection at site till erection.

2.1.24 ERECTION, TESTING & COMMISSIONING

(i) The equipment supplied shall be erected, tested and commissioned individually as well as for integrated operation.

(ii) All site tests on plants shall also subject to prior approval by Engineer-in-Charge. The Supplier/contractor shall submit to Engineer-in-Charge or his representative the list of pre-commissioning tests intended to be carried out. This list will be reviewed and finalized before commencement of tests.

(iii) The tests shall be carried out as per mutually agreed schedule so that they may be witnessed by Engineer-in-Charge.

(iv) The execution of the erection, testing and commissioning work shall be in such a manner that no interference is caused to the operation of other agencies working in the same area.

2.1.25 GUARANTEE AND PENALTIES

(i) All the equipment supplied shall be guaranteed for quality workmanship and compliance with the specified requirements for integrated performance to deliver rated outputs.

(ii) The Tenderer shall guarantee individual as well as integrated performance of all equipment supplied by him for a period of 12 months from the date of plant take – over by the Engineer-in-Charge.

(iii) Equipment offered shall be guaranteed for the attainment of specified parameters during the performance of specified parameters during the performance guaranteed parameters; the Supplier shall be advised for necessary rectification work. Even after two such consecutive rectification work, if a particular equipment fails to achieve the guaranteed parameters, it will be assumed that the plant and equipment supplied is defective in its design and will be subjected to penalties. However, while levying the penalties, the applicable tolerance will be taken into account. The expenditure incurred on account of implementing the modifications/changes shall be borne by the Tenderer/Supplier.

(iv) The penalties for non-performance shall be discussed during tender discussions and shall be finalized as mutually agreed.

(v) The approval of drawings and /or inspection by Engineer-in-Charge will not absolve or relieve the Supplier from any of his obligations under the contract and he shall be wholly and solely responsible for the satisfactory operation and guaranteed performance of his supply.

(vi) The Supplier will be solely responsible and accountable for any defects and subsequent delays in supply due to re-inspection.

2.2.0 TECHINICAL SPECIFICATION – TECHNOLOGICAL / MECHANICAL WORKS

2.2.01 SOURCE OF RAW WATER:

The source of raw water shall be either from municipal supply or underground water from tube wells located within complex.

2.2.02 QUALITY OF RAW WATER:

For design of water treatment, tenderer shall consider water quality of underground water from tube wells. Tenderer shall test and confirm water quality after award of work and before actual design and supply of treatment plant.

2.2.03 PROCESS OF WATER TREATMENT:

As the bore well water contains total hardness more than 240mg/l, water treatment is required to bring down the hardness level to 5 mg/l or less. The scheme of treatment shall comprise pressure sand filter followed by softener. Further provisions for disinfection shall be considered in the scheme.

2.2.04 CAPICITY OF WATER TREATMENT PLANT AND EQUIPMENT:

The tenderer shall design the treatment plant for 216m3/day and the plant shall operate for 8hours duration.

Accordingly the water treatment plant will contain the following equipment.

(i) Raw water pumps – 2 nos. (1W+1S) W – Working, S – Stand by

(ii) Pressure sand filter – 2 nos. (1W+1S)

(iii) Sodium hypochlorite dosing system, dosing pumps, etc complete 2 nos. (1W+1S)

(iv) Flow meters:

a) Electro Magnetic flow meter: 1no (1W)

b) Digital flow meter: 2 nos. (2W)

The equipment locations are marked in the plan for WTP and Common pump house.

2.2.05 EQUIPMENT SPECIFICATIONS:

(a) RAW WATER PUMPSET

The raw water pump-sets shall be of centrifugal type with each capacity Q=27m^3/h and H=40m WC (tentative).

The material of construction of pumps shall be SS: 304.

The pump-sets shall pump raw water from raw water sump to treatment units. Tendered shall finalize the head of the pump suitable for operation of the treatment plant.

(b) PRESSURE SAND FILTER

The tentative specifications of the pressure sand filter shall be as follows:

Diameter	: 1200mm
HOS	: 2000mm
Shell thickness	: 5mm
Dish end thickness	: 6mm
Max. Flow rate	: 40m^3/h
Average flow rate	: 27m^3/h
Period between backwash	: 24 hours (inlet turbidity<25NTU)
Pressure for cleaning	: 0.8 Kg/cm^2
Max. Working pressure	: 3.5 Kg/cm^2

Min. Working pressure : 2.0 Kg/cm^2

Backwash flow rate : 45.2 m^3/h

Source of water : Raw Water (<25 NTU)

MOC : MS Internal black bituminous and external red oxide paint.

Type of flow : Down flow

Internal arrangement : Pebbles & crushed gravels and support media of mixture of multi grade sand.

Type of Valves : Butterfly valve

Max Pressure loss : 1.0 Kg/cm^2

Suitable backwash and overflow arrangement shall be provided by the Tenderer.

(c) SOFTENER

The tentative specification of the softener shall be as follows:

Diameter : 1800mm

HOS : 2000 mm

Shell thickness : 6mm

Dish end thickness : 8mm

Max. Flow rate : 40m^3/h

Average flow rate : 27m^3/h

Period between regeneration : 10 hours

Max. Working pressure : 2.0 Kg/cm^2

Min. Working pressure : 1.8 Kg/cm^2

Regeneration tank (HDPE) : 2000 liters capacity

Regenerate Qty, (NaCl) : As required

Residual hardness : <5 ppm

MOC : MS internal black bituminous and external red Oxide paint

Type of Valves : Butterfly valve

Max Pressure loss	: 0.5 Kg/cm^2
Brine tank Size	1200 dia x 900 deep

Suitable regeneration and waste water disposal arrangement shall also be provided by the Tenderer.

(d) SODIUM HYPOCHLORITE DOSING SYSTEM:

The tentative specification for sodium hypochlorite dosing system shall be as follows:

No. of pump	: 1 No
Max. Discharge	: 12 lph
Max. Working pressure	: 5 kg/cm^2
Construction details	: PP Dosing Head
MOC of wet parts	: PP/PVC
MOC of tank	: HDPE / LDPE
Capacity of tank	: 200 liters
No. of tanks	: 1 no
Power consumption	: as required
Piping	: PVC flexible hose
Accessories included with pump	: Foot valve, Dosing valve, level Switch – one No. each

(e) DRINKING WATER PUMPSET

1. The drinking water pump-set shall be of centrifugal, horizontal or vertical type with each capacity Q= 45m^3/h and H = 40 m WC (tentative). The material construction of pumps shall be SS: 304.

2. The above pump set shall pump drinking water from drinking water sumps in WTP to pipe network feeding water to 2 Nos OHTs on building.

3. Suitable pressure switch or level control switch shall be provided for each pumpset set for automatic stop of the pumpset when the OHTs are filled up.

   The above instrumentation includes supply, erection, commissioning of power and control cables from WTP pump house to 2nos OHTs at building.

4. Pump shall have provision both auto stop as well as manual operation.

(f) DRAINAGE PUMPSET

Provide 1no drainage pumpset including delivery line and valves in WTP room for floor drainage. The capacity of pump shall be Q=7.5m^3/h; H=10mWC (tentative). The material construction of pumps shall be SS: 304.

(g) FLOW METERS

1. Electro magnetic flow meter: 1no (1W)) which shall be provided on the common delivery line of drinking water pumpsets.
   Line size: 150mm OD (6"), Flow Range: 0 to 150 m3/h. The supply shall include all accessories and cables etc complete.
2. Economical model Digital flow meter:
   The meter shall indicate rate of flow indicator and cumulative flow. 2nos(2W) shall be provided, 1 each on the Municipal water supply line and tube well water supply line to fire water sumps.
   Line size : 65mm OD (2½"), Flow Range: 0 to 50m^3/h. The supply shall include all accessories and cables etc complete.

2.2.06 INTER CONNECTING PIPELINES, VALVES AND FITTINGS

(i) The individual delivery lines from the pumps shall have non-return valves and gate valves.

(ii) Suitable number of valves shall be provided in the inter connecting pipelines for diversion and control of flows as approved by the Purchaser / Consultant.

(iii) All pipelines shall be so arranged to avoid excessive loss of head outside the pump or disturbance of the flow within pump.

(iv) The velocity of flow in the piping shall be generally 1.5 to 2.0 m/s.

(v) All high points in the pipelines shall be avoided to prevent any gas accumulation.

(vi) CI sluice valves shall conform to IS: 780.

(vii) CI butterfly valves shall confirm to IS: 13095.

(viii) CI non-return valves shall confirm to IS: 5312.

(ix) All centrifugally cast (spun) iron pipes shall confirm to IS: 1536.

(x) All cast iron flanged pipes shall confirm to IS: 1537.

(xi) CI pipes fitting shall conform to IS: 1538.

(xii) MS pipes /GI pipes shall conform to IS: 1239 and IS: 3589 and shall be laid as per IS: 5822.

(xiii) CI pipes shall be laid as per IS: 3114.

(xiv) Salt glazed stone ware pipes used shall conform to IS: 651 and shall be laid as per IS: 4127.

(xv) RCC pipes used shall conform to IS: 458 and shall be laid as per IS: 783.

(xvi) HDPE pipes used shall conform to IS: 4984 and shall be laid as per IS: 7634 (Part II).

2.3.0 OTHER SERVICE

The Tenderer shall provide necessary waste effluent disposal facility for the WTP. The above facilities are to be shown in the layout plan and other G.A. drawings as necessary.

2.4.0 QUALITY OF TREATED WATER

The treated water shall conform to following standards:

Parameters:

a) Total hardness(as CaCO3) : 5 mg/1 or less

b) Turbidity (NTU) : 1 or less

c) E.coli : Must not be detectable in any 100 ml sample

d) Residual chlorine : 0.2 to 0.3 mg/1

2.5.0 TECHNICAL SPECIFICATION – ELECTRICAL & INSTUMENTATION WORKS

2.5.01 ELECTRICS

The Electrical Specification of this work is intended to cover the supply, installation, testing and commissioning of the entire electrical equipments, its instruments and all items and accessories including consumable against the lump sum price of the contract.

The equipment and accessories shall be complete in all respects and any device not included in this specification but essential for proper operation of the plant shall be deemed to be with in the scope of this specification, whether specifically mentioned or not.

Some parts of the total work may tie ups with the existing system particularly mode of power supply to the Motor control centre etc, and the contractor has to get it done for the completion of this work.

The main incoming Panel Board (MCC) and instruments to cater main supply to all the motors and instruments comes under the scope of the contractor. However the incoming supply to MCC thought suitable UG cable will be given from the client side. From MCC to each and every motors and instruments supply will be given by the contractor. In all outdoor areas cables shall be laid mostly directly buried underground with adequate mechanical protection wherever necessary where as in indoor areas cable shall be laid in trenches /wall/ structures through suitable trays / cleats.

All allied civil works, such as foundations to motors and equipments come under the scope of the contractor. Supply of steel and cement required in the execution of the contract work shall also be the responsibility of the contractor.

All motors shall be suitable for outdoor installations with tropical insulation and protective category of IP – 54 and incase of submersible pump sets IP-68 protection should be adopted. All motors shall be started and stopped by push button at local control stations, located near the respective motors.

All motors with capacity below 10 HP shall have Direct-On-Line starters unless otherwise specified and motors with higher capacity shall have fully automatic star / Delta starters.

Earthing system shall be carried out with GI strips, wires, electrodes by GI pipes. All equipments shall have two separate and distinct earth points as per IS specifications.

Automatic power factor improvement panel with capacitor bunk shall be included to maintain a power factor of 0.92 lag all the time.

All cable glands should be brass double compression type. All AL /CU cables should be terminated though crimping type AL / CU ligs respectively with earth connection to the glands.

2.5.02 INSTRUMENTATION:

All instruments such as level switch for sump, Electromagnetic Flow meter, Flow measuring device, Receiver Electronic Indicator should be of IS specification and standards. The instrumentation shall be complete in every respect and liberal to the extent of providing data of all operation variables sufficient for the safe, efficient, easy operation, easy fault diagnosis, start-up and shut down of the plant.

The design and installation of instruments shall be generally in accordance with ISA / API recommended practices and other applicable IS standard.

All instruments and equipments shall be suitable for use in a hot, humid and tropical industrial climate in which inflammable gases may be present.

Instrument power circuits shall be individually protected from fault with the help of fuses. Power supply to the individual instrument shall be able to disconnect with the help of switch and protected with the help of fuses.

All instruments shall be electronic type Transmitters shall be "smart' type and conventional electronic type where 'smart' version is not available. All electronic instruments shall be immune to Radio Frequency interferences.

Flow indicator – cum- Totalizes as well as single pen recorder shall be provided on the control panel for indicator and recording of flow rate and digital display of total flow over a period of time.

For all drives lamp indicators shall be provided on the control panel for running indicator as well as audiovisual alarms. All the instruments proposed should be as per IS specification and standard to read the correct measurements and readings.

2.5.03 DRAWINGS AND DATA

The contractor shall furnish the following drawings and get the approval from the Engineer in charge before commencement of the work.

i. General Arrangement drawing for all equipments.

ii. Schematic Diagram.

iii. As fitted drawing (After completion)

The contractor should also issue the Technical catalogues, and operation and maintenance manual for all vital equipments to the clients.

All Electrical Installations are to be carried out as per the statutory requirement of Chief Electrical Inspector to Govt. / Explosive Authority / IE Rules / applicable IS code / code practices for obtaining clearance from Electrical Inspectorate.

In general Data to be furnished by Tenderer along with offer and after placement of order by successful Tenderer shall follow relevant specification of this TS vide section 7.5.0 and 7.6.0.

3.0 COMMERCIAL CONDITIONS

3.01 The tendered rate shall inter alias be deemed to include for the provision of all materials, process, operation and special requirements detailed in the particular specification irrespective of whether these are mentioned in the description of equipment schedule and Bill of quantities or not. It is an express condition of the contract that the tendered rates for various items in the Bill of Quantities shall be deemed to include for the full, entire and final condition of the contractor respective items of the works in accordance with the provision of the contract.

3.02 The tendered rate shall include for all taxes, duties, etc. as applicable and shall be quoted on the works contract basis for Supply, Erection, Testing & Commissioning and Handing over of Water Treatment Plant at REGIONAL INSTITUTE OF ALLIED HEALTH SCIENCES AT COIMBATORE.

3.03 The tendered rate shall remain firm and free from variation due to rise in the cost of materials/equipment, labour or any other reasons whatsoever during the contract period and valid extension.

3.04 The quantum of excise duty included in the tendered price, the rate at which they were assumed etc. shall be indicated in the tender.

3.1 UNIT RATES

3.1.1 The tenderer shall indicate unit rates for quantities of various items like piping, power wiring, insulation and other relevant items.

3.1.2 Only approved work will be measured on completion and priced as per rates quoted against the respective items.

3.2 BRIEF DESCRIPTION OF PRICING

3.2.1 The tenderer shall furnish duly certified breakup of material and labour separately for each item of work. The same shall be attached separately along with the price bid.

3.3 PRO-RATA VALUE

The detailed break up of prices for various items of equipments and materials of the full system should be provided by successful tenderers within fifteen days from the date of letter of intent to facilitate the Employer for assessment and verification and to certify payment.

3.4 SALES TAX AND EXCISE DUTY

The tenderer shall clearly indicate sales tax, Excise and other duties as applicable in his offer for carrying out this work.

3.5 EXTRA ITEMS

The contractor is bound to carry out any items of work necessary for the completion of the job even though such items may not have been included in the schedule of probable quantities or rates, such items being necessary or essential for completing the job. Variation order in respect of such additional items and their quantities will be issued in writing by the Engineer-in-Charge.

All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of work and on completion including that of the sub-contractors and special tradesman and all materials condemned by the project engineer shall be cleared and removed from the site by the contractor without any extra charge.

All measuring steel taps, scaffolding, ladders instruments and tools that may be required for taking measurements shall be supplied by the contractor.

4.0 DATA TO BE FURNISHED BY TENDERER ALONGWITH OFFER

In order to enable the Engineer-in-Charge to properly evaluate the Tenders, the following drawings / information shall be furnished with the Tender:

(i) General arrangement (plan, elevation and sections) and data sheets of equipment / facility / plant with dimensions.

(ii) Equipment list and individual equipment data sheets indicating the following:

- Equipment no. and more
- Quantity
- Estimated weight
- Brief specifications, dimensions, etc.
- Services requirement

(iii) Descriptive information catalogues, drawings, etc. of all equipment and pertinent engineering data so that Engineer-in-Charge may have full and complete knowledge/assessment of equipment offered.

(iv) Experience list about supply and execution of similar type of plant by the Tenderer/Manufacturer.

(v) Write-up or brochures on details of manufacturing and testing facilities in the shops of the Manufacturer/Supplier.

(vi) List of equipment parts, total weight and weight of major items, Preliminary load data at load transfer points to be indicated.

(vii) List of bought – out items and catalogues.

(viii) Requirement of power and water.

(ix) Layout of services pipelines, cabliling, power supply distribution, etc. indicating terminal points.

(x) All relevant technical parameters.

(xi) List of commissioning and insurance spare parts and spares recommended for two years of normal operation and maintenance.

(xii) List of tools, tackles and material handling equipment for repair and maintenance.

(xiii) Schedule of design and engineering, submission of drawings for approval of Engineer-in-Charge, manufacture, supply/delivery, erection, testing commissioning, etc. in the form of bar chart.

(xiv) Write-up on quality assurance and control (QAQC) plan.

(xv) List of drawing and documents to be submitted to the Engineer-in-Charge for approval/comments/reference and records, and records, clearly identified under each category.

(xvi) List of electrics and instrumentations.

(xvii) Safety interlocks and alarm annunciation schemes.

(xviii) Instrumentation and control scheme.

(xix) Catalogues of major instruments.

(xx) Details of drive motors.

(xxi) List of deviations and list of exclusions.

(xxii) Any other relevant data/calculation and particulars which may further elucidate and project the Tenderer's experience and competence and details of the system offered.

5.0 DATA TO BE FURNISHED BY SUCCESSFUL TENDERER

5.01 GENERAL

(i) The Contractor shall furnish a schedule of submission of drawings for approval of Engineer-in-Charge. Submission of drawings shall commence within two weeks after placement of order and shall be completed keeping in view the overall completion schedule of the project

(ii) The Contractor shall submit detailed bar chart of all activities pertaining to contract, which will be approved by Engineer-in-Charge and will be subsequently used for review of progress.

(iii) Detailed billing schedule shall be submitted by Contractor, which will be approved by Engineer-in-Charge and shall be subsequently followed for payment purpose against progress milestones.

(iv) All drawings, documents, performance curves and manuals for Engineer-in-Charge approval/reference and records shall be submitted in six copies.

(v) After erection of equipment, the Contractor shall submit one soft copy and six sets of all as-built drawings.

(vi) All drawings shall be fully dimensioned and complete to the extent that may facilitate approval by Engineer-in-Charge in conjunction with other

drawings submitted earlier by the Contractor. Cross-references with other drawings and documents shall be clearly indicated.

(vii) All drawings shall be complete with bill of materials indicating quantity, material specification, unit and total weights and applicable standard code in respect of each item.

(viii) Shop test certificates, test reports and curves for all items shall be submitted for scrutiny/ approval along with or before inspection call for the item.

5.02 APPROVAL OF DRAWINGS AND DOCUMNENTS

(i) After scrutiny drawings, the Engineer-in-Charge will return one copy/ set of drawings to the Contractor marked with stamp of approval. The stamping shall be in any of the following four categories:

1. Approved
2. Approved except as noted. Forward final drawing.
3. Comments marked. Resubmission required.
4. Not approved.

(ii) Drawing under categories 2, 3 and 4 shall be revised to incorporate the comments and resubmitted for final approval. All revisions shall be marked on the drawings, together with date, reference and details of changes made. Reasons for not incorporating any of the comments made by the Engineer-in-Charge shall be clearly brought out to the attention of the Engineer-in-Charge while submitting the revised drawing.

(iii) Revised drawing shall be submitted within 15 days from the date of comment on drawing by Engineer-in-Charge

(iv) The drawings will be reviewed only for general conformity with contract requirement and specification. The approval will not relieve the Contractor of his responsibility towards adequacy and completeness of design and material and final fitment of parts sub-assemble/assembled at site for satisfactory operation of plant and equipment supplied.

5.03 DATA, DRAWINGS AND DOCUMENTS TO BE SUBMITTED

5.03.1 Immediately after Order Placement

Following drawings/documents with supporting calculations shall be submitted in six copies for approval of Engineer-in-Charge at least 60 days before scheduled date of commencement of this work.

01. List and schedule of submission of drawings.

02. Detailed QC and QA plan.

03. Calculations for sizing/selection of equipment.

04. Equipment overall dimension drawing.

05. Layout drawing, foundation plan and load data.

06. GA drawings of civil facilities, buildings, trenches, etc.

07. Water and power requirement along with electrical load data.

08. Electrical information.

5.03.2 As per Schedule Agreed with Engineer-in-Charge

Following drawings and documents shall be submitted for approval/ reference at a mutually agreed date as per approved overall schedule:

01 Detailed specification/data sheets of equipment and auxiliaries.

02 Detailed drawings of all equipment and auxiliaries showing plan, sections and elevations.

03 Technical literature/detailed catalogues of all equipment.

04 P & ID and piping layout.

05 Electrical and instrumentation drawings.

06 Any revisions in drawings and documents indicated at item no. 7.6.03.01

07 Dispatch sequences of all items

08 Final list of drawings.

09 Final list of special tools & tackles.

10 Final list of consumables and spares.

11 As-built drawings as applicable.

12 Test certificates.

13 Other data/documents as considered necessary for proper up keep and operation of the plant and equipment and as may have been called for in the general conditions of the contract.

5.04 OPERATION AND MAINTENANCE MANUALS

The Contractor shall furnish 3 sets of operation and maintenance instruction manuals meeting the following requirements:

(i) Instruction manuals shall present the following basic categories of information in practical, complete and comprehensive manner prepared for use by operating and/or maintenance personnel.

1. Instruction for initial installation.

2. Instructions for operation, maintenance and repair.

3. Recommended inspection points and periods of inspection.

4. Ordering information for all replaceable parts.

5. Lubrication chart.

(ii) Information shall be organized in a logical and orderly sequence. A general description of the equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment.

(iii) Necessary drawings and/or other illustrations shall be included on copies of appropriate certified drawings shall be bound in the manual. Test, adjustment and calibration information, as appropriate, shall be included and shall be identified to specific equipment.

(iv) A parts list shall be included showing nomenclature, manufacture's parts number and /or other information necessary for accurate identification and ordering of replaceable parts.

(v) Instructions and parts list shall be clearly legible and prepared on good quality paper. Instruction manuals shall be securely bound in durable folders.

(vi) If a standard manual is furnished covering more than the specific equipment purchased, the applicable model (or other identification) number, parts number and other information for the specific equipment purchased shall be clearly identified.

(vii) Instruction manuals shall include list of all special tools and tackles furnished with complete drawings and instructions for use.

6.6 TERMS OF PAYMENT

6.6.1 For items delivered and sorted at the site for the installation, the payment will be made by the HLL in accordance of this contract.

6.6.2 The rate of payment for the contract value under this contract shall be regulated and detailed below:

A. 75% of BOQ rate shall be paid on receipt of the materials at Site and after inspection and passing on pro-rata basis.

B. 10% of BOQ rate shall be paid on satisfactory erection and installation of materials on pro-rata basis

C. 10% after successful completion of running tests and provisional taking over.

D. 5% after final performance and removal of all defects pointed out during running.

SECTIOIN III

SEWAGE TREATEMENT PLANT

1.0 SPECIAL CONDITIONS

1.1. EXECUTION OF WORK

The whole of the work as described in the contract (including bills of materials, specification and all drawings pertaining thereto) and as advised by the Employers from time to time is to be carried out and completed in full to the entire satisfaction of the Employers. Any minor details of construction which are obviously and fairly intended, or which may not have been definitely referred to in this contract, but which are usual construction practice and essential to the work, shall be included in this contact.

1.2. MAINTENANCE & TRAINING FOR PERSONNEL

1.2.1 The contractor shall without any extra cost carry out for a period of 12 months after the installation is taken over by the owners, all routine and special maintenance and attend to any difficulties and defects that may arise in the operation of Sewage Treatment Plant.

1.2.2 The contractor shall associate with the Employers' staff during erection and the maintenance period, in the maintenance/operation of the Sewage Treatment Plant.

1.2.3 If required, by the Employers, the contractor shall also train members of the Employers' staff at their works/service station without any extra charge.

1.3. CERTIFICATE OF COMPLETION

1.3.1 The contractor shall intimate to HLL in writing as and when the works are completed and put into beneficial uses in order to enable HLL to check certify to take over the plants.

1.3.2 The work shall not be considered as completed and put into beneficial use until HLL have certified in writing that the same has been completed and put into beneficial use.

1.3.3 The defects liability period shall commence from date of such completion or any specific date mentioned therein.

1.4. OPERATIONAL AND MAINTENANCE MANUALS

1.4.1 The contractor shall also furnish the prints of all up-dated handing over along with required set of operating/maintenance manuals / instructions.

1.4.2 The Agency/contractor shall ensure adequate and prompt after sales service in the form of maintenance personnel and spares as and when required ensuring that all spares are easily available during the normal life of the installation. Every effort shall be made to provide zero defect performance during the guarantee period of 12 months (DLP) by undertaking preventive maintenance.

2.0 TECHNICAL INSTRUCTION TO TENDERER

2.01 SCOPE OF WORK

The tenderer's scope of work shall cover the following:

Design and engineering of the following:

a) The complete system of STP consisting mainly coarse screen chamber, sewage lift pump house, fine screen chamber, grit channels, equalization tank, sewage distribution pit, aeration tanks, secondary setting tanks, sludge pump house, sludge digester and drying beds, parshall flume flow measuring structure and other required facilities.

b) Tertiary treatment plant for further treating the clarified effluent from secondary settling tanks consisting filter feed sump, pressure sand filter, activated carbon filter, disinfection system using sodium hypochlorite solution, treated/reclaimed water sump, all pumping systems, etc complete.

c) STP Electrical Panel Room for power supply to all the MCCs inside STP area.

d) Suitably pretreatment facilities for hospital laboratory effluents comprising neutralization pit, chemical dosing system with pH monitor and control, propeller type agitator in the neutralization pit, etc. complete.

e) All civil works for STP including plant roads, foot paths, fencing and entry gate, etc, complete.

f) All electrical work for STP consisting of STP Electrical panel, MCC, ultrasonic liquid level controller, local push button controls, ventilation fans, all power and control cables from MCC onwards, etc. complete.

- Ultrasonic type flow recording device at flume structure.
- Necessary instrumentation required for smooth running of STP.
- Necessary illumination of pump houses, treatment units and entire plant area.

g) Necessary material handling facilities for all pump houses and tertiary treatment plant.

2.02 Manufacture, procurement, assembly, shop testing, surface preparation, shop painting, packing, supply at site, storing at site for all equipment/items.

2.03 Erection of equipment at site.

2.04 Finish paint of equipment at site after erection.

2.05 Testing and commissioning of the equipment and whole treatment plant.

2.06 Demonstration of performance guarantee.

2.07 Furnish all drawings, documents, load data and other information / data like fault diagnosis, operation and maintenance manual, etc., general arrangement and layout drawings, design calculations and equipment specifications, together with as built drawings for all mechanical and electrical installations.

2.08 All civil works design and construction including general structural works. All technological structures, supports for equipment, etc. complete.

2.09 Supply of spares for normal operation and maintenance of equipment for a period of 2 years to be reckoned from the date of taking over of the equipment by the client.

A list of spares shall be indicated in the offer and these spare parts shall be supplied to the client's store at site prior to commission of the equipment. No equipment shall be taken over by the client until these spares are supplied. The Tenderer will be required to replenish at his own expense the stock of spares used up during the performance test and with in guarantee period.

2.10 The Tenderer shall include in the scope, the requirement of all lubricants, and other consumables for testing, commission and performance guarantee runs.

2.11 The Tenderer shall list out in offer and provide a complete new and unused set of all special tools and tackles required for operation and maintenance of equipment. Necessary material handling equipment shall also be part of these tools.

2.12 All necessary foundation bolts, puddle flanges, matching flanges and anchoring parts shall be in the scope of the Tenderer.

2.13 Any additional work / equipment and material which may not be specially mentioned in the specification but are required to make the equipment complete in every respect in accordance with technical specification and necessary for safe operation and guaranteed performance of the plant shall be covered and provided by the tenderer.

2.14 The tenderer shall consider in their scope for supply and laying of 10m length each for inlet sewer line and final reclaimed waterline, and also quote unit rate for the same.

2.15 The Tenderer shall assist the Client for obtaining the clearance from State Pollution Control Board and other statutory agencies concerned. The

Tenderer will assist the Client for obtaining "No Objection certificate" and "Consent for discharge of effluents" from the State Pollution Control Board.

2.16 WORKMANSHIP AND QUALITY CONTROL

i) The equipment supplied shall be new and best of their kind and of latest technology. All materials and equipment shall comply with the latest Indian standards and statutory requirements of the concerned State Governments. In absence of relevant Indian standards / practices, any other international standards acceptable to the Engineer-in-Charge may be followed, but the same shall be clearly brought out in the offer.

ii) The equipment shall be designed to have maximum reliability and ease of operation and maintenance.

iii) The Tenderer shall avoid offering sophisticated and complicated equipment where simple and proven equipment will achieve the specified requirements.

iv) Quality assurance plan shall be furnished after placement of order.

2.17 CODES AND STANDARDS

(i) All equipment supplied shall be in conformity with applicable codes and standards. All codes and standards used/referred to shall be to their latest edition /version as on the date of the acceptance of the tender.

(ii) All equipment shall conform to the provision of statutory and other regulations in force, such as Indian Explosive Act, Indian Factories Act, etc.

(iii) All electrical equipment shall comply with the latest revision of Indian Electricity Rules and within the statutory requirement of the Government of India and State Government as regards safety, earthing and other provision specified therein for installation and operation of electrical equipment.

2.18 DEVATION, ASSUMPTION AND ALTERNATIVE PROPOSALS

(i) The deviations from specification in any respect shall be clearly defined and indicated by the Tenderer along with reasons in the offer. In case of no list of deviations submitted by the Tenderer, all requirement and provisions of the specification shall be automatically deemed to have been agreed and complied by the Tenderer.

(ii) Any assumption made for calculations or working out details shall be indicated in the offer clearly by the Tenderer.

(iii) The Tenderer shall submit an offer which complies with the technical specification. However, the Tenderer, if desires, can submit in addition and alternative offer for a design which may differ from specification. However, the Tenderer, if desires, can submit in addition an alternative offer for a design which may differ from specification. Such alternative would be given careful consideration provided that adequate supplementary information drawings and data are submitted to permit a complete evaluation of the offer made.

2.19 PAINTING

(i) All ferrous metal works shall be provided with corrosion resistant paint treatment applied in accordance with the best trade practice suitable for plant and equipment.

(ii) The paints shall be obtained from reputed manufacturer. The formulation and application procedure shall be as per recommendation of the manufacturer for appropriate exposure conditions.

(iii) Final / touch-up painting shall be done at site after erection of equipment.

(iv) In case the equipment operating conditions require any other special painting, the Supplier shall indicate the same in the offer.

2.20 IDENTIFICATION MARKING

(i) Flow direction shall be marked on the various fluids piping in contrast colour shade.

(ii) Equipment part number/name shall be marked on all equipment parts and machinery. Match-marks, wherever necessary, shall be provided for facilitating erection.

2.21 INSPECTION AND WORKS TESTING

(i) The plant and equipment will be subjected to inspection and witnessing of tests by the Engineer-in-Charge. The supplier shall inform the Purchaser/his Consultants at least fifteen days in advance of the date when the plant and equipment will be made available for shop inspection and testing.

(ii) The Engineer-in-Charge shall be allowed to use free of cost all the testing facilities available with the Manufacturer for the purpose of testing.

(iii) Necessary test, for which adequate facilities are not available with the Supplier/sub-contractor, will be carried out at mutually agreed testing laboratories at the cost of contractor.

(iv) Inspection and works testing shall be carried out based on approved drawings and specifications and as per relevant standards.

(v) A copy of the order on the sub-suppliers, comprising all the detailed specification and bill of materials shall be provided to the Purchaser along with or before inspection call.

(vi) The Supplier shall inspect the equipment/part before offering to the Engineer-in-Charge for inspection and satisfy himself with regard to the quality and quantity and issue an internal inspection certificate along with manufacturer's test certificate to the Engineer-in-Charge.

(vii) The Supplier shall not dispatch the materials from his works unless it has been inspected, tested and accepted by the Engineer-in-Charge unless specific approval for the same is given by Engineer-in-Charge. In either case, the material shall be dispatched by Supplier only after issue of dispatch clearance by Engineer-in-Charge.

(viii) The Engineer-in-Charge shall have the full right to accept or reject the materials, if during inspection and testing, the materials are found not conforming to specification and/or standard.

(ix) Inspection by the Engineer-in-Charge shall not relieve the Supplier of his liability for rectifying defects which may subsequently appear or be detected during or after erection. After rectification, the testing of the plant and equipment shall be repeated to the satisfaction of the Engineer-in-Charge.

2.22 PACKING, DISPATCH, HANDLING & TRANSPORTATION

(i) Packing and weather proofing shall be subject to approval of the Engineer-in-Charge. This approval will be general and may not be required every time for an article or group of articles to be dispatched. However, the Engineer-in-Charge reserves the right to examine the packing for any particular consignment at Supplier's / Manufacturer's works before dispatch.

(ii) The Supplier shall be entirely responsible for the insurance, shipment, handling and transportation of all equipment, construction tools, labourers and materials including unloading at destination, transporting to site, off-loading, storing and protection at site till erection.

2.23 ERECTION, TESTING & COMMISIONING

(i) The equipment supplied shall be erected, tested and commissioned individually as well as for integrated operation.

(ii) All site tests on plants shall also subject to prior approval by Engineer-in-Charge. The Supplier/Contractor shall submit to Engineer-in-Charge or his representative the list of pre-commissioning tests intended to be carried out. This list will be reviewed and finalized before commencement of tests.

(iii) The tests shall be carried out as per mutually agreed schedule so that they may be witnessed by Engineer-in-Charge.

(iv) The execution of the erection, testing and commission work shall be in such a manner that no interference is caused to the operation of other agencies working in the same area.

2.24 GUARANTEE AND PENALTIES

(i) All the equipment supplied shall be guaranteed for quality workmanship and compliance with the specified requirements for integrated performance to deliver rated outputs.

(ii) The Tenderer shall guarantee individual as well as integrated performance of all the equipment supplied by him for a period of 12 months from the date of plant take-over by the Engineer-in-Charge.

(iii) Equipment offered shall be guaranteed for the attainment of specified parameters during the performance of specified parameters during the performance guaranteed parameters; the tenderer shall be advised for necessary rectification work. Even after two such consecutive rectification works, if a particular equipment fails to achieve the guaranteed parameters, it will be assumed that the plant and equipment supplied is defective in its design and will be subjected to penalties. However, while levying the Penalties, the applicable tolerance will be taken into account. The expenditure incurred on account of implementing the modifications/changes shall be borne by the Tenderer.

(iv) The penalties for non-performance shall be discussed during tender discussed during tender discussions and shall be finalized as mutually agreed.

(v) The approval of drawings and /or inspection by Engineer-in-Charge will not absolve or relieve the tenderer from any of his obligations under the

contract and he shall be wholly and solely responsible for the satisfactory operation and guaranteed performance of his supply.

(vi) The tenderer will be solely responsible and accountable for any defects and subsequent delays in supply due to re-inspection.

3.0 TECHNICAL SPECIFICATION – TECHNOLOGICAL / MECHANICAL WORKS

3.01 TYPE OF TREATMENT PLANT

(i) The Tender shall provide Fluidized Bio Reactor (FBR) type sewage treatment plant for secondary treatment of sanitary and faecal sewage from the proposed hospital. Further the STP shall have provision for tertiary treatment of secondary clarified effluent to produce reclaimed water for landscaping and other uses.

(ii) The STP shall comprise coarse screen chamber, sewage, lift pump house, fine screen chamber, grit channels, equalization tank, distribution pit, aeration tanks, secondary settling tanks, sludge pump house, sludge digester and drying beds, parshall flume flow measuring structure, filter feed sump, pressure filter, activated carbon filter, sodium hypochlorite dosing system, reclaimed water sump, pumping machineries, electrical panel room and other required facilities. Further pretreatment facility for laboratory effluents shall be separately provided at the lab area.

3.02 DESIGN CAPACITY

(i) The Tender shall design the STP for 6.75m^3/h (average flow) with 400mg/l BOD_5 at 20^o C organic loading.

(ii) Peak flow for design of raw sewage pumping shall be considered as 20.25m^3/h.

(iii) The Tenderer shall provide three streams of aeration tank and settling tank with 50% average design capacity each, i.e. the STP shall have 150% capacity with all three streams working and shall have 100% capacity with two streams working.

3.03 TREATMENT UNITS

The dimensions / sizes and levels of various treatment units given in the followings specification are tentative only. The Tenderer shall provide dimensions / sizes of treatment units based on detailed calculations and actual site condition as approved by the Engineer-in-Charge.

3.04 COARSE SCREEN CHAMBER

(i) The raw sewage from sewerage network shall enter the coarse screen chamber at invert level - 2.10 m from FGL. The inlet sewer line shall be of 150mm dia SW pipe.

(ii) The coarse screen chamber shall have an overall area of 4.00 m x 1.20 m.

(iii) Suitable fixed types SS bar screen shall be provided with screen opening of 25 mm clear.

(iv) PVC step shall be provided for access into the chamber for cleaning and maintenance.

(v) Suitable hand railing shall be provided around the coarse screen chamber.

3.05 SEWAGE LIFT PUMP HOUSE

The sewage lift pump house shall have sewage sump and pump room above FGL. Submersible sewage pump sets shall be placed inside the sump and the pump room shall accommodate MCC, delivery pipelines, valves and fittings, suitable ultrasonic liquid level controller, lifting facilities for sewage pump sets. The sewage pump house shall have suitable illumination and mechanical ventilation facilities. Suitable door and window shall be provided for the pump house.

a) Sewage Sump

(i) The sewage sump shall have size 3.00 m x 2.00 m x 4.00 m (+0.30 m to - 3.70 m)

(ii) The sewage sump shall have suitable capacity not greater than 30 min detention for the lowest rate of pumping.

(iii) The sewage sump shall have suitable access opening in the pump room floor slab and PVC step provision for access inside the sump.

b) Pump Room

The pump room have sewage sump shall be of size 3.00 m x 3.00 m x 3.50 (+0.30 m to + 3.80 m) and shall accommodate individual delivery lines and common header with all valves and fittings. A suitable monorail with chain pulley block shall be provided and shall be capable of lifting the heaviest component of the pumping systems. Further suitable mechanical verification facilities using exhaust fans shall be provided. Suitable magnetic flow meter shall be provided for measuring the rate and cumulative flow of the raw sewage pumped to the treatment plant.

3.06 RAW SEWAGE PUMPSETS

(i) 2 Nos. submersible type pump sets with one working and the other stand by shall be provided.

(ii) Each pump shall have capacity 30m3/h with 10m head.

(iii) Pumps shall be of non-clog type handling domestic sewage.

(iv) Pump shall have impeller in SS 304 and shaft in SS 410 material as approved by the Engineer-in-Charge.

(v) Pump shall have manual control in addition to automatic liquid level control using ultrasonic sensor.

(vi) The automatic liquid level control will be such that the working pump shall start when the liquid level in the sewage sump reaches a preset high level and it shall stop when the liquid level falls to a preset low level.

3.07 FINE SCREEN CHAMBER

(i) Sewage lift pump house shall discharge the sewage to fine screen chamber having bottom level 3.75m above FGL.

(ii) The fine screen chamber shall have and overall area if 3.00m x 1.00m.

(iii) Suitable fixed type SS bar screen shall be provided with screen opening 16 mm clear.

(iv) Suitable MS ladder shall be provided for access to the fine screen chamber.

3.08 GRIT CHANNELS WITH PROPORTIONAL FLOW WEIR

(i) 2 Nos. Grit channels shall be provided with one working and the other standby.

(ii) Proportional flow weir shall be provided at the end of each grit channel to maintain grit settling velocity about 0.3m/s at average flow and 0.9 m/s at peak flow.

(iii) The bottom of the grit channel shall have space for accumulation of grit and also drain pipe with butterfly valve for removal of grit material periodically once in a week.

(iv) Each grit channel shall have two numbers slide gates on either ends and slide gates shall be CI or aluminum material.

3.09 EQUALIZATION TANK

(i) Provide 1 No equalization tank with 2 hour detention time for peak flow condition.

(ii) The tentative size of equalization tank shall be 4.00mx 3.50m x 3.75m (3.0m +0.75m) overall depth.

(iii) Suitable diffused aeration shall be provided at the bottom of equalization tank to avoid settlement of solids.

3.10 FLOW DISTRIBUTION CHAMBER

(i) Suitable semicircular sewage flow distribution chamber shall be provided at the end of equalization tank.

(ii) HDPE pipe with CI Butterfly valve shall be provided to discharge the sewage from distribution pit to aeration tanks.

3.11 AERATION TANKS

(i) 3 Nos. aeration tanks shall be provided in parallel with 50% capacity each.

(ii) The aeration tank shall be of size 3.00 m x 3.00 m x 4.05 m (3.30 m + 0.75 m) overall depth.

(iii) FBR volume required shall be 1.5kg BOD/ d/m3 for design of aeration tank.

(iv) Media BOD loading rate shall be 20g of BOD/d/m2 of media surface area.

(v) Oxygen requirement of 2 Kg / Kg BOD applied shall be adopted for diffused aeration.

(vi) The side wall of the aeration tank shall have suitable protection hand railing.

(vii) 3Nos air blowers shall be provided in the blower room located in the tertiary treatment plant for supply of diffused aeration to aeration tanks (3), equalization tank (1) and reclaimed water sump.

3.12 SECONDARY SETTLING TANKS

(i) 3 Nos. secondary setting tank shall be provided in parallel.

(ii) The settling tank shall be of size 3.00 m x 3.00 m (effective) area with hopper bottom.

(iii) The settling tank shall be designed for 0.5m^3 / m^2 /h surface loading rate and 2.5 hr detention time.

(iv) The hopper slope shall be 45º or as approved during detailed engineering.

(v) The settling tank shall have suitable inlet and overflow launder arrangement.

(vi) The settling tank shall have suitable protective hand railing.

(vii) The settling tank shall have suitable access ladder from FGL.

3.13 SLUDGE RECIRCULATION PUMP HOUSE

(i) A sludge pump house of 9.00 m x 3.00 m x 3.50 m (+0.30m to +3.80 m) shall be provided to accommodate 3 Nos. sludge pumps, one number for each stream. Sludge pump shall receive sludge from hopper bottom settling tank.

(ii) Each stream shall have 1 No. sludge pump set (1W) for sludge pumping to sludge digester.

(iii) The capacity of each pump set shall be 10 m^3/h with suitable head.

(iv) The pump shall be non-clog type with SS impeller and shaft.

(v) The sludge pump house shall accommodate MCC for control of sludge pumpsets.

(vi) The sludge pump house shall be provided with suitable door and windows.

(vii) Suitable mechanical ventilation using exhaust fans shall be provided for the sludge pump house.

(viii) Suitable material handling facility with chain pulley block and monorail shall be provided for handling the sludge pumps.

3.14 SLUDGE DIGESTER

(i) Provide 1 No anaerobic sludge digester with retention time of 365days for digested sludge. However provided a minimum volume of 40m3.

(ii) The digester sludge from the digester shall be withdrawn and dried in sludge drying beds.

3.15 SLUDGE DRYING BEDS

(i) 2 Nos. sludge drying beds shall be provided with each size 3.00 m x 1.50m (effective) area.

(ii) 20 cm sludge depth and 10 days drying period shall be adopted for designing the sludge drying beds.

(iii) The sludge drying bed shall have suitable depth of sand and gravel bed as per CPHEEO sewage manual and as approved by the purchaser.

(iv) The sludge drying beds shall have suitable sludge distribution system with sludge channels and control slide gates of aluminium materials.

(v) Suitable drain pipe system below sludge drying beds shall be provided using loose joined SW pipes and filtrate drainage shall be connected to raw sewage lift pump house by gravity line.

(vi) Sludge drying beds shall be covered with suitable shed having poly carbonate roof sheet. The sides of shed shall be kept open to allow natural ventilation.

3.16 PARSHALL FLUME FLOW MEASURING STRUCTURE

(i) Suitable parshall flume flow measuring structure shall be provided to measure the flow of clarified effluent from secondary settling tanks to tertiary treatment plant.

(ii) Ultrasonic type flow measuring system shall be provided to recording rate of flow as well as cumulative flow. Necessary electronics and digital display shall be housed inside Tertiary treatment plant.

(iii) The parshall flume shall be designed for a maximum flow measurement of 60m^3/h.

3.17 TERTIARY TREATMENT PLANT & BLOWER ROOM

(i) The secondary clarified effluent from secondary settling tank shall be received in a filter feed sump of 8 hours capacity, also provision for disinfection using sodium hypochlorite dosing system shall be made before filtration.

The effluent shall be filtered using pressure sand filter and then passed through activated carbon filter. The activated carbon filtered effluent shall be disinfected using sodium hypochlorite dosing system before receiving in a reclaimed water sump of 1 day capacity.

There shall 2 Nos. of stream of equipment with one working and other stand by as follows.

a) Filter feed pumps 2 Nos. (1W + 2S) (W- Working; S – Stand by)

b) Pressure sand filters 2 Nos. (1W+ 1S)

c) Activated carbon filters 2 Nos. (1W + 1S)

d) Sodium hypochlorite dosing system 2 Nos. (1W+1S)

e) Reclaimed water pumpsets 2 Nos. (1W+1S)

The above equipment and system shall be suitable designed for 20 hours duration of operation.

(ii) The tertiary treatment plant including blower room shall have overall size of 10.00 m x 7.0m x 4.00 m (+0.50m to + 4.50m). The filter feed sump and reclaimed water sump shall be below FGL, and treatment plant and blower room above FGL.

(iii) The blower room accommodates 3 No blowers, compressed air piping and MCC for blowers.

(iv) The tertiary treatment plant and blower room shall have suitable door and windows.

(v) Further the tertiary treatment plant and blower room shall have suitable material handling facility with chain pulley block and monorail.

(vi) Suitable mechanical ventilation facilities using exhaust fans shall be provided for the plant room and blower room.

3.18 INTER CONNECTING PIPELINES, VALVES AND FITTINGS

(i) The individual delivery lines from the pumps shall have non-return valves and gate valves.

(ii) Suitable number of valves shall be provided in the inter connecting pipelines for diversion and control of flows as approved by the Engineer-in-Charge.

(iii) All pipelines shall be so arranged to avoid excessive loss of head outside the pumps or disturbance of the flow within pump.

(iv) The velocity of flow in the piping shall be generally 1.5 to 2.0 m/s

(v) All high points in the pipelines shall be avoided to prevent any gas accumulation.

(vi) CI Sluice valves shall confirm to IS:780 class-1

(vii) CI Butterfly valves shall confirm to IS: 13095.

(viii) CI non-return valves shall confirm to IS: 5312.

(ix) MS pipes / GI pipes shall confirm to IS: 1239 and IS: 3589 and shall be said as per IS: 5822.

(x) Salt glazed stone ware pipes used shall confirm to IS: 651 and shall be laid as per IS: 4127.

(xi) RCC pipes used shall confirm to IS: 458 and shall be laid as per IS: 783.

(xii) HDPE pipes used shall confirm to IS 4984.

3.19 OTHER SERVICE

The tenderer shall provide necessary storm water drains, plant roads, pavement / foot paths, drinking water lines and drainage platforms, toilet facility, fencing and entry gate for the STP. The above facilities are to be shown in the layout plan and other G.A. drawings as necessary.

3.20 PRETREATMENT FACILITY FOR LABORATORY EFFLUENTS

(i) Process Description:

The laboratory section will discharge various chemical effluents and which require pretreatment before discharging to domestic sewerage.

These chemical effluents from the building shall be collected separately in neutralization pits 2 Nos. (1W+1S). Each neutralization pit shall have capacity to receive effluents for 1 shift operation of laboratories. At the end of each shift pH of the effluent shall be monitored and required chemicals shall be continuously added. There shall be agitator mounted on the neutralization pit for proper mixing of the effluent. When the pH of the effluent reaches to neutral range (say pH around 7) the addition of chemical shall be stopped automatically. Then the neutralized effluent is let out to the sewer line by opening the outlet valve of the pit.

(ii) The following points shall be considered for providing neutralization facility:

a) Each neutralization pit shall have mechanical agitator mounted over the pit for proper mixing of effluent. The agitator shall be of acid resistant material. The pit shall have suitable acid proof lining, otherwise suitable synthetic or PVC tank shall be provided.

b) Provision of dosing chemicals and dosing pumps 2 Nos. (1W + 1S) shall be provided.

c) Automatic pH monitor and control system shall be provided for operation of dosing pumps.

d) Inlet and piping of the neutralization pit shall have suitable control valves of PVC or acid resistant material.

3.21 QUALITY OF SECONDARY CLARIFIED EFFLUENT

The secondary clarified effluent leaving the secondary settling tank shall conform to effluent discharge standards as required by Central and State Pollution Controls Boards, and other statutory agencies.

The effluent quality shall be:

a) BOD_5 at 20^0 c : 20 mg/l or less

b) Total S.S : 30 mg/l or less

3.22 QUALITY OF RECLAIMED WATER

The quality of reclaimed water shall be fit for landscape and gardening uses.

The quality of effluent shall be:

a) BOD_5 at 20^0 c : 10 mg/l or less

b) Total SS solid : less than 10 mg/l

c) Residual chlorine : 0.1 mg/l

d) Faecal coliform : not more than 1000/ 100 ml

4.0 TECHNICAL SPECIFICATION – CIVIL WORKS

All the civil construction works shall be in general conform to the CPWD specification. The civil structures shall be designed as per latest and modified design standards and shall implement the Seismic standard and code also.

The drawings and design details shall be furnished to the consultants prior to implementation and construction.

The contractor shall be responsible for all designs and providing civil and structural drawings.

All the underground structure like sumps and walls shall be provided with R.CC M 25 / M 30 grade concrete, and water proofing shall be carried out wherever required. The inner dimensions of each structure shall be as per

TS – Technological works. Any variation or changes shall be carried out on written confirmation from the Engineer-in-Charge.

The entire cost of civil works shall include cost of civil construction, design details and providing all necessary construction drawings in hard copy and soft copy as per relevant specification in this T.S. vide section.

5.0 TECHNICAL SPECIFICATION - ELECTRICAL & INSTUMENTATION WORKS

5.01 ELECTRICAL

The Electrical Specification of this work is intended to cover the supply, installation, testing and commissioning of the entire electrical equipments, its instruments and all items and accessories including consumable against the lump sum price of the contract.

The equipment and accessories shall be complete in all respects and any device not included in this specification but essential for proper operation of the plant shall be deemed to be with in the scope of this specification, whether specifically mentioned or not.

Some parts of the total work may tie ups with the existing system particularly mode of power supply to the Motor control centre etc, and the contractor has to get it done for the completion of this work.

The main incoming Panel Board (MCC) and instruments to cater main supply to all the motors and instruments comes under the scope of the contractor. However the incoming supply to MCC through suitable UG cable will be given from the client side. From MCC to each and every motors and instruments supply will be given by the contractor. In all outdoor areas cables shall be laid mostly directly buried underground with adequate mechanical protection wherever necessary whereas in indoor areas cable shall be laid in trenches / wall / structures through suitable trays / cleats.

All allied civil works, such as foundations to motors and equipments come under the scope of the contractor. Supply of steel and cement required in the execution of the contract work shall also be the responsibility of the contractor.

All motors shall be suitable for outdoor installations with tropical insulation and protective category of IP – 54 and incase of submersible pump sets IP – 68 protections should be adopted. All motors shall be

started and stopped by push button at local control stations, located near the respective motors.

All motors with capacity below 10 HP shall have Direct-On-Line starters unless otherwise specified and motors with higher capacity shall have fully automatic star / Delta starters.

Earthing system shall be carried out with GI strips, wires, electrodes by GI pipes. All equipments shall have two separate and distinct earth points as per IS specifications.

Automatic power factor improvement panel with capacitor bunk shall be included to maintain a power factor of 0.92 lag all the time.

All cable glands should be brass double compression type. All AL / CU cables should be terminated through crimping type AL / CU lugs respectively with earth connection to the glands.

Indoor lighting points shall be carried out with M.S conduit pipe with FRLS copper wires and the light fittings with fluorescent lamps so as to have required lumen level in the pump house and control room and other areas specified in NBC.

5.02 INSTRUMENTATION:

All instruments such as level switch for sump, Electromagnetic Flow meter, Flow measuring device, Receiver Electronic Indicator should be of IS specification and standards. The instrumentation shall be complete in every respect and liberal to the extent of providing data of all operation variables sufficient for the safe, efficient, easy operation, easy fault diagnosis, start up and shut down of the plant.

The design and installation of instruments shall be generally in accordance with ISA / API recommended practices and other applicable IS standard.

All instruments and equipments shall be suitable for use in a hot, humid and tropical industrial climate in which inflammable gases may be present.

Instrument power circuits shall be individually protected from fault with the help of fuses. Power supply to the individual instrument shall be disconnect able with the help of switch and protected with the help of fuses.

All instruments shall be electronic type Transmitters shall be "smart" type and conventional electronic type where "smart" version is not available. All electronic instruments shall be immune to Radio Frequency interferences.

Inlet flow and Effluent outlet flow – rate measurements in open channel will be done by flume and ultrasonic level sensing instruments. Flow indicator-cum-Totalizes as well as single pen recorder shall be provided on the control panel for indicator and recording of flow rate and digital display of total flow over a period of time.

For all drives except aerators lamp indicators shall be provided on the control panel for running indicator as well as audiovisual alarms. There will be three lamps for each aerator. RED for running GREEN for stop and AMBER for overload trip indications.

Flow-rate measurement for recirculation sludge to Aeration Tank shall be carried out with the help of magnetic flow meter.

All the instruments proposed should be as per IS specification and standard to read the correct measurements and readings.

5.03 DRAWINGS AND DATA

The contractor shall furnish the following drawings and get the approval from the Engineer in charge before commencement of the work.

(i) General Arrangement drawing for all equipments.

(ii) Schematic Diagram.

(iii) As fitted drawing (after completion)

The contractor should also issue the Technical catalogues, and operation and maintenance manual for all vital equipments to the clients.

All Electrical Installations are to be carried out as per the statutory requirement of local Electrical Inspectorate / Explosive Authority / IE Rules / applicable IS code / code practices for obtaining clearance from Electrical Inspectorate.

In general Data to be furnished by Tenderer along with offer and after placement of order by successful Tenderer shall follow relevant specification.

6.0 COMMERCIAL CONDITIONS

6.01 The tendered rate shall inter alias be deemed to include for the provision of all materials, process, operation and special requirements detailed in the particular specification irrespective of whether these are mentioned in the description of equipment schedule and Bill of quantities or not. It is an express condition of the contract that the tendered rates for various items in the Bill of Quantities shall be deemed to include for the full, entire and final condition of the contractor respective items of the works in accordance with the provision of the contract.

6.02 The tendered rate shall include for all taxes, duties, etc. as applicable and shall be quoted on the works contract basis for Supply, Erection, Testing & Commissioning and Handing over of Sewage Treatment Plant (STP) at Regional Institute of Allied Health Sciences at Coimbatore

6.03 The tendered rate shall remain firm and free from variation due to rise in the cost of materials/equipment, labour or any other reasons whatsoever during the contract period and valid extension.

6.04 The quantum of excise duty included in the tendered price, the rate at which they were assumed etc. shall be indicated in the tender.

6.1 UNIT RATES.

6.1.1 The tenderer shall indicate unit rates for quantities of various items like piping, power wiring, insulation and other relevant items.

6.1.2 Only approved work will be measured on completion and priced as per rates quoted against the respective items.

6.2 BRIEF DESCRIPTION OF PRICING

6.2.1 The tenderer shall furnish duly certified breakup of material and labour separately for each item of work. The same shall be attached separately along with the price bid.

6.3 PRO-RATA VALUE

The detailed break up of prices for various items of equipments and materials of the full system should be provided by successful tenderer within fifteen days from the date of letter of intent to facilitate the Employer / Purchaser for assessment and verification and to certify payment.

6.4 SALES TAX AND EXCISE DUTY

The tenderer shall clearly indicate sales tax, Excise and other duties as applicable in his offer for carrying out this work.

6.5 EXTRA ITEMS

The contractor is bound to carry out any items of work necessary for the completion of the job even though such items may not have been included in the schedule of probable quantities or rates, such items being necessary or essential for completing the job. Variation order in respect of such additional items and their quantities will be issued in writing by the Employer /Purchaser.

All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of work and on completion including that of the sub-contractors and special tradesman and all materials condemned by the project engineer shall be cleared and removed from the site by the contractor without any extra charge.

All measuring steel taps, scaffolding, ladders instruments and tools that may be required for taking measurements shall be supplied by the contractor.

6.6 TERMS OF PAYMENT

6.6.1 For items delivered and sorted at the site for the installation, the payment will be made by the HLL in accordance of this contract.

6.6.2 The rate of payment for the contract value under this contract shall be regulated and detailed below:

E. 75% of BOQ rate shall be paid on receipt of materials at Site and after inspection and passing on pro-rata basis.

F. 10% of BOQ rate shall be paid on satisfactory erection and installation of materials on pro-rata basis

G. 10% after successful completion of running tests and provisional taking over.

H. 5% after final performance and removal of all defects pointed out during running.

7.0 DATA TO BE FURNISHED BY TENDERER ALONGWITH OFFER

In order to enable the Engineer-in-Charge to properly evaluate the Tenders, the following drawings/information shall be furnished with the Tender.

(i) General arrangement (plan, elevation and sections) and data sheets of equipment / facility / plant with dimensions.

(ii) Equipment list and individual equipment data sheets indicating the following:

- Equipment no. and name
- Quantity
- Estimated weight
- Brief specifications, dimensions, etc.
- Services requirement

(iii) Descriptive information catalogues, drawings, etc. of all equipment and pertinent engineering data so that Engineer-in-Charge may have full and complete knowledge / assessment of equipment offered.

(iv) Experience list about supply and execution of similar type of plant by the Tenderer/ Manufacturer.

(v) Write-up or broachers on details of manufacturing and testing facilities in the shops of the Manufacturer/Supplier.

(vi) List of equipment parts, total weight and weight of major items. Preliminary load data at load transfer points to be indicated.

(vii) List of bought-out items and catalogues.

(viii) Requirement of power and water

(ix) Layout of services pipelines, cabling, power supply distribution, etc. indicating terminal points.

(x) All relevant technical parameters.

(xi) List of commissioning and insurance spare parts and spares recommended for two years of normal operation and maintenance.

(xii) List of tools, tackles and material handling equipment for repair and maintenance.

(xiii) Schedule of design and engineering, submission of drawings for purchaser's approval, manufacture, supply / delivery, erection, testing commissioning, etc. in the form of bar chart.

(xiv) Write-up on quality assurance and control (QAQC) plan.

(xv) List drawings and documents to be submitted to the Engineer-in-Charge for approval / comments/references and records, clearly identified under each category.

(xvi) List of electrics and instrumentations

(xvii) Safety interlocks and alarm annunciation schemes.

(xviii) Instrumentation and control scheme.

(xix) Catalogues of major instruments.

(xx) Details of drive motors.

(xxi) List of deviations and list of exclusions.

(xxii) Any other relevant data/calculation and particulars which may further elucidate and project the Tenderer's experience and competence and details of the system offered.

8.0 DATA TO BE FURNISHED BY SUCCESSFUL TENDERER

8.01 GENERAL

(i) The Contractor shall furnish a schedule of submission of drawings for approval of Engineer-in-Charge. Submission of drawings shall commence within two weeks after placement of order and shall be complete keeping in view the overall completion schedule of the project.

(ii) The Contractor shall submit detailed bar chart of all activities pertaining to contract, which will be approved by Engineer-in-Charge and will be subsequently used for review of progress.

(iii) Detailed billing schedule shall be submitted by Contractor, which will be approved by Engineer-in-Charge and shall be subsequently followed for payment purpose against progress milestones.

(iv) All drawings, documents, performance curves and manuals for Purchaser's approval /reference and records shall be submitted in six copies.

(v) After erection of equipment, the Contractor shall submit one soft copy and six sets of all as-built drawings.

(vi) All drawings shall be fully dimensioned and complete to the extent that may facilitate approval of Engineer-in-Charge in conjunction with other drawings submitted earlier by the Contractor. Cross-references with other drawings and documents shall be clearly indicated.

(vii) All drawings shall be complete with bill of materials indicating quantity, material specification, unit and total weights and applicable standard code in respect of each item.

(viii) Shop test certificates, test reports and curves for all items shall be submitted for scrutiny/ approval along with or before inspection call for the item.

8.02 APPROVAL OF DRAWINGS AND DOCUMENTS

(i) After scrutiny of drawings, the Engineer-in-Charge will return one copy/set of drawings to the Contractor marked with stamp of approval. The stamping shall be in any of the following four categories.

1. Approved.
2. Approved except as noted. Forward final drawing.
3. Comments marked. Resubmission required.
4. Not approved.

(ii) Drawing under categories 2, 3 and 4 shall be revised to incorporate the comments and resubmitted for final approval. All revisions shall be marked on the drawings, together with date, reference and details of changes made. Reasons for not incorporating any of the comments made by the Engineer-in-Charge shall be clearly brought out to the attention of the Engineer-in-Charge while submitting the revised drawing.

(iii) Revised drawing shall be submitted within 15 days from the date of comment on drawing by Engineer-in-Charge.

(iv) The drawings will be reviewed only for general conformity with contract requirement and specification. The approval will not relieve the

Contractor of his responsibility towards adequacy and completeness of design and material and final fitment of parts sub-assemble /assembled at site for satisfactory operation of plant and equipment supplied.

8.03 DATA, DRAWINGS AND DOCUMENTS TO BE SUBMITTED

8.03.2 Immediately after Order Placement

Following drawings/documents with supporting calculations shall be submitted in six copies within two weeks from the date of placement of order for approval/information/ of Engineer-in-Charge.

(i) List and schedule of submission of drawings

(ii) Detailed QC and QA plan.

(iii) Calculations for sizing/selection of equipment.

(ii) Equipment overall dimension drawing.

(iii) Layout drawing, foundation plan and load data.

(iv) GA drawings of civil facilities, buildings, trenches, etc.

(v) Water and power requirement along with electrical load data.

(vi) Electrical information.

8.03.3 As per Schedule Agreed with Engineer-in-Charge

Following drawings and documents shall be submitted for approval /reference at a mutually agreed date as per approved overall schedule:

(i) Detailed specification/data sheets of equipment and auxiliaries.

(ii) Detailed drawings of all equipment and auxiliaries showing plan, section and elevations.

(iii) Technical literature / detailed catalogues of all equipment.

(iv) P & ID and piping layout.

(v) Electrical and instrumentation drawings.

(vi) Any revisions in drawings and documents indicated at item no. 7.03.01.

(vii) Dispatch sequence of all items.

(viii) Final list of drawings.

(ix) Final list of special tools & tackles.

(x) Final list of consumables and spares.

(xi) As-built drawings as applicable.

(xii) Test certificates.

(xiii) Other data/documents as considered necessary for proper up keep and operation of the plant and equipment and as may have been called for in the general conditions of the contract.

8.04 OPERATION AND MAINTENANCE MANUALS

The Contractor shall furnish 3 sets of operation and maintenance instruction manuals meeting the following requirements:

(i) Instruction manuals shall present the following basic categories of information in practical complete and comprehensive manner prepared for use by operating and /or maintenance personnel.

1. Instruction for initial installation.
2. Instructions for operation, maintenance and repair.
3. Recommended inspection points and periods of inspection.
4. Ordering information for all replaceable parts.
5. Lubrication chart.

(ii) Information shall be organized in a logical and orderly sequence. A general description of the equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment.

(iii) Necessary drawings and / or other illustrations shall be included on copies of appropriate certified drawings shall be bound in the manual. Test, adjustment and calibration information, as appropriate, shall be included and shall be identified to specific equipment.

(iv) A parts list shall be included showing nomenclature, manufacturer's parts number and / or other information necessary for accurate identification and ordering of replaceable parts.

(v) Instructions and parts list shall be clearly legible and prepared on good quality paper. Instruction manuals shall be securely bound in durable folders.

(vi) If a standard manual is furnished covering more than the specific equipment purchased, the applicable model (or other identification) number, parts number and other information for the specific equipment purchased shall be clearly identified.

(vii) Instruction manuals shall include list of all special tools and tackles furnished with complete drawings and instructions for use of such tools tackles.

SECTION IV

ELECTRICAL & ALLIED SERVICES

1.00 GENERAL SPECIFICATIONS

1.1 The works shall be executed in accordance with the CPWD General Specifications for Electrical works Part –I Internal (2005), Part III Lifts & Escalators (2003) Part –IV, Substation (2007), Part – V Wet riser & Sprinkler Systems (2006), Part VII DG Sets (2006) and Specifications for Heating, Ventilation & Air Conditioning (2004) with up to date amendments and shall meet the requirements of the Indian Electricity Act rules.

1.2 In case of contradictions between the description in schedules of quantities and the Additional Specifications, the former shall prevail.

1.3 The work will be executed as per general arrangement drawing and detailed Fabrication drawings duly approved by the Engineer-in –charge. The various items of Equipments will be ordered only after the drawings are approved and quantities in detail of various items are ascertained as per actual requirements. Therefore the actual quantities / measurement may vary from the quantities stipulated in the BOQ.

1.4 All the equipment will be duly inspected in the manufacturers' works / premises before dispatch to the site.

1.5 The rate is inclusive of all taxes, levies, insurance, freight and nothing additional will be paid as per clauses (commercial conditions) of additional specification of appropriate CPWD specification.

1.6 The work will be executed as per the programme of the completion of the project, and as per detailed PERT chart to be approved by the Engineer-in – charge. The delivery & erection Schedule of various materials/equipments will be as per approval of Engineer – in – charge.

1.7 Payment shall be made as per relevant clause of commercial and additional conditions of CPWD specification of corresponding Electrical works.

1.8 Inspection & Testing :

HT Panels, Transformers, Busducts, Rising Mains with accessories, MV panels and APFC panels will be inspected in the respective manufacturer's works place before dispatch and routine test as per applicable BIS will be provided for each equipment. During the testing in the presence of the Engineer-in–Charge or his authorized representative, the contractor shall ensure compliance with the agreement specifications, conditions and approved drawings.

2.0 UNINTERRUPTED POWER SUPPLY SYSTEM

SCOPE OF WORK:

The scope of work under this head shall include supply, installation testing and commissioning of UPS system.

The electrical loads proposed to be connected to UPSs are, 1. All lighting and power loads in all buildings, 2. All computers in all the floors. Taken in to account of above mentioned items the total electrical UPS loads have been calculated. As per the UPS loads 2 Nos. of 60 KVA UPS are required to cater supply to all the above defined loads. Provision is also made to connect extra unexpected future small loads to the UPS.

The UPS are not proposed to be connected for parallel operation. 2 Nos. of 60 KVA UPS are separately feeding 2 Nos. of 125 Amp Bus bars meant to cater UPS supply to the essential loads. These UPS are proposed to be erected in the UPS room in the Academic building. . UPS DBs for all the floors for lighting, power and computer plugs are proposed separately and the same are clearly indicated in the schematic diagram and the electrical layout.

2 Nos. of 60 KVA UPSs, battery racks, 2 Nos. of 125 Amps Panel Boards are all proposed to be erected in the UPS room beneath the ramps in ground floor and the same is shown in the electrical layout drawing.

The load calculation for UPS, the schematic diagram, the electrical layout showing UPS panel boards and DBs are all enclosed separately which are self explanatory and give detailed picture of this proposal.

SECTION V

HVAC SYSTEMS
TECHNICAL SPECIFICATIONS

1.00 INTRODUCTION

The proposed Regional Institute of Allied Health Sciences (RIAHS) is being constructed at Coimbatore in the State of Tamil Nadu.

The proposed buildings are the Academic Block, the Auditorium building and the Guest House building of RIAHS.

Air conditioning system

It is proposed to provide a Variable Refrigerant Volume (VRV) system of air-conditioning – also called the Variable Refrigerant Flow (VRF) system – for the Academic Block. The system shall be referred to as VRV system in this document.

Split ductable type air conditioners shall be provided for the Auditorium building.

Unitary split air conditioners with wall mounted indoor units shall be provided for the rooms of the Guest House building.

The scope of work includes design, supply, installation, testing and commissioning of the above air conditioning systems in line with the specifications enumerated in this document.

_____

1.00 BASIS OF DESIGN

1.01 Location :

Site Location : Coimbatore

Latitude : 11 Deg N

1.02 Outdoor Design Conditions **:**

Outdoor Design Conditions for Coimbatore based on weather data corresponding to 1% annual cumulative frequency of occurrence have been considered as follows:

Summer
Dry Bulb Temperature 37º C
Wet Bulb Temperature 25º C

Monsoon
Dry Bulb Temperature 28º C
Wet Bulb Temperature 24º C

1.03 Inside Design Conditions

All Areas 24 ° C ± 1.5 ° C

1.04 Lighting: 1 W per sq. ft. of floor area, unless otherwise specified.

1.05 Fresh air

For all areas 20 CFM per person OR one air change per hour, whichever is greater

1.06 Air filtration

For all areas Filters of 90% efficiency down to 10 microns particle size.

1.07 Areas to be air conditioned

Air-conditioning will be provided for the specified areas in the following three buildings in the campus.

A. Academic block
B. Auditorium building
C. Guest house

A. Academic Block

Ground Floor

No.	Zone	Area – sq. mts.	
1.	Admission section		70.8
2.	Waiting area		13.75
3.	Accounts section		81.35
4.	Accounts officer & dining area		28.8
5.	Waiting lounge		67.92
6.	Reception		19.35
7.	Corridor		45.5
8.	Director's room & dining area		39.6
9.	Dy. Director's room & dining area		39.6
10.	Senior superintendent & dining area	28.3	
11.	Senior superintendent & dining area	28.3	
12.	Superintendent 1		11.8
13.	Superintendent 2		11.8
14.	Superintendent 3		11.8
15.	Superintendent 4		11.8
16.	Junior superintendents		71.6
17.	Admin officer		16.2
18.	P A's room		11.88
19.	Waiting		12.67
20.	HOD (Optometry) & dining area		28.6
21.	Dept. office		28.2
22.	HOD (Prosthetics & Rehab.) & dining area	28.6	
23.	Dept. office		28.2

First floor

24.	Waiting		23.1
25.	Placement office		80.93
26.	Dining room		17.29
27.	Training cell		40.69
28.	Tech. officer		23.82
29.	Sports officer		16.6
30.	Common room		24.4
31.	HR		39.3
32.	Dining room		16.7
33.	Pantry		8.8
34.	Conference room 1		62.73
35.	Conference room 2		41.93
36.	Lobby and corridors		67.26
37.	HOD (Surg. & intervention tech.) & dining area		28.6
38.	Dept. office		28.2
39.	HOD (Med. Lab technology) & dining area	28.6	
40.	Dept. office		28.2

41.	Library hall		538.1
42.	HOD (Radiography) & dining area	28.6	
43.	Dept. office		28.2
44.	HOD (Audiology) & dining area		28.6
45.	Dept. office		28.2

Third floor

46.	Library hall		538.1
47.	HOD (Med. Tech.) & dining area		28.6
48.	Dept. office		28.2
49.	HOD (Dental) & dining area	28.6	
50.	Dept. office		28.2

Fourth floor

51.	Library hall		407.0
52.	Projector room		41.0
53.	Service room		30.25
54.	A V room		59.65
55.	HOD (Surg. & anesthesia) & dining area		28.6
56.	Dept. office		28.2
57.	HOD (misc.)		28.6
58.	Dept. office		28.2

B. Auditorium Building

1.	Auditorium hall		760.0
2.	Green room 1	18.0	
3.	Green room 2	18.0	

C. Guest House

Ground floor

Suite No. 1

1.	Lounge	23.0	
2.	Bedroom & dressing	22.3	

Suite No. 2

3.	Lounge	23.0	
4.	Bedroom & dressing	22.3	
5.	Single room No. 1		15.8
6.	Single room No. 2		15.8

First floor

7.	Double room No. 1		15.8
8.	Double room No. 2		15.8
9.	Double room No. 3		15.8
10.	Double room No. 4		15.8
11.	Double room No. 5		15.8

12.	Double room No. 6	15.8
13.	Double room No. 7	15.8
14.	Double room No. 8	15.8
15.	Double room No. 9	15.8
16.	Double room No. 10	15.8
17.	Single room	15.8

Fourth floor

18.	Living room	24.7
19.	Dining room	19.3
20.	Bedroom No. 1	20.2
21.	Bedroom No. 2 & dressing	19.95

Fifth floor

22.	Bedroom No. 3 & dressing	19.95
23.	Family room	17.87

2.0 SYSTEM DESCRIPTION

For the above cooling requirement the following air conditioning systems have been selected.

A. Academic Block – VRV air conditioning system.
B. Auditorium building – Ductable split air conditioners
C. Guest House – Unitary split air conditioners

The VRV system

The VRV system shall have a total capacity of 312 HP (about 250 TR). There shall be Six numbers of Outdoor condensing Units each of 52 HP capacity. There shall be a total of 67 ductable type indoor cooling units of various capacities. Wall mounted and cassette type indoor units have also been included. All the indoor units shall be distributed as equally as possible, capacity-wise, among the six outdoor condensing units, to form six independent refrigerant circuits. Insulated copper refrigerant piping and control wiring shall be provided for interconnecting each outdoor unit with all the indoor units that form part of that circuit. An integrated Control System or Plant Manager shall be provided for controlling the entire VRV system.

Ductable Split air conditioners

There shall be 6 numbers of 17 TR capacity Ductable Split air conditioners.

Unitary Split air conditioners

There shall be a total of 27 numbers of Unitary split air conditioners. All these units shall have wall mounted indoor cooling units.

Cool, dehumidified air from all the ductable type indoor cooling units shall be uniformly distributed inside the space to be air conditioned by means of GI sheet metal supply air ducting and supply air grills. Return air shall be routed back to the indoor units through the void above the false ceiling. Acoustic and thermal insulation shall be provided for the ducts. Access doors will be provided in the false ceiling for attending to the indoor units.

Under deck thermal insulation shall be provided for the roof of all the conditioned areas exposed to direct sunlight.

3.0 EQUIPMENT AND SERVICES - SPECIFICATIONS

VRV System

3.1.0 OUTDOOR CONDENSING UNITS

These shall be High Efficiency Air cooled Scroll type refrigerant condensing units. They shall be pressure-tested and pre-wired at the factory and shipped to the site in a fully assembled condition. Each Outdoor Unit shall comprise the following main components.

SCROLL TYPE COMPRESSORS

3.1.1 The scroll compressors shall be of hermetically sealed type. They shall be suitable for operation with R-134a / R407c / R410a refrigerant.

3.1.2 The scrolls shall be manufactured from forged steel. The profile of the scrolls shall permit safe operation up to a speed of 5000 RPM for 50 Hz operation.

3.1.3 The compressor housing shall be of deep drawn mild steel sheet of at least 2.5 mm thickness and finished to a close tolerance for precision fitting of the compressor – motor assembly.

3.1.4 The rotor shall be mounted on anti-friction bearings designed to reduce friction and power input. There bearings shall be designed to adequately handle the radial and axial loads.

3.1.5 There shall be built in oil reservoir to ensure full supply of lubricant to the bearings.

3.1.6 There shall be oil pump or other means of differential pressure inside the compressor for forced lubrication of all parts during startup, running and during shut down.

3.1.7 The compressor motors shall be interlocked with the air cooled condenser fans, to ensure that the compressors start operating only when the condenser fans are in operation.

3.1.8 The compressor drive motors shall be of hermetic type and protected against damage by means of built in protection devices.

3.1.9 Each outdoor condensing unit shall be fitted with multiple scroll compressors, of which at least one compressor should be fitted with an inverter drive capacity control mechanism. By means of the multiple compressor lay-out and the inverter drive, it must be possible to achieve a capacity control from a minimum of 10% to 100% of the capacity of the condensing unit, in order to match the prevailing load of the operating indoor units.

3.1.10 The specified capacity of the outdoor condensing units shall be measured at 35 degrees Celsius Entering air Dry Bulb temperature at the condenser coil and Entering air temperature of 27 degrees Celsius Dry Bulb and 19 degrees Celsius Wet Bulb at the cooling coil. The maximum distance between any indoor unit and its outdoor unit would not exceed 50 metres in this project. The maximum vertical distance between the indoor and outdoor units will not exceed 15 metres.

3.2.0 CONDENSER.

3.2.1 The Condensers shall be of Air cooled Fin and tube type, designed, constructed and tested for the refrigerant specified in the tender specifications.

3.2.2 The condenser capacity shall match the total heat rejection of the evaporator and the heat of compression of the compressors and also have adequate factor of safety built in for peak summer operation.

3.2.3 The condenser shall be designed for an entering air temperature of 35 degree C.

3.2.4 The fins shall be of aluminium sheet of 0.3 mm thickness and shall be provided with surface treatment for all weather outdoor application.

3.2.5 The tubes shall be of seamless copper having a wall thickness of not less than 0.5 mm.

3,2,6 The tube circuit shall be so designed that a few rows of tubes provide sub-cooling, so that a sub-cooling of at least 2 degrees Celsius is achieved.

3.2.7 The condenser shall be designed for the working pressure of the selected refrigerant and it shall be pressure tested for not less than three times the normal working pressure.

3.2.8 The total volume of the condenser tubes should be such that it can hold the entire refrigerant charge of the system in the event of pump-down for maintenance purpose.

3.2.9 The condenser fans shall have a total air flow capacity to cater to the heat rejection capacity plus an adequate factor of safety. The air flow capacity shall be not less than 700 CFM of standard air per TR of system capacity.

3.2.10 The condenser fan blades shall be of cast aluminium alloy suitable for outdoor installation and shall be statically and dynamically balanced.

3.2.11 The fans shall be provided with a safety guard fabricated out of steel wire of 2.5 mm thickness, suitably spaced to allow free air flow.

3.2.12 The entire assembly shall be provided with a powder coated finish.

3.2.13 The condenser shall be provided with the following connections and accessories and conforming to Section 'Refrigerant Piping' where applicable:-

i) Hot gas inlet and liquid outlet connection. The liquid line connections shall be provided with isolating valves.

ii) Pressure relief device

3.3.0 REFRIGERANT PIPING

Design aspects of Refrigerant Piping

3.3.1 Refrigerant piping shall be designed and installed so as to:

1) Ensure circulation of adequate refrigerant at all loads.
2) Ensure oil return to compressor positively and continuously.
3) Keep pressure losses within limits, especially in suction lines.
4) Prevent liquid refrigerant from entering the compressor when the compressor is working as well as when it has stopped.
5) Prevent trapping of oil in evaporator or suction lines, which may return to the compressor in the form of slugs.

3.3.2 Hot gas lines:

The hot gas or compressor discharge lines shall be so designed that Oil shall be entrained and carried by the hot gas under all load conditions likely to be encountered in normal operation.

3.3.3 Liquid Lines:

1) Liquid lines shall be designed to ensure that flashing of liquid refrigerant does not occur by minimizing the pressure drop suitably and by appropriate sub cooling.
2) Each liquid line shall be provided with a permanently installed refrigerant drier of throw away or rechargeable type. The drier shall be installed in a valved line.
3) Flow indicator (moisture indicating type) shall be installed on all liquid lines.

3.3.4 Suction Lines:

1) Oil must be entrained and carried by the suction gas under all conditions of load likely to be encountered in normal operation.
2) Piping shall be designed for a suitable velocity of refrigerant (similar to hot gas line) to ensure that oil will not separate from the gas and drain to the compressor in slugs.
3) The refrigeration system shall be equipped with controls for pump down so that the evaporator and suction line are emptied before the compressor shuts off, thus preventing liquid refrigerant from entering the compressor when restarted.
4) Refrigerant lines shall be sized to limit pressure drop between evaporator and condensing unit to less than 0.2 kg. per sq. cm. (3 psi).
5) Isolating valve shall be provided to enable isolation of each compressor unit (as built in valves), strainer, drier and any other components as may be required for proper operation and maintenance.
6) Thermostatic/electronic expansion valve shall be provided in all the indoor units for refrigerant flow control.

3.3.5 Refrigerant piping shall be of seamless copper tubing. Test reports of refrigerant pipes to be provided as per IS 10773 – 1995 and IS 5493 – 1981. All the refrigerant pipes are to be tested for its conformation to relevant IS.

3.3.6 Isolation valves shall be of the packed, back-seating type and these shall be of forged brass construction.

3.3.7 The scope of Refrigerant Piping work shall include Supply, installation, testing and commissioning of all the interconnecting pipe work between the condensing units & indoor units, with all the required fittings and valves, including special refrigerant distribution joints or Refnets.

3.3.8 The piping shall be routed at site in such a manner, that brazed joints in the Refrigeration Piping are kept to a minimum.

3.3.9 The refrigerant distribution joints and headers shall be installed in an appropriate orientation to enable correct distribution of refrigerant. The distribution joints shall be factory insulated with pre-formed sections of expanded Polystyrene / equivalent insulation material.

3.3.10 At all times during the pipe installation work it must be ensured that the inside surfaces of all the pipes, fittings and valves are kept spotlessly clean in order to avoid any entry of dust or foreign particles that will result in malfunctioning of the system. It must be strictly ensured that all the copper pipes, fittings etc. have their ends tightly sealed till the jointing work is taken up. It must also be ensured that when there is a break in the work schedule, the open ends of the half completed lines must be temporarily sealed till the moment the work is restarted.

3.3.11 Pipe supports shall be provided at 2.5 metre intervals.

3.3.12 Pipes laid on the terrace floor shall be covered with GI covers which are removable for inspection.

3.3.13 Pressure Testing

i) After completion of the piping installation, the entire refrigerant circuit shall be pressure tested with dry nitrogen or any other inert gas at three times the maximum working pressure that is likely to be encountered in any part of the circuit.

ii) This test shall be carried out as follows:-

a) The system shall be initially charged with nitrogen or inert gas to 1.0 Kg./sq. cm. gauge and all joints shall be checked for leaks. Brazed joints, which leak, shall be opened and redone. These shall not be repaired by addition of brazing alloy to the joints.

b) The system shall now be charged with nitrogen to a pressure three times that of the highest working pressure that will be encountered in the system or 30 kgs. per sq. cm., whichever is higher and checked for leaks. The test pressure shall be maintained for a period of not less than 24 hours. No measurable drop in pressure should be detected after the pressure readings are adjusted for temperature changes.

Pressure sensitive devices like thermostatic expansion valves and other controls may be valved off during pressure testing.

3.3.14 After satisfactory pressure testing, the refrigerant piping shall be evacuated and dehydrated to a vacuum level of - 750 mm Hg and held at that level for 12 hours.

3.3.15 Thermal insulation shall be applied over the refrigerant piping only after satisfactory pressure testing and after obtaining the written permission of the Engineer in charge of the site, to proceed with the insulation work.

3.3.16 The Condensing units and Evaporating units shall be factory assembled and tested. The condensing units shall be filled with an initial charge of the specified refrigerant at the factory. The weight of the additional refrigerant charge required at site must be calculated based on the actual length of the refrigerant pipe work. The refrigerant charging process at site must be carried out with an appropriate charging station and under the supervision of the Engineer-in-charge at site.

3.3.17 The refrigerant charge required additionally shall be added at site free of cost and loss of refrigerant due to defect of equipment or workmanship shall also be filled up free of cost even during the warranty period.

3.3.18 The VRF system proposed for this project shall be capable of handling a maximum refrigerant piping run of 60 mts. between the condensing unit and indoor unit with 20m level difference without any oil return problem. Oil equalizing lines shall be provided inside the condensing units, to avoid inverted oil traps at site.

3.4.0 PIPING INSULATION

3.4.1 All the refrigerant suction lines shall be provided with thermal insulation. The insulation material shall be closed cell elastomeric nitrile rubber sleeves having a wall thickness of 19 mm and covered with aluminium foil.

3.4.2 The pipe surface shall be thoroughly cleaned first. Then the insulation material shall be firmly stuck on the pipe surface using suitable adhesives. Insulation joints shall be covered with gummed tapes.

3.5.0 Indoor Cooling Units.

3.5.1 The indoor cooling units shall be of concealed ductable type, complete with evaporating coil of copper tubes and aluminium fins, centrifugal blowers, suitable capacity direct drive motors, insulated drain tray, automatic refrigerant device and electrical terminal box all installed inside an insulated sheet metal housing finished with powder coating.

3.5.2 The cooling units shall be provided with a corded remote control unit comprising room thermostat, on / off and three speed fan control.

3.6.0 Central Control System

3.6.1 A central control system or Plant Manager shall be provided for integrating the performance of all the six outdoor units and the sixty seven indoor units of the VRV system. The control system shall be micro processor based and shall have the following features.

i) Remote On / off control of the indoor and outdoor units.

ii) Start and Stop of the units at desired pre-set timings.

iii) Indication of number of operating units.

iv) Temperatures in the various rooms

v) Fault indication in the event of system malfunctioning

4.0 DUCTABLE SPLIT AIR-CONDITIONERS

4.1 Ductable split air conditioners with ceiling suspended type indoor unit, outdoor unit fitted with high efficiency scroll compressors, interconnecting insulated copper refrigerant piping, power and control wiring and earthing between the indoor and outdoor units, mounting bracket for the outdoor unit and condensate drain piping for the indoor unit shall be supplied and installed in the specified areas, as per the indicated capacities.

5.0 SPLIT ROOM AIR-CONDITIONERS

5.1 Split type Room air conditioners with wall mounting indoor unit, outdoor unit fitted with high efficiency scroll compressors, interconnecting insulated copper refrigerant piping, power and control wiring and earthing between the indoor and outdoor units, mounting bracket for the outdoor unit, condensate drain piping for the indoor unit and slim wall mounting type automatic voltage stabilizers, shall be supplied and installed in the specified areas.

6.0 PROPELLER FANS

6.1 Wall mounted propeller fans are to be provided for toilet exhaust. In the case of individual toilets the exhaust fans shall be mounted directly in an external wall of the toilet. In the case of toilets with multiple cubicles a ducted exhaust system shall be provided to properly exhaust the air from all the cubicles. In this case the exhaust fan shall be installed in an external wall of the toilet, above the level of the false ceiling that will be provided. Short lengths of GI sheet metal ducts and exhaust grills shall be provided for connection to the exhaust fan. The fans shall be of the Axial flow type of robust design, suitable for continuous duty in industrial applications. The fans shall be complete with mounting frame, cowl and mesh.

7.0 SHEET METAL DUCTING

i) Ducts shall be factory fabricated and shall be generally as per IS: 655 'Specifications for metal air ducts', unless otherwise specified.

ii) No variation of duct configuration or sizes is permitted except with written permission.

iii) Duct design:

Maximum flow velocity	:	1500 Ft/Min.
Maximum friction	:	0.1 in.WG/100 Ft. Run

N.B. Whichever of the above two values is lower, shall be selected.

Maximum velocity at supply air outlet /grill	:	400 Ft/Min.

Noise Level Design Criteria

In accordance with Design Standards and Criteria, permissible noise level in various spaces, considered when unoccupied, shall be as follows:

No.	Area	Acceptable Noise Levels (NC)
1.	Small Rooms & Cabins	25 - 30
2.	Large areas and Halls	35 - 40

7.1 DUCT MATERIAL

i) The thickness of sheets for fabrication of rectangular ductwork shall be as under. The thickness required corresponding to the longest side of the rectangular section shall be applicable for all the four sides of the ductwork.

Longest side (mm)	Minimum sheet thickness (mm)
750 mm and below	0.63
751 mm to 1500 mm	0.80
1501 mm to 2250 mm	1.00
2251 mm & above	1.25

ii) Flanges for duct joints, stiffening angles (braces) and supporting angles shall be of rolled steel sections, and of the following sizes.

Application	Duct Width	Angle size
Flanges	Upto 1000 mm	35mm x 35mm x 3mm
-do-	1001mm to 2250 mm	40mm x 40mm x 3mm
-do-	More than 2250 mm	50mm x 50mm x 3mm
Bracings	Upto 1000 mm	25mm x 25mm x 3mm
-do-	More than 1000 mm	40mm x 40mm x 3mm
Support angles	Upto 1000 mm	40mm x 40mm x 3mm
-do-	1001mm to 2250 mm	40mm x 40mm x 3mm
-do-	More than 2250 mm	Size and type of RS section shall be decided in individual cases

iv) Hangers shall be fully threaded rods of 8mm dia. and of galvanized mild steel for duct sizes up to 1500 mm and of 10mm dia for ducts upto 2250mm size, and 12 mm dia for larger sizes.

v) All nuts, bolts and washers shall be zinc plated steel. All rivets shall be galvanized or shall be made of magnesium - aluminium alloy. Self tapping screws shall not be used.

vi) Hanger Straps: ASTM A653 galvanized steel with zinc coating as per ASTM A90.

vii) Structural Steel Members: ASTM A36 steel.

7.2.1 DUCTWORK FABRICATION

i) The interior surfaces of the ducting shall be smooth.

ii) All the ducts up to 600 mm longest side shall be cross broken between flanges by a single continuous breaking. Ducts of size 600 mm and above shall be cross broken by single continuous breaking between flanges and bracings. Alternatively, beading at 300mm centres for ducts up to 600 mm longest side, and 100 mm centres for ducts above 600 mm size shall be provided for stiffening.

iii) All sheet metal connections, partitions and plenums required for flow of air through the filters, fans etc. shall be at least 1.25 mm thick galvanized

steel sheets and shall be stiffened with 25 mm x 25 mm x 3 mm angle iron braces.

iii) As far as possible, long radius elbows and gradual changes in shape shall be used to maintain uniform velocity accompanied by decreased turbulence, lower resistance and minimum noise. The ratio of the size of the duct to the radius of the elbow shall be normally not less than 1:1.5.

iv) Flanged joints shall be used at intervals not exceeding 2500 mm. Steel flanges shall be welded at corners first and then riveted to the duct.

v) Plenums for filters shall be complete with suitable access door of size 450 mm x 450 mm.

vii) Provide rectangular 45 degree entry fittings for rectangular ducts and 45 degree wye takeoffs for round ducts.

viii) Duct sizes indicated are inside clear dimensions.

ix) Increase duct size gradually, not exceeding 15 degree divergence wherever possible. Do not exceed 30-degree divergence upstream of equipment. Do not exceed 45-degree convergence downstream of equipment.

7.3 INSTALLATION OF DUCTS

i) The fabrication and installation shall be done in a workmanlike manner. Duct work shall be rigid and straight without kinks.

ii) All exposed ducts within the conditioned space shall have slip joints. Flanged joints shall not be used. This is not applicable to ducts concealed by false ceiling.

iii) All joints shall be airtight.

iv) Ducts shall be supported independently from the building structure and adequately, to keep the ducts true to shape. The support spacing shall be not more than 2 m. Where ducts cannot be suspended from ceiling, wall brackets or other suitable arrangements, as approved by the Engineer-in-charge shall be adopted. Neoprene or other vibration isolation packing of minimum 6 mm thickness shall be provided between the ducts and the angle iron supports/brackets. Vertical duct work shall be suitably supported at each floor by steel structural members.

v) Where metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitting heavy flanged collars. Where ducts pass through brick or masonry openings, wooden frame work shall be

provided within the openings and the crossing ducts shall be provided with heavy flanged collars on either side of the wooden frame work, so that duct crossing is made leak-proof.

vi) Duct connections to the indoor units shall be made by inserting a double canvas sleeve 150 mm long. The sleeve shall be securely bonded and bolted to the duct and unit casing.

vii) Dampers shall be provided in branch duct connections for proper volume control and balancing the air quantities in the system, whether indicated in the drawings or not. Suitable links, levers and quadrants shall be provided for proper operation, control and setting of the dampers. Every damper shall have an indicating device clearly showing the position of the dampers at all times.

viii) During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

ix) Use double nuts and lock washers on threaded rod supports.

x) Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

xi) Provide flexible connections with minimum 25 mm slack immediately adjacent to equipment in ducts associated with fans and motorized equipment.

xii) Repair damaged galvanized ductwork surfaces (welds, scratches, etc.) by applying minimum 2 coats of a zinc base paint.

xiii) Provide duct drops to diffuser same size as diffuser neck size.

xiv) Install openings in ductwork where required to accommodate thermometers and controllers. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

7.4 BALANCING

The entire air distribution system shall be balanced with the help of an anemometer. The measured air quantities at fan discharge and at the various outlets shall be within ± 5 percent of those specified / quoted. Branch duct adjustments shall be permanently marked after the air balancing is completed so that these can be restored to their correct position if disturbed at any time.

7.5 MEASUREMENT

i) Duct measurements (for insulated ducts) shall be taken before application of insulation.

ii) Duct work shall be measured section wise on the basis of external surface area by multiplying the axial length from flange face to flange face for each section by the corresponding duct perimeter in the centre of that section length.

iii) Uniformly tapering straight sections shall also be measured as in (ii) above. However, for special pieces like tees, bends etc. area computations for surface areas shall be done as per shape of such pieces.

iv) The quoted unit rate for external surfaces of ducts shall include all wastage allowances, flanges, gaskets for joints, vibration isolators, bracings, hangers and supports, inspection chambers/access panels, splitter dampers with quadrants and levers for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall not be separately measured.

v) Grilles and diffusers (except linear diffusers) shall be measured by the cross sectional areas, perpendicular to the airflow, and excluding the flanges. Volume control dampers, where provided shall not be separately accounted for.

vi) Linear slot type diffusers shall be measured by linear measurements only, and not by cross-sectional areas, and shall exclude flanges for mounting of the linear diffusers. The supply air plenum for linear diffusers shall be measured as described above for ducting.

vii) Fire dampers shall be measured by their cross sectional area perpendicular to the direction of the airflow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door and fusible link arrangement.

8.0 GRILLES / DIFFUSERS

i) Grilles/diffusers shall be fabricated of extruded aluminium sections and shall present a neat appearance and shall be rigid with mechanical joints.

ii) Square and rectangular grilles shall have a flanged frame with the outside edges curved 5 to 7 mm. The outer framework of the grilles shall be made of not less than 1.6 mm thick aluminium sheet. The louvers shall be of aerofoil design of extruded aluminium section with minimum thickness of 0.8mm at front and shall be made of 0.8mm thick aluminium sheet. Louvers may be spaced 18 mm apart.

iii) Square and rectangular diffusers shall have a flange flush with the ceiling into which it is fitted or shall be of anti smudge type. The outlets shall comprise an outer shell with duct collar and removable diffusing assembly. These shall be suitable for discharge in one or more directions

as required. The outer shell shall not be less than 1.6 mm thick extruded section aluminium sheet. The diffuser assembly shall not be less than 0.80 mm thick extruded aluminium section.

iv) Circular diffusers shall have either flush or anti smudge outer cone. Flush outer cones shall have the lower edge of the cone not more than 5mm below the underside of the finished ceiling into which it is fitted. Anti smudge cones shall have the outer cone profile designed to reduce dirt deposit on the ceiling adjacent to the air outlet. The metal sheet used for construction of these shall be minimum 1.6 mm thick extruded aluminium sheet.

v) Linear slot type diffusers shall have a flanged frame with the outside edges curved 3.5mm and shall have the required number of slots. The air quantity through each slot shall be adjustable. The metal sheet used for the construction of these shall be minimum 1.6 mm thick extruded aluminium sheet.

vi) Grilles and diffusers constructed of extruded aluminium sections shall have grille bars set straight, or deflected as required. These shall be assembled by mechanical interlocking of components to prevent distortion.

vii) All supply air grilles/diffusers shall be fitted with a volume control damper, made of MS sheets. The damper blades shall be pivoted on nylon bushes. These dampers shall be located immediately behind the grille/diffuser and shall be fully adjustable from within the occupied space without removing the grille/diffuser. The volume control damper for circular outlets shall be opposed blade radial/shutter type dampers. Opposed blade dampers shall be used for square and rectangular grilles/diffusers.

viii) The locations of the grilles/diffusers are shown in the tender drawings. Necessary openings and wooden framework for fixing the grilles shall be provided by the air conditioning contractor. The location of grilles/diffusers is subject to change; hence the approval of the Engineer-in-Charge shall be obtained before finally fixing the grilles/diffusers in position.

ix) While installing grills, the fasteners should be fixed in recessed grooves so that they are not visible on the flange or face of the grille/diffuser. Only non-ferrous screws shall be used.

x) The grilles/diffusers shall be powder coated to the desired colour to match the surroundings wall/ceiling. The paint colour shall be approved by the Engineer-in-Charge.

xi) All damages to the finish of the structure during the installation work shall be made good by the air-conditioning contractor before handing over the installation.

9.0 FRESH AIR INTAKES

i) A fresh air intake cowl of GS sheet metal of square/rectangular shape and having a bend of 45 deg. angle to prevent rain water entry, shall be provided on the external wall.

ii) The above cowl shall be provided with a bird screen made of GI wire mesh of 18 swg thick wire and having 6 mm holes. This screen shall be fixed tight to a flange on the outer edge of the cowl with 6mm GI bolts and nuts.

iii) An opposed blade Volume Control Damper fabricated out of MS sheet and powder coated shall be fixed on the inner wall of the fresh air opening. The adjustable louvers shall be pivoted on nylon bushes. The damper shall be provided with an easily operable lever with a locking arrangement. The damper and cowl shall be of the same face area.

10.0 FIRE DAMPERS

i) Fire dampers shall be provided in all supply air ducts. Access door will be provided in the duct before each set of fire dampers.

ii) Fire dampers shall be multi blade louvers type. The blade should normally remain in the open position and shall allow maximum free area to reduce pressure drop and noise in the air passage. The blades and frame shall be constructed with minimum 1.6mm thick galvanized steel sheet.

iii) The louvers of the fire damper shall be held in the open position by means of a fusible link made of two copper metal strips soldered together in an overlapping position, using a certified low-melting point solder. A heavy duty spring would ensure that the louvers are shut tight when the fusible link melts. The louver blades shall be pivoted on gun metal bushes.

iv) Fire dampers shall have a rating of 90 minutes against collapse and flame penetration as per UL 555-1995.

11.0 INSULATION WORK

11.1 MATERIAL

The insulation material to be used for various applications shall be as follows:

i) <u>For thermal Insulation of duct work:-</u>

a) Fiber glass mat covered with aluminium foil.

b) Nitrile rubber sheet

iii) For acoustic lining of ducts
Fiber glass rigidboard covered with RP tissue and perforated aluminium sheet.

11.2 MATERIAL SPECIFICATION

The insulation material shall satisfy the following requirements:

ii) For thermal insulation of ducts:

Material	Minimum Density (Kg./Cub.M)
Fiber glass mat Nitrile rubber sheet	24

Maximum thermal conductivity: 0.03 Kcal / hr. / sq. mt. /deg. C / mt. at 10 deg. C mean temp.

Fiber Glass Insulation used for duct insulation shall be factory faced with aluminium foil on one side, reinforced with Kraft paper & fused to the insulation material.

iii) For acoustic lining:

Application	Material	Minimum Density (Kg./Cu.M)
Duct	Fiber glass rigidboard	48
AHU room	Fiber glass mat	24

iv) The fiber glass mat and rigidboard shall be as per IS 8183 as amended up to date.

11.3 INSULATION THICKNESS

The thickness of insulation shall be as indicated below.

ii) For Duct insulation

Application	Fiber glass mm	Nitrile rubber mm
Thermal for AC area	25	12
Thermal for Non AC area	50	25
Acoustic	12	NA

16.4 APPLICATION OF THERMAL INSULATION ON DUCT

i) The surface of duct on which the external thermal insulation is to be provided shall be thoroughly cleaned with wire brush and rendered free from all dust and grease.

ii) Two coats of cold compound adhesive (CPRX compound) shall be applied over the duct. Any other adhesive recommended by the manufacturers may also be used with the approval of the Engineer-in-charge.

iii) The aluminium faced insulation shall then be wrapped to the duct with aluminium facing on the outer side. The joints shall then be sealed with BOPP tape.

iv) The insulation shall then be covered with 0.63mm x 19mm G.I. wire mesh netting on the outside.

v) The ducts in areas exposed to the weather shall be additionally covered with one layer of tar felt conforming to IS: 1322 Type 3 Grade-1. The tar felt shall be stuck with Hot Bitumen.

11.5 APPLICATION OF DUCT ACOUSTIC LINING

i) The Inside surface of duct on which the acoustic lining is to be provided shall be thoroughly cleaned with wire brush and rendered free from all dust and grease.

ii) RP tissue shall be stuck on one side of the fiberglass rigidboard slabs using fevicol or equivalent adhesive.

iii) The rigidboard with RP tissue shall be stuck to the inner sides of the duct with adhesive.

iv) Perforated aluminium sheet of 26 swg thick and having a minimum of 30 % perforation area shall be laid over the rigidboard slabs with suitable overlaps and with the edges folded down on the two open ends of the duct. The entire insulation shall be rigidly held in place by means of GI screws, nuts and washers that are inserted through the duct sheet at intervals of 50 cms.

11.6 MEASUREMENT OF INSULATION

i) Pipe insulation shall be measured in units of length along the centre line of the insulated pipe. The linear measurements shall be taken before the application of the insulation. For piping measurements, all valves, orifice plates and strainers shall be considered strictly by linear measurement along the centre line of the pipes, and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

ii) Duct insulation and acoustic lining shall be measured on the basis of surface area along the centre line of insulation thickness. Thus the surface

area of externally thermal insulated or acoustically lined duct shall be based on the perimeter at the centre of thickness of insulation, multiplied by the centre-line length of ducting including tapered pieces, bends, tees, branches etc. as measured for bare ducting. In the case of tapering pieces, their average perimeter shall be considered.

12.0 UNDERDECK INSULATION

The underside of the ceiling must be cleaned thoroughly. Rawl plugs and hooks shall be fixed on to the ceiling at a spacing of 1 meter in one direction 0.5 metre in the other direction. GI wire shall be inserted into the hooks in the ceiling and extended to about 150 mm length. Fire retardant EPS slabs of 24Kg/cu.m density and 50 mm thick shall be stuck to the under side of the ceiling using suitable adhesive, such that the GI wire extensions are left at each corner of the EPS slabs. GI washers of 50 mm square cut from 24 swg thick sheets, and with their corners upturned shall be pierced into the eps slabs at the corners such that each GI washer supports four slabs. The GI wire extensions are drawn out through a hole in the middle of the washer and is twisted tight to secure the washer and the corners of the four slabs tight against the ceiling.

13.0 QUALITY ASSURANCE

13.1 Inspection and testing

I. All equipment and components supplied may be subjected to inspection and tests by the Consultants during manufacture, erection/installation and after completion. The inspection and tests shall include but not be limited by the requirements of this contract document. Prior to inspection and testing, the equipment shall undergo pre-service cleaning and protection.

II. Tenderers shall state and guarantee the technical particulars listed in the Schedule of Technical Data. These guarantees and particulars shall be binding and shall not be varied without the written permission of the Consultants.

III. No tolerances shall be allowed other than the tolerances specified or permitted in the relevant approved Standards, unless otherwise stated.

IV. If the guaranteed performance of any item of equipment is not met and / or if any item fails to comply with the specification requirement in any respect whatsoever at any stage of manufacture, test or erection, the Consultants may reject the item, or defective component thereof.

13.2 Performance

It is the Tenderer's responsibility to ensure that the entire HVAC system as a whole and all its individual components deliver the specified levels of performance, reliably and continuously. The Quality Assurance will include but not be limited to the following criteria.

i. Verification of design conformity.

ii. Establishing that the fluid flow rates, volumes and operating pressures are as specified.

iii. Ensuring that the energy consumption of all the relevant components of the system are as specified.

iv. Establishing that the operating sound and vibration levels are within the specified limits.

v. Adjusting and balancing the various systems as per the design parameters.

vi. Recording and reporting the results as per the specified formats.

14.0 LIST OF APPROVED MAKES FOR EQUIPMENT & MATERIALS

S.No	Details of Materials / Equipment	Manufacturer's Name
1.	VRV / VRF Air-conditioners Including Outdoor & Indoor Unit, Remote controls and other Accessories	Blue star, Carrier, Daikin , General, Hitachi, Mitsubishi, Voltas
2.	Integrated Control system	Preferably of the same make as the VRV system
3.	GI sheets for ducting	Tata, SAIL, Jindal
4.	Duct thermal insulation – Fiberglass mat with Al foil facing	UP Twiga, Owens Corning
5.	Duct thermal insulation - closed cell elastomers	Armacell - Armaflex, Eurobatex – Union Foam, Hylam, Superlon
6.	Duct acoustic insulation – fiberglass rigidboard	UP Twiga, Owens Corning
7.	Grills / Diffusers/Dampers / Fire Dampers	Caryaire, Ravistar, Air Master, Dynacraft, Air Breeze / Ajanta
8.	Refrigerant copper tubes and fittings	Kwality Tubes & Capillaries (KTC) Parasmani / Jugal

9.	Vibration isolators	Dunlop Cushy Foot / Resistoflex
10.	Exhaust fans	GEC / Crompton / Almonard
11.	Control cables	Polycab / Finolex / Torrent / Universal

15.0 LIST OF BUREAU OF INDIAN STANDARDS CODES

IS : 277 - 1992	Galvanized steel sheet
IS : 655 - 1963 (Reaffirmed 1991)	Metal air ducts.
IS : 659 – 1964 (Reaffirmed 1991)	Air conditioning (Safety Code)
IS : 660 – 1963 (Reaffirmed 1991)	Mechanical Refrigeration (Safety Code)
IS : 822-1970 (Reaffirmed 1991)	Code of procedure for inspection of welds.
IS : 1239 (Part - I) - 1990	Mild steel tube
IS : 1239 (Part - II) - 1992	Mild steel Tubulars and other wrought steel pipe fittings.
IS : 2379 - 1990	Colour code for the identification of pipelines.
IS : 3103 – 1975 (Reaffirmed 1999)	Code of practice for Industrial Ventilation.
IS : 4894 - 1987	Centrifugal Fan.
ASHRAE Hand Books	The Latest versions and standards.

16.0 INFORMATION REQUIRED WITH THE TENDER

i) VRV system

Make / Model
Capacity of ODU
No. of compressors
How many VFD compressors per ODU
Refrigerant used
Ikw / TR

Ductable IDUs
Make / Model
HP / CFM of each model

ii) Ductable Splits

Make / Model
Compressor type
Indoor unit CFM
Refrigerant
Input power

iii) Unitary splits

Make / Model
Star Rating
Input power

SECTION VI

TECHICAL SPECIFICATION OF INTELLIGENT FIRE DETECTION & ALARM SYSTEM

1.0 BASIS OF DESIGN

An intelligent Fire Alarm System (IFAS) shall be provided to effect total control over the life safety services required in the facility. The IFAS shall be of the digital, distributed processing, real time, multi-tasking, multi-user and multi-location type. IFAS shall be integrated to Building Automation System and Security System.

The Fire Alarm shall consist of an Operator Station with windows based, graphical user interface software running on it. The operator workstation & Fire Alarm Main Panels shall be located in the Fire Alarm Room located in the utility Areas. Repeater panel shall be located in the Security Cabins.

The IFAS provided shall be able to tie-up the following Mechanical, Electrical & Low Voltage Services into an integrated system.

a. HVAC System

b. Public Addressable System

c. Lifts

2.0 APPROVALS

The system shall have proper listing and / or approval from the following nationally recognized agencies.

- UL – Underwriters Laboratories Inc
- ULC – Underwriters Laboratories Canada
- FM – Factory Mutual
- Vds
- EN Standards

The Fire Alarm Control Panel, Detectors, devices, sounder, strobes etc., shall be UL Approved components.

2.0 BRIEF DESCRIPTION OF FIRE ALARM PRODUCTS

3.1 FIRE ALARM CONTROL PANEL (FACP)

- The distribution intelligent Fire Alarm Control Panel (FACP) shall function as fully stand-alone panel as well as providing a communication interface to the central station. FACP shall have its own microprocessor, software and memory and should be listed under UL. In the event of failure of the central or communication breakdown between the central station and the FACP, the FACP shall automatically operate on stand-alone mode without sacrification any functions. The FACP shall be capable of accepting up to 16 fire loops with each loop capable of handling minimum 125 detectors and 125 modules.
- The memory data for panel configuration and operation shall reside in non-volatile memory (EPROM). Removal of the board shall not cause not loss of memory. If such removal can cause loss of memory, then the card conditioning the memory shall have battery back-up to 100 hours on the board itself.
- FACP's shall supervise detection circuits and shall general an alarm in case of abnormal condition.
- FACP's shall provide general purpose inputs for monitoring such functions as low battery or AC power failure. FACP's shall provide tamper protection and commendable outputs, which can operate relays or logic level devices. Output commands shall take any of, but not limited to, maintained command, Momentary

  Command, Alarm Follow, or Alarm latch as required. Any relay in the FACP which is intended to be removable shall be supervised against removal.
- Smoke detectors shall be powered using the FACP-based smoke detection circuits.
- FACP's shall provide for resetting smoke detectors, fault-isolation and sensor loop operation. It shall be possible to mix different fire devices within the same FACP to optimize field wiring.
- FACPs shall provide indication for communication with the central console and alarm/trouble conditions in each sensor loops.

- FACPs shall provide monitoring and control of one floor or area or for multiple floors or areas. FACPs shall meet the following requirements to assure the integrity and reliability of the system.
  - The FACP shall be UL listed/FM approved as a fire alarm control panel.
  - FACP electronics shall be contained in an enclosure made of minimum 16gauge steel. Access to FACP switches and electronics shall be by key – lock. Usage of no other tools should be required. Visual indicators of FSP status for each zone shall be visible without opening the key – locked cover.
- All hardware and software to allow the FACP configuration and operation to be changed shall be provided. Memory data shall be contained in non-volatile memory (EPROM).
- Alarm verification with field – adjustable time from 0 to 450 seconds for individual smoke detector shall be provided. During the alarm verification, the panel shall retard the alarm until the end of the period. If the alarm is only a transient smoke alarm, the panel shall automatically reset the alarm. Only a verified alarm shall initiate the alarm sequence for the software zone (logical Point Group) or point. Final time setting shall be as per approval of the fore authorities. When alarm verification is being performed on a smoke detector, the action shall be printed in the listed printer(s).
- Digital numeric display at the FACP shall be provided to indicate point in alarm or trouble. In such systems, means for manually scanning the points in trouble shall be provided and a trouble and alarm LED shall be used to indicate that there are points in alarm/trouble. The alarm/trouble LED shall only extinguish when all alarm / troubles are cleared from the loop.
- It shall be possible to command test, reset and alarm silence from both the FACP and the central console.
- FACP switches shall allow authorized personnel to accomplish the following, independent of the central console :
  - Initiate a general alarm condition.
  - Silence the local audible alarm.
  - It shall be possible to acknowledge (Silence the local FACP audible) without

silencing the alarm indicating devices (hooters).

- Reset all zones (Logical Point Group) / Points, after all initiating devices have

returned to normal.

- Perform a complete operational test of the microprocessor and memory with

a visual indication with each board.

- Test all panel LEDs for proper operation without causing a change in the condition of any zone (Logical Point Group)
- Walk test.

- Software zones / loops shall be circuited and protected by Fault Isolation Modules which are provided along with all detector / devices.

- Intelligent Smoke and thermal sensors shall be located as shown and shall report sensed levels in analog form.
- Monitor modules shall be provided to monitor and address contact - type input devices.
- The FACP shall be able to set dual alarms threshold for occupied and unoccupied periods. During unoccupied the alarm threshold shall automatically be lowered to facilitate quicker. In addition, the FACP shall further process all analog values for pre-alarm limits to
  - Any time sensor value transitions beyond the secondary and higher limit value, an alarm initiation and report shall be issued.
  - Limits and sensor values shall be displayed, modifiable, and reported in decimal values.
  - The FACP shall have Drift Compensation facility to compensate for environment. The FACP shall have the ability to recalibrate. Pre- alarm and Alarm limits if required, after comparing each sensor's operating characteristics with the set sensitivity. This should annunciate trouble conditions when sensor(s) is beyond compensation range (excessively dirty sensor).

  - The FACP should be UL listed/FM approved to provide the sensitivity measurement and documentation required by NFPA 72E.

- FACP shall have real – time clock to prevent loss of time and date in case of failure of power supplies.
- The display on FACP shall provide indication for AC power, System Alarm, System Trouble/Security Alarm, Display Trouble and Signal Silence.
- Minimum four different password levels wills be provided to prevent unauthorized system control or programming.
- Operator control switches for Signal Silence, lamp Test, Reset, System test and Acknowledge shall be provided.
- The FACP should truly field programmable. This would mean that in the event of change of any logic, detector / zone sequence alteration, the operator can initiate these by use of the alpha-numeric keys on the FACP panel to reconfigure the above parameters. Panels, which require external programming devices to perform the above function, will not be acceptable.
- Power supply unit of FACP shall have following characters :
    - The main power supply shall be 230 VAC + / - 10%, 50Hz + / -1% and shall in turn provide all necessary power of the FACP.
    - It shall provide a battery charge for 24 hours for standby power using dual-rate charging technique for fast battery recharge.
    - It shall provide a very low frequency sweep earth fault detect circuit, capable of detecting earth faults on sensitive addressable modules.
    - It shall be power-limiting using Positive Temperature Coefficient (PTC) resistor.
    - It shall provide indication for battery voltage and charging current.
- For ease of service, all wiring terminal blocks shall be plug-in type and shall have sufficient capacity for 18 to 12 AWG wire termination. Fixed terminal blocks shall not be acceptable.

3.2 LCD REPEATER PANEL

- An LCD repeater panel identical to the main control panel display shall be provided which is completely compatible with main panel
- The panel shall have 2x40 character backlit and alphanumeric display.
- The repeater panel shall get its supply from the main panel and should not need external power supply
- Operation of alarm silence, manual evacuation and system reset buttons should initiate the appropriate on the control panel
- The repeater and main panel should monitor each other fault conditions and any anomalies in either panel should cause the relevant fault LED to illuminate and the buzzer to sound in both the panels

3.3 GENERAL FEATURES COMMON TO ALL DETECTORS

- Compatibility: All automatic fire detectors shall be interchangeable without requiring different mounting bases or alterations in the signal panel.
- Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

  Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head.

  Distributed intelligence shall improve response time by decreasing the data flow between detector and Analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable.

  Each detector microprocessor shall contain an environment compensation algorithm which identifies and sets ambient

"Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long term and 4 hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environment compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "Learned" base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once hour. Systems in which the environmental compensation is done at the panels and not at detector levels shall not be accepted.

- Sensitivity: on average 30 mgs of burned material per cu.m (As Measured in a 1 cu.m. chamber) shall release an alarm sensitivity which shall be adjustable according to the use of the space.
- Power Consumption: Each detector uses the minimum of power, for economic circuits, so that it shall have capacity to connect at least 120 detectors, 100 modules and 20 fault isolator modules in one loop.
- Built-in-response indicator: Each detector shall incorporate indicator "LED" at the detector which shall blink during normal condition and light up on actuation of the detector to locate the detector which is operated. The detector shall not be affected by the failure of the response indicator lamp.
- Maintenance: All detectors shall be fitted either with plug-in system or bayonet type connections only from the maintenance and compatibility point of view.
- Construction: The detector shall be low profile intelligent plug-in type. A special tools allows maintenance personnel to plug-in and removal of the unit without using the ladder.

- Atmospheric and Thermal Disturbance: The detector shall so designed as to be practically immune to environmental criteria such as air currents, humidity, temperature fluctuations, and pressure and shall not trigger false alarm, due to the above conditions.
- Continuous Operation: An alarm release shall not effect a detector's functioning. After resetting the Alarm, the detector shall resume operation without any readjustment.
- Adaptability to ambient conditions: Detectors shall be designed for adaptability to humid locations. No performance deterioration shall be acceptable.

3.3.1 Intelligent Addressable Photoelectric Smoke Detectors

- Smoke detectors shall be microprocessor based, intelligent and addressable dev ices, and shall connect with two wires to one of the Fire Alarm Control Panel loops. Minimum to 120 intelligent detectors should connect to one loop. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density. The detectors shall be ceiling mounted type and shall include a twist-lock base with built in fault isolation module.
- The detectors shall provide a test means whereby will simulate an alarm condition and report that condition to the control panel. Such a test may be activated remotely on command from the control panel.
- The detectors shall provide addressable-setting by automatic polling. Systems which use binary jumpers or DIP switches to set the detector address shall not be acceptable. The detectors shall also store an internal identifying code, which the control panel shall use to identify the type of detector.
- The detector shall provide dual alarm power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an

alarm conditions has been detected. An output connection shall also be provided in the base to connect an external; remote alarm LED.

- The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the data. Systems using central intelligence for alarm decision shall not be acceptable.
- The detector shall continually monitor any change in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be strode in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC hand-held programming tool.
- Using software in the FACP, the detectors shall compensate for dust accumulation and other slow environmental changes which may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
- The area covered by each smoke detector shall be as per IS – 2189

3.3.2 Response Indicator

In addition to built-in response indicator of each detector, secondary response indicator of LED type shall be provided outside the room wherever asked for by the Consultant, for indication of fire through detector in the room.

3.3.3 Addressable Manual Stations

Addressable manual stations shall be provided to connect to the fire Alarm control

panel loops.

- It shall be possible to address each intelligent fire alarm pull station (non coded type) without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.
- Press/break stations with re-settable capability are also acceptable.

- Manual stations shall be constructed of high impact LEXAN sheet with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters.
- Stations shall be suitable for surface mounting, or semi-flush mounting. And shall be installed not less than 42 inches, nor more than 48 inches above the finished floor unless otherwise specified by applicable building codes.

3.3.4 Addressable Sounders

All loop sounders should preferably be addressable and software configurable. All sounders should be able to provide at least a minimum of 3 different tones, which should be user configurable. The minimum decibel level of each hooter should be 90db. All hooters should be UL/FM listed.

3.3.5 Addressable Control Module / Relay Module / Monitor Module

The control module / Relay Module / Monitor Module shall provide address-setting and shall also store an internal identifying code which the control panel shall use to identify the type of device. Modules which use binary jumpers are not acceptable. An LED shall be provide which shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.

3.3.6 Cable

The cable shall be 2Cx1.5 sqmm, twisted shielded, FRLS type, armoured double insulated copper cable of standard make.

3.4 SYSTEM SUPERVISION

- In the normal supervisory condition, only the “POWER” ON, and “RUN” conditions, shall be illuminated. The LCD display shall display “System Normal” and the current time and date.

- The LCD display shall indicate the loss of power condition and the printer shall record the same be automatically reset and the printer shall record the "return to normal condition"
- The LCD display shall indicate the loop in trouble and the printer shall record same.
- The LCD display shall indicate trouble and the printer shall record same. Operation of a momentary "Silence" switch shall silence the audible trouble signal but the visual "Trouble" LEDs shall remain ON until the malfunction has been corrected and the system has reset. The FACP printer shall record this action.

3.5 PROGRAMMING OF FACP

- The LCD display programming shall be accomplished on site by means of lap-top personal computer which shall plug into the FACP. Modules requiring off-site programming are not acceptable. LCD shall initiate test of all intelligent addressable sensors in the system.
- Programming functions shall include alarm/trouble type assignment, point descriptor assignment, alarm message assignment etc. Data file for the LCD display and a printer shall be stored in EPROM.

3.6 OTHER DEVICES:

Fault-isolation of fire zones (Logical Point Group) / circuit modules shall be provided, to enable part of a fault-tolerant loop to continue operating when a short occurs in the loop.

SPECIFICATION TO BE FILLED BY TENDERER

Following data sheets to be filled and submitted by vender during the submission of tender. The data shall strictly meet the specification given above.

Fire Alarm Control Panel		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	Type of Display	
4	Power Supply	
5	Battery back up	
6	Communication Speed	
7	Response time	
8	Intelligence Capability	
9	Addressable Capability	
10	Loop Capacity	
11	Maximum loop Length	
12	System Diagnostic test	
13	Fault Isolation Capability	
14	Alarm Verification	
15	Fire Pattern recognition	
16	Networking Capability	
17	Historical log	
18	Annunciators	
19	Fault tolerant wiring capability	
20	Building managem't system Integration	
21	Material of Construction	
22	Dimensions	
23	Approvals/Listing	
Repeater Panel with display		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	Display	

4	Voltage Requirement	
5	Distance Limitation	
6	No of Display Panels per system	
7	Programming of Display Panel	
8	Operating temperature °C	
9	Humidity range	
10	Operating Voltage	
11	Normal Current	
12	Material of Construction	
13	Listings	
Optical Smoke Detector		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	LED Indication	
4	Blinking LED Facility	
5	Addressable Capability	
6	Intelligent Capability	
7	Remote / local test capability	
8	Sensitivity	
9	Sensor coverage	
10	Programming of Detector	
11	Operating temperature °C	
12	Humidity range	
13	Operating Voltage	
16	Alarm Current	
17	Velocity rating	
18	Dimensions	
20	Approvals/Listing	

Heat detector		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	LED Indication	
4	Blinking LED Facility	
5	Addressable Capability	
6	Intelligent Capability	
7	Remote / local test capability	
8	Fixed temperature alarm	
9	Rate of rise temperature	
10	Sensor Coverage	
11	Sensor Temperature setting	
12	Programming of Detector	
13	Operating temperature Deg C	
14	Operating RH	
15	Humidity range	
16	Operating voltage	
17	Normal current	
18	Alarm Current	
22	Approvals/Listing	
Multi-Sensor		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	LED Indication	
4	Blinking LED Facility	
5	Addressable Capability	
6	Intelligent Capability	
7	Remote / local test capability	

8	Sensitivity	
9	Fixed temperature alarm	
10	Sensor Coverage	
11	Sensor Temperature setting	
12	Programming of Detector	
13	Operating temperature Deg C	
14	Operating RH	
15	Humidity range	
16	Operating voltage	
17	Normal current	
18	Alarm Current	
19	Velocity rating	
20	Dimensions	
21	Approvals/Listing	
Manual Pull Station		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	LED Indication	
4	Operating temperature °C	
5	Humidity range	
6	Operating Voltage	
7	Normal current	
9	Operation	
10	Color(External & Internal)	
11	Material of Construction	
12	Approvals/Listing	

Loop Sounder		
SL.No	**Technical Specification**	**Supplier Equipment Specification**

1	Make	
2	Type	
3	Noise level (Distance coverage)	
4	Operating temperature °C	
5	Humidity range	
6	Operating Voltage	
9	Operation	
10	Color(External & Internal)	
11	Material of Construction	
12	Approvals/Listing	
Fault Isolator Module		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	Application	
4	LED Indication	
5	Operating temperature °C	
6	Humidity range	
7	Operating Voltage	
8	Normal current	
9	Approvals/Listing	
Monitor Module		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	Application	
4	LED Indication	
5	Operating temperature °C	
6	Humidity range	
7	Operating Voltage	
8	Normal current	

9	Approvals/Listing	
Control Module		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
1	Make	
2	Type	
3	Application	
4	LED Indication	
5	Operating temperature °C	
6	Humidity range	
7	Operating Voltage	
8	Normal current	
9	Supervisory Current	
10	Approvals/Listing	
Cables For Fire Alarm System		
SL.No	**Technical Specification**	**Supplier Equipment Specification**
	FAS Signals	
A	Manufacturer	
B	Country of Origin	
C	No. of Cores	
D	Area	
E	Type	
F	Characteristics	
G	Standards	
H	Application	
	FAS Communications	
A	Manufacturer	
B	Country of Origin	
C	No. of Cores	
D	Area	

E	Type	
F	Characteristics	
G	Standards	
H	Application	

SECTION VI

SPECIFICATION FOR CLOSED CIRCUIT TELEVISION SYSTEM

1.0 General

Closed circuit Television and surveillance system remain an ideal method for remotely monitoring and detecting unauthorized entry and to protect the building. As the hospital is continuous mass moving place CCTV and surveillance system become inevitable for safety measure.

The CCTV cameras have been proposed in all important common areas inside the building and also in out side near the entrance so as to have a complete surveillance of the entire campus. The location of the outside and indoor cameras has been marked in the plans and a list containing the location has also been enclosed.

The work under this system shall consist of design, supply, installation, testing, training & handing over of all materials, equipment's and appliances and labor necessary to commission the said system, complete with Hi-Speed Dome Cameras, Vandal proof varifocal dome camera for outdoor, Varifocal and fixed dome camera for Indoor , Digital Video Recorder and Monitor. It shall also include laying of cabling, necessary for installation of the system as indicated in the specification and Bill of Quantities. Any openings/chasing in the wall/ceiling required for the installation shall be made good in appropriate manner.

2.0 Equipment

The CCTV System shall comprise of Indoor Varifocal dome camera, Vandal proof varifocal dome camera for outdoor, Hi-Speed dome Camera, Digital Video Recorder and 17 Inch TFT colour Monitor.

3.0 Indoor Varifocal Dome Camera:

The Dome camera unit shall be 1/3" Sony CCD type Color and shall provide a minimum of 480 TV lines resolution. It shall be possible to use lenses of 3 -9 mm focal length. The complete unit shall be housed in a dome and base unit, both preferably made from injection mounded plastic. It shall be possible to adjust the camera head inside the dome in both the planes so that it can be wall or ceiling mounted. The camera shall operate on 12 volts D.C. The Camera shall comply with the enclosed datasheet.

4.0 Technical Specifications for Indoor Varifocal Dome Camera:

Image Sensor	1/3" Sony Super HAD CCD
Effective Pixels	PAL: 752 (H) x 582 (V)
Scanning System	2:1 Interface, V 50Hz, H 15.625 KHz
Video Output	1 Vp-p, 75 ohms unbalanced
Resolution	480 TV Lines
Minimum Illumination	1.0 Lux F1.4
White Balance	Auto Tracking 2500*K - 9500*K
Back Light Compensation	Auto (center area)
Gain Control	Auto AGC
Shutter Control	AES: 1/50 (60) - 1/100,00 sec.
S/N Ratio	more than 48dB
Gamma Correction	`0.45
Lens	Built-in Varifocal Lens 3-9mm V
Operating Temperature	+10* C to +45* C
Power Supply	DC 12V +/-10% tolerance
Power Consumption	210 mA ± 10 %
Dimension	H: 90 (mm) x 106mm Dia

5.0 Outdoor Vandal proof Varifocal Dome Camera:

The Dome camera unit shall be 1/3" Sony CCD type Color with Day night feature and shall provide a minimum of 540 TV lines resolution. It shall be possible to use lenses of 3.5 -9.5 mm focal length (9-22mm varifocal Lens as optional lens). The complete unit shall be housed in a dome and base unit, both preferably Vandal proof housing of IP 66 rated suitable for indoor and outdoor use. It shall be possible to adjust the camera head inside the dome in both the planes so that it can be wall or ceiling mounted.

The camera shall operate on 12 volts D.C. The Camera shall comply with the enclosed datasheet.

6.0 Technical Specifications for Outdoor Vandal proof Varifocal Dome Camera:

Image Sensor	1/3" Sony CCD
Effective Pixels	PAL: 752 (H) x 582 (V) P
Scanning System	2:1 Interface, V 50Hz, H 15.625 KHz
Synchronization	DC: Internal / AC: Line lock
Video Output	1 Vp-p, 75 ohms unbalanced
Resolution	540 TV Lines
Minimum Illumination	0.05 Lux / F1.4
White Balance	Auto Tracking 2500*K - 9500*K
Back Light Compensation	Auto (center area)
Gain Control	Auto AGC
Electronic Shutter	Auto
S/N Ratio	more than 58Db
Gamma Correction	`0.45
LED	28 Pieces
IR Range	20 meters
Day Night	Color to Monochrome switched by ICR Filter, under low light
Lens	3.5 to 9.5 mm Varifocal DC Iris (9-22mm optional) V
Operating Temperature	-10* C to +45* C
Power Supply	AC 24V / DC 12V ± 20% (dual power)
Power Consumption	1R OFF 220mA / IR ON 650 mA A (under DC 12V) A
Dimension	150 (mm) x 80mm

7.0 Hi-Speed outdoor Pan/Tilt/Zoom Color Dome camera

The Dome camera system would be consisting of a 1/6" image format, DSP color CCD camera with a 18X Optical zoom and 12X digital zoom auto-iris lens delivering the power of 216X zoom to ensure that the finest details are captured. The Unit shall have a camera with 480 TV lines and auto focus lens, a high-speed pan/tilt in a dome enclosure. The enclosure for outdoor pan tilt dome camera shall be weatherproof and constructed from die cast aluminum. The High speed dome shall have an integral RS-485 communication channel for direct control via the Digital Video Recorder.

The auto dome shall contain an integral 360-degree pan/tilt device. This variable speed pan/tilt shall be capable of operating in the manual mode to speeds up to 150 degree per second (variable speed). The camera shall operate on 24 volts A.C. The auto dome system shall be compatible with the Digital Video Recorder. The Camera shall comply with the enclosed datasheet.

8.0 Technical Specifications for 1/4" Hi-Speed Dome Camera :

Image Sensor	1/4" Sony Ex View HAD CCD, PAL:800 Pixels
TV System	2:1 Interface, PAL V:50Hz, H:15.625KHz
Horizontal Resolution	480 TV Lines
Synchronization	Internal / V-Lock
Optical Lens	18X Zoom, f=4.1 – 73.8mm (F1.6-3.8)
Digital Zoom	12X (Upto 216X with Optical Zoom)
AGC	Auto
Minimum Illumination	0.1 Lux (F1.4, 1/50s PAL), 0.01 Lux (1/3s PAL)
S/N Ratio	>50dB
BLC	On/Off
Shutter Speed	Auto: 1/50 - 1/10000, Manual: 22 steps
White Balance	ATW (2000°K - 10000°K), One Push WB

BL Compensation	Auto, Manual , Backlight Compensation
Focusing system	Auto (Sensitivity: Normal , Low)
Focus	Auto / Manual
Day / Night Function	Yes, with infrared IR-Cut (Auto / Manual)
Preset	4 sequences each one with 32 preset
Privacy Zone	24 Zones
On- Screen Display	Yes
Interace	RS-485
Protocol	Europlex, Pelco - D/P, VCL, Kalatel, Emitec, Lin, Vicon
Alarm Function	4 Inputs / 1 Output
Emission & Safety Standard	CE Approval
Power Supply	AC 24V +/- 10% / 50Hz +/- 1 Hz
Operating Temperature	30% - 90% RH / 0°C - + 60°C
Power Consumption	50W (max)
Weight	1343g (Excluding housing)
Dimension	223.7mm (H) x 1343mm(D), about 5.3 inches

9.0 16 Channel Digital Video Recorder:

The Digital Video Recorder (DVR) shall have on board Ethernet and shall be able to integrate with the Integrated Security Management Software (ISMS).

The DVR shall include, but not limited to the following

- The DVR shall use H.264 compression technology and shall have on board Ethernet port
- The DVR shall have embedded Linux operating system and shall function as a standalone unit. For either programming or normal operation, it shall not require the use of a computer, special monitors or any other special peripheral devices.

- The DVR shall have internal hard disk drives with SATA interfaces. Internal HDD shall be able to support up to a maximum of 2TB storage
- The DVR shall have Triplex capability that allows to record, playback and view live images simultaneously
- The DVR shall have a built-in web server and it shall be possible to do the configuration through a web browser over the IP network
- The DVR shall have the capability to record and playback real time video at CIF resolution.
- The DVR shall use a battery internally to back up memory that stores the time, date and all internal programming functions
- The DVR shall have an easy to ready on screen text and menus. It shall also allow the user to change the position of On screen display
- The DVR shall have buttons, jog / shuttle integrated into the front panel to allow menu navigation, set up and control of unit, without the need of any external device
- The front panel buttons shall be capable of controlling / navigating Pan / Tilt / Zoom functions of PTZ cameras connected to the unit
- The DVR shall the following the following option

    a. The unit shall allow the user to select different resolution for each channel
    b. The unit shall have the option to select either different frame rate for each channel.
    c. The unit shall allow the option to select either Fixed or Variable bit rate for each channel. The bit rate shall range from 32 Kbps up to 2 Mbps

- The DVR shall have the following record mode
    a. Continuous
    b. Manual
    c. Motion Detection
    d. External alarm
    e. Motion & Alarm

f. Motion or Alarm

- The DVR shall allow setting up of privacy mask for each camera using an on screen menu. Each camera shall have the possibility to set at least 4 privacy mask area
- The DVR shall have a minimum of one audio input channel for every video channel and additional audio input to provide bi-directional audio. The compressed audio bit rate shall not exceed 16Kbps
- The video and audio signals shall be synchronized and the DVR shall have the option of having a mixed stream (Video & Audio) or a Video only stream
- The DVR shall the following video output

a. Multi-screen / Sequential – BNC Type
b. Auxiliary Video output – BNC Type
c. VGA

- The DVR shall have one digital alarm input for each video channel and a minimum of 4 relay outputs

- The DVR shall provide automated alarm handling. Upon receipt of an alarm, shall have the capability to change the resolution and frame as defined in the alarm recording settings

- In addition to changing of record settings upon receipt of an alarm, the DVR shall also be capable to provide relay output operation

- The DVR shall also have the capability to integrated with access control system controllers, intruder alarm panels and other security control equipments to receive alarm signals from those devices and perform alarm handling over IP network

- The DVR shall support pre-alarm recording maintained in a buffer and shall append this buffer to the beginning of all recorded alarms. The DVR shall

continue to record with the alarm record settings until the alarm is reset or acknowledged.

- The DVR shall provide the option of single channel as well as multi-channel playback
- The DVR shall provide extensive search capabilities for archiving, restoring and playback operation.
- The DVR shall have the capability of archiving the recorded images from internal hard disk to an external medium
- The DVR shall support USB HDD, USB CD R/W, USB DVD R/w
- The DVR shall allow the option to set 'STOP RECORDING' or OVERWRITE' when the hard disk is full
- The DVR shall support recording of all images with a digital watermark
- The DVR shall support Infra-red Remote control to operate, configure and navigate the menus. The remote control shall also support PTZ controls
- The DVR shall support configuration / operation through any of the following
    - DVR Front panel buttons
    - Remote client viewer software over the network
    - Integrated Security Management software (ISMS)

10.0 Technical Specifications for DVR:

Operating system	Embedded Linux
Network Ready	Yes
Built-in web server	Yes

System Control	Front button / Remote control / Tracer Viewer/Euronet
Video Compression	H.264
Video Channel Input	`16
Video Output	a) Multiscreen / Seq output: BNC - (1.0Vp-p, 75Ω)
	b) VGA - Supported resolution: 800x600 / 60Hz, 800x600 / 75Hz, 1024x768 / 60Hz
Playback Video	2CIF @ 6FPS / Ch, CIF @ 25FPS / Ch
Network transmission Bit	32Kbps to 2 Mbps
Audio Input	4
Audio Output	1 Channel
Audio Bit rate	16Kbps
HDD Interface	SATA
HDD Capacity	2000 GB (Max)
Multi-zone motion detection	Yes
Camera Block (Tamper) alarm	Yes (Using VGA or Main Monitor)
Video Signal Loss alarm	Yes (Using VGA or Main Monitor)
Alarm Inputs	16 x Digital Inputs
Relay Outputs	4
Area Masking	Yes, Multizone
Water Mark	Yes
Communication Interface	1 X RJ45 10M/100M Self-adaptive Ethernet Interface, 1X RJ45 RS232 Port and 1 RS485 PTZ port
Keyboard	1 Port (D+, D-)
DVD /RW	Yes, External
USB	Yes
Viewer Software	Tracer Viewer, EuroNET (requires additional license))

Protocols Supported	Multiple including Pelco D (Contact Sales team for complete details)
Power Supply	230 V AC
Working Temperature	-10 to +55 Deg C
Working Humidity	10 to 90%

11.0 19" Color TFT Monitor

The Color monitor shall be suitable with the standards of the selected cameras. It shall be 19 inch TFT monitor. It shall provide a bright, clear and well-defined picture display on the screen. All controls for brightness, contrast etc. shall be provided on the front panel for readily adjusting the levels of the video signal. The rear panel shall be provided with input and output BNC connectors for coupling the video output to other Monitors. The video monitors installed shall be minimum 19" size.

12.0 Technical Specifications for 19" TFT Color Monitor

Type	19" color TFT active matrix LCD
Display Area	16.1" horizontal x 10.0" vertical; 19" diagonal
Optimum Resolution	Resolution 1440x900
Contrast Ratio	700:1 (typ)
Viewing Angles	160° horizontal, 165° vertical (CR>5)
Response Time	2ms (typ)
Light Source	Long life, 40,000 hrs. (typ)
Brightness	300 cd/m2 (typ)
Panel Surface	Anti-glare
Video	RGB analog (75 ohms, 0.7 Vp-p)
Sync	H/V separated (TTL)
Frequency	Fh: 30~82kHz, Fv: 50~75Hz
COMPATIBILITY	

PC	VGA up to 1440x900 non-interlaced
Mac®**	Power Mac™ G3/G4/G5 up to 1280x1024
Analog PC	15-pin mini D-sub
Power	3-pin AC plug (CEE22)
Voltage	AC 100–240V (universal), 50/60Hz (auto switch)
Consumption	48W (typ)
Speakers	2x2-watt
Controls:	
Basic	Power, 2, up, down,1
On View®	Auto image adjust, brightness, contrast, View Match® color adjust
	(sRGB, 9300K, 6500K, 5400K user color),H. position, V. position, H. size, resolution notice
	OSD position, OSD timeout, OSD background, fine tune, sharpness, language, recall, volume, mute
OPERATING CONDITIONS	
Temperature	32–104°F (5–35°C)
Humidity	20–80% (non-condensing)
Physical (mm)	450mm x 434mm x 209mm
Physical (in)	27.7" x 17" x 8.2"
Regulations	UL, cUL, FCC-B,CB, CE, WEEE, ISO13406-2

13.0 Training

All training shall be by the contractor and shall utilize specified manuals and As-Built Documentation

Operator training shall include total seven sessions each of six-hour encompassing:

- Modifying text and graphics
- Sequence of operation review
- Selection of all displays and reports
- Use of all specified OS functions

- Use of portable operators terminals
- Trouble shooting
- Password assignment and modification

The training shall be under taken in two phases. One training session shall be conducted at system completion, and the other shall be conducted within forty-five days of system completion.

14.0 Warranty

All component, system software, parts and assemblies supplied by the contractor shall be guaranteed against defects in materials and workmanship for one year from the acceptance date.

Labour to troubleshoot, repair, reprogram, or replace system components shall be furnished by the contractor at no charge to the owner during the warranty period.

All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

15.0 LIST OF APPROVED MAKES

1.	Cameras	:	Pelco / GE / Europlex/ SIEMENS
2.	Digital Video Recorder	:	Pelco / GE / Europlex/SIEMENS
3.	Monitor	:	Viewsonics / Samsung / Philips/
4.	Cables	:	Teleflex/Varsha/finecore/finolex

SECTION VII

TECHNICAL SPECIFICATIONS FOR DATA NETWORKING

SCOPE:

Supply, Installation, testing and commissioning of Active and Passive Components for ESTABLISHMENT OF REGIONAL INSTITUTE OF ALLIED HEALTH SCIENCES AT COIMBATORE.

Project and the required Data Networking shall be the latest state of the art technology. The system needs to cater to the Hospital management functions for the complete hospital.

1.0 DESIGN CRITERIA

The Server Room is located in the 1St Floor (Service Room) of the building.
The design is based on the considering One Core Switches and 11 No's of Edge Switches.
The Active and Passive components in this case shall be as per the following specifications.

2.0 PASSIVE COMPONENTS

2.1 STANDARDS AND REGULATIONS

This Invitation to Tender (ITT) provides a description for a generic structured cabling system based on the known and current standards for Category 6 / Class E systems. The object of the standards is to define the structured cabling independently of the applications, which it is capable of supporting. This Tender document covers the design, supply, installation, testing and commissioning of a Category 6 cabling system.

The aim of this ITT is to describe a **Category 6 / Class E** universal cabling system which will function for voice, data and LAN communications, for video applications etc. The cabling system is also open to new applications which require an **ISO/IEC 11801** cabling system of Class E /Cat 6 as defined in the latest edition of the standard: **ISO/IEC 11801:**

2002.Furthermore, to allow for future demands, the cabling system must be easy to expand and maintain.

The terminology and references in this document as well as the Link/Channel Performance figures for Class E are based on **ISO/IEC 11801: 2002**.

The data sheet showing the guaranteed values for the material proposed will be attached by the vendor to his tender documents.

All proposed components including the patch cords have to be produced by the same manufacturer. This issue will ensure that a « **Class E Channel Warranty** » can be obtained from the manufacturer. When using the best grade of Cat.6 patch cords available from the cabling system manufacturer, the latter must guarantee an additional minimum channel margin of +6dB ACR.

2.2 HORIZONTAL CABLING

2.2.1 HORIZONTAL DISTRIBUTION CABLE

The horizontal 4 pair cable shall be **Category 6 UTP** to meet the quality and performance criteria necessary to ensure correct operation of the installation in future and compliance with the warranty.

The installation design and routing of all cables shall take account of the manufacturer limits for the continued performance of the cables and the compliance with the warranty.

The cable shall be a 4 twisted pair cable with AWG 24 conductors. Having an external sheathing in a material that does not give off toxic fumes (Zero Halogen) in case of fire and offer flame propagation retardant properties. Trace ability numbers should accompany the cable supplied from the manufacturers packaging to assist in quality validation of the installed cable.

In the construction of the cable cross-talk performance shall be maintained using a **C³ (Central dielectric Cross-talk Cancellation)** member set between the 4 pairs.

All pairs must have impedance of 100 Ohms, with a tolerance of +/- 15 Ohms.

Insulators in standard Blue/White, Orange/White, Green/White, Brown/White colours must cover the conductors.

2.2.2 INFORMATION OUTLETS (I/O)

The connector shall be fully compliant to the **IEC 60603-7-4** standard that define the screened Cat.6 connector to be used to form a Class E channel as specified in the **ISO/IEC 11801:2002** standard.

Each connector shall provide both T568A and T568B colour code identification for the pins at the rear of the connector. The punch down is to be in accordance with the T568B colour code. Reassignment of pairs is forbidden.
All conductors from the 4 pair cable are to be terminated on the respective contacts.
To avoid installation errors, the wire organiser of the snap-in connector must be identified by the same standard colour coding as the wires.

All Category 6 RJ45 connectors shall be fully compliant with the **ISO/IEC 11801:2002** standard.

All Category 6 RJ45 connectors shall be reusable.
When the Category 6 RJ45 connectors are to be reused, this shall be done in a safe and reliable way.
For this reason, a tool specially developed by the manufacturer shall be used.

In the case of a 3 or 4 connector Channel with CP, a specific version of connector having IDC contact suitable to receive stranded cable shall be used.

All outlets are fitted with removal shutters, which can be replaced by colour-coded shutters (red, green, blue, and yellow) available from the manufacturer standard product range.

The presentation of the outlet shall provide for labelling and identification. A transparent window shall protect the labelling tag.

A. SNAP-IN / KEYSTONE FORMAT

The dimensions of the Snap-in format connectors are 22.95 mm x 16.3 mm x 28.6 mm (H x W x D)

The same format connectors (unscreened) shall be used on each link.

The connector fits in specific structural hardware for Snap-in format of third parties. If not available, the Snap-in connector can be used in combination with a keystone clip and specific structural hardware for keystone connectors.

2.3 COPPER PATCH PANELS (RJ45)

Patch panels must have 19" equipment practice dimensions to permit mounting in standard cabinets, racks or bays.

The vendor shall make their proposals for this tender using 24 port Snap-in format (Modular) patch panels equipped with a cable management mechanism that provides strain relief, earthing and grounding features.

The presentation of the Patch Panel shall provide for labelling using a printed numbering system.

If baluns, circuit cross over or impedance matchers are used, these shall be external to the Patch Panel.

The connector shall provide both T568A and T568B colour code identification for the pins at the rear of the connector. Patch panel outlets must have each Category 6 RJ45 connector, connected separately. The punch down is to be in accordance with the T568B colour code. Reassignment of pairs is forbidden.

All conductors from the 4 pair cable are to be terminated on the respective contacts.

To avoid installation errors, IDC blocks must be identified by the same standard colour coding as the wires.

Each Patch Panel shall provide a means to locate and clamp the incoming cables without causing damage to the cable or affecting the performance of the Link.
The installer must avoid any risk of cable pinching or compression during the installation or termination of the cables. Therefore the use of Velcro cable ties is preferred.
In the rack, the Patch Panels shall be separated by metallic patch-guides that have a closed front to protect the patch cords. The height of these guides will be 1U or 2U depending on the layout of the rack.

The Patch Panel shall provide an automatic contact with the metal frame of the cabinet in order to ensure grounding.

2.4 PATCH CORDS

To achieve a **Class E Channel performance** all Patch Cords shall be Category 6 rated.
All patch cord cable will be made from PVC

2.4.1 DATA PATCH CORDS

The Category 6 cords must be fitted with Category 6 RJ45 plugs, booted at each connector. The characteristic impedance of the pairs must be identical to that of the horizontal cables. The Patch Cords shall have a guaranteed performance level of greater than 750 insertions without degradation to the performance level of the solution.

The cable used for the Patch Cords shall be Category 6 PVC patch cable. The cable shall be a 4 twisted pair cable with stranded conductors. Trace ability numbers should accompany the cables supplied from the manufacturers packaging to assist in quality validation of the installed cable.

All pairs must have an impedance of 100 Ohms.

2.5 CLASS E LINK OR CHANNEL

Manufacturer should demonstrate guaranteed minimum worst-case performance to be compliant with class E channel performance according to the **ISO/IEC 11801: 2002** standard.

Components used must be compliant with the Category 6 standard mentioned above and the manufacturer should be able to demonstrate independent Delta verification.

The performance of both the components and the link and channel should show stable performance up to 250MHz in order to allow for possible future applications requiring crosstalk cancellation up to 250MHz.

The system supplier must be able to demonstrate in house design and manufacturing expertise for all components used (e.g. cables, outlets, panels and cords) in order to ensure compatibility of system.

2.6 BACKBONE CABLING

2.6.1 VOICE BACKBONE

This backbone will link the Floor Distributors to the Voice Main Distribution Frame.

A. MULTI PAIR VOICE CABLES

To meet the Standard cabling practices outdoor grade Telephone Multi-pair cable may be used to connect the Inter-building distributors. This cable should also contain a separate earth conductor in addition to the required pair content. The number of pairs in the backbone cable for each voice circuit will be dependent on the type of PABX the client is using. As a guide a minimum of one pair per circuit should be used however a maximum of three pairs per voice circuit may be required, this will need to be clarified with the client prior to commencement of the project.

For indoor risers or backbones Category 3 or 5 Multi-pair cable (25, 50 or 100 pairs / impedance: 100 Ohms / 24 AWG solid copper wire) will be used to connect the Intra-

building distributors. The number of pairs in the backbone cable for each voice circuit will be dependent on the type of PABX the client is using.

B. VOICE PATCH PANEL

The Telephone multi-pair cable arriving from the Main Distribution Frame (MDF) will be terminated in the Floor Distributor

2.6.2 DATA BACKBONE

This backbone will link the Switches located in the Floor Distributors (FD) to the Data network server through the Building Distributor (BD).

A. OPTICAL FIBER CABLE

The manufacturer shall provide the choice between the 7 different types of fibres described below. Enhanced OM1, OM2 & OM3 fibres providing warranted extended distance for the transmission of high rate data signals shall be available to avoid limitations due to bottlenecks in the longest building and campus backbone links. The choice of fibre will be made according to the present and future bandwidth needs for the longest OF backbone links.

If the 10Gbit Ethernet application has to be supported, the OM3 or OM3 enhanced fibres shall be used to ensure the transmission of the signal over 300 (or 450 m) metres at 850nm.

Due to their limited bandwidth, the use of OM1 optical fibres to form the backbones for Class E cabling systems is not recommended.

Technical Data – Fibre Transmission

Fibre type	**SM (G652)**
Attenuation	**@1310 nm**
Typical	≤ 0.35
Max.	≤ 0.42
Attenuation	**@1550 nm**
Typical	≤ 0.22
Max.	≤ 0.28
Application	
Fast Ethernet	-
1 Gigabit Ethernet	-
10 Gigabit Ethernet	-
Fibre Channel 1Gbps	-
Fibre Channel 2Gbps	-
Fibre Channel 4Gbps	-
Application	**Transmission max. distance @ 1300 nm**
Fast Ethernet	2.000 m
Gigabit Ethernet	10.000 m
10 Gigabit Ethernet	10.000 m

B. TIGHT BUFFERED INDOOR AND LIGHT DUTY OUTDOOR WATERPROOF OFC CABLE

This optical fibre cable shall be used for indoor home run back to patch panel routes in risers, horizontal applications and for outdoor duct applications where there is permanent water present i.e. flooded duct. This cable shall be selected where the required fibre count is from 2 to 24.

The cable shall be suitable for connector manufacturer field termination processes (SC or LC connectors) and for OF pigtails splicing.

The cable shall be a dry construction i.e. with no gel content. The jacket material shall be waterproof LSZH with a minimum fire performance of IEC 332 part 3C.

Every fibre shall be 900µm diameter secondary coated each being a different colour or suitably identified for termination identification.

The cable strength member shall be glass yarn laid longitudinally between the fibres and the inside wall of the outer jacket. The cable shall be dielectric construction, i.e. with no metallic content.

Applications support

FDDI	100 Mbps
Ethernet	10 base FL
	100 base FX
	1000 base SX
	1000 base LX
Fibre Channel	266 Mbps
	1000 Mbps
ATM	155 Mbps
	622 Mbps

C. OPTICAL FIBER PATCH PANEL

Optical fibre Patch Panels shall be mounted in 19" frames of the cabinets. The patch panels shall be equipped with a mechanism that ensures the retention and support of incoming cables. The patch panel shall be designed with a sliding mechanism enabling front side installation and maintenance work to be carried out without having to remove the entire panel.

The patch panel shall provide facilities to recess the front connector plate deeper than the front of the 19" rails of the cabinet. This will provide sufficient bend radius for the patch cords once connected to the panel. This shall also prevent damage to the patch cords when the cabinet doors are closed.

Direct Termination of the connectors (SC & LC) on to the fibres as well as splicing of pigtails (SC, LC & MT-RJ) shall be possible.

The Patch Panel shall provide management for 1m of fibre per link after breaking the fibres out from the cable.

The front plate of the 24 port modular Patch Panel shall be compatible with the following connector types: SC, LC and MT-RJ.

Standard LC, SC, DSC and MT-RJ snap-ins couplers shall be available to load the modular patch panel.
The fully loaded panel (One height unit or 1HU) shall support up to 24 fibres when working with SC snap-in couplers and up to 48 fibres when working with LC or MT-RJ snap-ins couplers.

Up to four optional splice trays should be supported to manage up to 48 splices.
In the panels, the fibres have to be wired in such a way that the dual OF channel polarity is maintained. Wiring of the fibres has to be done according to the guidelines provided by the manufacturer.

D. OPTICAL FIBER PATCH CARDS

The Fibre snap-ins adapters will be connected to the active equipment by means of "Cross-over" duplex patch cords. In order to maintain the duplex OF channel polarity.
The patch cords should be available in lengths of 2 and 5 meters and have a LSHF-FR outer sheath.

When using SM optical fibre cables, patch cords produced with the same SM fibre have to be installed.

a) Single mode connector performances
   - Maximum insertion loss at 1300nm (IEC 61300-3-4) 0.5dB (ST, LC & SC)
   - Minimum return loss (IEC 61300-3-6) 50dB
   - Durability (IEC 61300-2-2) < 0.2dB

b) Compliance

- SC connector compliant with IEC61754-04 specifications

2.7 TESTING

The manufacturer of the cabling system shall provide copper (Data) and optical fibre testing procedures that clearly describes the tools and settings to be used to ensure correct measurements of the system.

2.7.1 TESTING OF CLASS E

100 % of the installed horizontal links have to be tested. The testing procedure has to comply with the standard **ISO/IEC 11801: 2002** for Class E, according to the procedure for "Channel or Permanent Link". The measurements shall be done using Level III or IV testing equipment. Channel testing shall be preferred.

The testing equipment must be yearly calibrated by the manufacturer and the copy of the calibration certificate must be included in the warranty request.

The following parameters have to be tested:

- ✓ Pair continuity (wiremap)
- ✓ Pair length
- ✓ DC Loop resistance per pair
- ✓ Insertion loss (Attenuation) per pair
- ✓ Next and Power sum Next for every pair combination
- ✓ Next and Power sum Next for every pair combination
- ✓ The ACR (ratio NEXT/ insertion loss) for every pair combination
- ✓ Return Loss (impedance match, retransmitted signal)

The complete test results of all the installed links or channels have to be collected in a certification file. It is preferred to have the test result in electronic format to facilitate the certification procedure.

Apart from all the test results mentioned above, a few more documents have to be added to the file: a list of material used for the project, a design of the network, a Cable

schedule per distributor and finally all the necessary co-ordinates of the persons responsible of the project.

Class E Permanent Link : Specific values for links guaranteed as in **ISO/IEC 11801: 2002**.

Freq.	IL (dB)	NEXT (dB)	PS NEXT (dB)	ACR (dB)	PS ACR (dB)	ELFEXT (dB)	PS ELFEXT (dB)	RL (dB)	Prop. delay (ns)
4	4,0	64,1	61,8	60,1	57,8	52,1	49,1	21,0	504
10	5,6	57,8	55,5	52,2	49,9	44,2	41,2	21,0	498
16	7,1	54,6	52,2	47,5	45,1	40,1	37,1	20,0	496
20	7,9	53,1	50,7	45,1	42,7	38,2	35,2	19,5	495
31,25	10,0	50,0	47,5	40,0	37,5	34,3	31,3	18,5	494
62,5	14,4	45,1	42,7	30,7	28,2	28,3	25,3	16,0	492
100	18,5	41,8	39,3	23,3	20,8	24,2	21,2	14,0	491
155	23,5	38,7	36,2	15,2	12,6	20,4	17,4	12,1	491
200	27,1	36,9	34,3	9,9	7,2	18,2	15,2	11,0	490
250	30,7	35,3	32,7	4,7	2,0	16,2	13,2	10,0	490

Class E Channel : Specific values for links guaranteed as in **ISO/IEC 11801: 2002**.

Freq.	IL (dB)	NEXT (dB)	PS NEXT (dB)	ACR (dB)	PS ACR (dB)	ELFEXT (dB)	PS ELFEXT (dB)	RL (dB)	Prop. delay (ns)
4	4,2	63,0	60,5	58,9	56,4	51,2	48,2	19,0	562
10	6,6	56,6	54,0	50,0	47,4	43,3	40,3	19,0	555
16	8,3	53,2	50,6	44,9	42,3	39,2	36,2	18,0	553
20	9,3	51,6	49,0	42,3	39,7	37,2	34,2	17,5	552
31,25	11,7	48,4	45,7	36,7	34,0	33,4	30,4	16,5	550
62,5	16,9	43,4	40,6	26,5	23,7	27,3	24,3	14,0	549
100	21,7	39,9	37,1	18,2	15,4	23,3	20,3	12,0	548
155	27,6	36,7	33,8	9,1	6,2	19,5	16,5	10,1	547

200	31,7	34,8	31,9	3,1	0,1	17,2	14,2	9,0	547
250	35,9	33,1	30,2	-2,8	-5,8	15,3	12,3	8,0	546

2.8 VERTICAL COPPER TESTING

Multi-pair copper backbone cable will be continuity tested only with the results presented in spreadsheet format.

1.0 ACTIVE COMPONENTS

3.1 CORE SWITCH SPECIFICATIONS

	Switch - 24 port 10/100/1000baseT		
Sl.No	**General Specification**	**Compliance (Yes or No)**	**Remarks**
A	**Switch Architecture General Specification**		
1	The switch shall be stackable 19 inch Rack mountable unit with the rack mount kit		
2	The switch should support external Redundant 230V AC power supply.		
B	**Payload modules support**		
1	The Layer 3 switch should supports 24 ports of 10/100/1000baseT including combo 4 1000BaseX SFP slots.		
2	In case the routing license is needed for routing functionality, the same should be included from day 1		
3	The switch should be supplied with latest firmware software.		

C	**Performance Architecture**		
1	The switching capacity of switch should be 48 Gbps		
2	Should support stacking capacity of 96 Gbps on the dedicated stacking ports		
3	The switch should support closed loop stacking for redundancy where all units in stack are treated as one single device allowing common stack management feature,firmware upgrade, port mirroring, vlan definition and link aggregation to be performed on the		
4	The switch should be stackable upto 8 units in stack using separate configured dedicated stack ports (No Virtual Stacking)		
5	The switch should support 35 Mpps Switching throughput		
6	The switch should support 16,000 MAC Address		
7	The switch should support 1024 802.1Q port based VLAN with 4096 VIDS		
8	Should be able to do Layer 2/3/4 Classification		
D	**The switch should support the following Switching - Layer-2 Services**		
1	IEEE 802.1AB – LLDP		
2	LLDP-MED		
3	IEEE 802.1D – MAC Bridges		
4	IEEE 802.1s – Multiple Spanning Trees		
5	IEEE 802.1t – 802.1D Maintenance		
6	IEEE 802.1w – Rapid Spanning Tree Reconvergence		
7	Full/half duplex auto-sense support on all ports		
8	IGMP Snooping v1/v2/v3		
9	Jumbo Frame support (9,216 bytes)		
10	Loop Protection		

11	One-to-One and Many-to-One Port Mirroring		
12	Port Description		
13	Protected Ports		
14	Per-port Broadcast/Multicast/Unknown Unicast Suppression		
15	Spanning Tree Backup Root		
16	STP Pass Thru		
E	**The switch should support the following Switching - Layer-3 Services**		
1	Should support ACLs & Extender ACLs		
2	ARP & ARP Redirect		
3	DVMRP		
4	IP Helper Address		
5	Ethernet ARP		
6	RIP v1, v2		
7	ICMP Router Discovery Messages		
8	IGMPv2		
9	OSPF v2		
10	PIM-SM		
11	DHCP/BootP Relay		
12	VRRP – Virtual Router Redundancy Protocol		
13	Static Routes		
14	VLAN-based ACLs		
F	VLAN Support		
1	Generic Attribute Registration Protocol (GARP)		
2	Generic VLAN Registration Protocol (GVRP)		
3	IEEE 802.1p – Traffic classification		
4	IEEE 802.1q – VLAN Tagging		
5	Protocol-based VLANs with Enterasys Policy		
6	IEEE 802.3ac – VLAN Tagging Extensions		
7	Port-based VLAN (private port/private VLAN)		

8	Tagged-based VLAN		
9	VLAN Marking of Mirror Traffic		
G	**Quality of Service**		
1	8 Priority Queues per Port		
2	802.3x Flow Control		
3	IP DSCP – Differentiated Services Code Point		
4	IP Precedence		
5	IP Protocol		
6	Queuing Control – Strict and Weighted		
7	Round Robin		
8	Source/Destination IP Address		
9	Source/Destination MAC Address		
H	**Security Features**		
1	Standard ACLs		
2	Extended ACLs		
3	MAC Address Authentication		
4	MAC locking (Static/Dynamic)		
5	802.1X Port-based Authentication		
6	MAC-based Authentication		
7	The switch should support RFC 3580		
8	The switch should support multiple authentication types per port Simultaneously		
9	The switch should support multiple authentication types Per Port namely 802.1X, Web based authentication and MAC based authentication		
10	The switch should be able to do preventive act of blocking worms and viruses which intent to brings down the entire network.		
11	The switch should be able to control them using Connection Rate Filtering/Throttling that thwarts viruses from spreading by blocking routing from		

	certain hosts exhibiting abnormal traffic behavior.		
12	The switch should Throttle denial-of-service (DoS) attacks or other malicious behaviors that uses high volume ICMP traffic.		
13	The switch should be able to limits authorized list for CLI/Web/Telnet/SNMP management access to the switch to particular authorized hosts		
14	User and IP Phone Authentication on any given port		
15	Password Protection (encryption)		
16	User and IP Phone Authentication		
17	Web-based Port Authentication		
I	**Network Management**		
1	The switch should support CLI/WEB/SNMP Management		
2	The switch should support multiple Syslog Servers		
3	The switch should support RADIUS Client		
4	The switch should support FTP/TFTP Client		
5	The switch should support SNTP		
6	The switch should support Telnet – Inbound/Outbound		
7	The switch should support Cisco CDP v1/2 or equivalent		
8	The switch should support configuration File Upload/Download		
9	The switch should support RMON –(Stats, History, Alarms, Events, Filters, Packet Capture)		
10	The switch should support multiple firmware images and configuration files with option for revision roll back		
11	The switch should support Text-based Configuration		

	Files		
12	The switch should support SSH v2 and SSL		
13	The switch should support Multiple local user account management		
14	The switch should support SNMP v1/v2c/v3		

3.2 EDGE SWITCH SPECIFICATIONS

	Edge Switch - 24 port 10/100/1000baseT		
Sl.No	**General Specification**	**Compliance (Yes or No)**	**Remarks**
A	**Switch Architecture General Specification**		
1	The switch shall be stackable 19 inch Rack mountable unit with the rack mount kit		
2	The switch should be stackable upto 8 units in stack using separate configured dedicated stack ports (No Virtual Stacking)		
3	Stacking Capacity 48 Gbps		
4	The switch should support closed loop stacking for redundancy where all units in stack are treated as one single device allowing common stack management feature,firmware upgrade, port mirroring, vlan definition and link aggregation to be performed on the		
5	The switch should support external Redundant 230V AC power supply.		
6	Flash Memory should support 32MB		
7	DRAM Memory should be 256 MB		
B	**Payload modules support**		

1	The switch should support 24 ports of 10/100/1000baseT including combo 4 1000BaseX SFP slots. And 48 ports of 10/100/1000baseT including 4 combo 1000BaseX SFP slots		
C	**Performance Architecture**		
1	The switch should support scalable Fabric with current requirement to support minimum of 48Gbps for 24 port switch and 96 Gbps or more for 48 port switch.		
2	The switch should support 35.7 Mbps for 24 port switch and 71 Mbps for 48 port switch as the Switching throughput		
3	The switch should support latency based on RFC 1242		
4	The switch should support 16K MAC Address		
5	The switch should support 1024 802.1Q port based VLAN with 4096 VIDS		
D	**The switch should support the following Switching - Layer-2 Services**		
1	802.1Q – Virtual Bridged Local Area Networking		
2	802.1p – Traffic Class Expediting		
3	Number of Spanning Tree instances should be 3 or more		
4	802.1w – Rapid Reconfiguration of Spanning Tree		
5	802.1s – Multiple Spanning Trees		
6	Auto MDI-X Media Dependent Interface Crossover Detect (Enhanced for non auto negotiating ports)		
7	802.3ad – Link Aggregation supporting minimum 6 groups having 8 ports per group		
8	Jumbo Frame support		

9	802.3x – Flow Control		
10	Inbound and Outbound Rate Limiting supporting minimum of 64Kbps		
11	Strict and Weighted Round Robin Queuing		
12	Link Flap detection		
13	Spanning Tree Loop Protection		
14	Broadcast Suppression		
15	Directed Broadcast		
16	SpanGuard / Spanning Tree Backup Root support		
17	802.3x (Flow Control)		
18	IGMP Join and leave latency: < 500 mSec		
19	The switch should support minimum 256 IGMP groups		
20	The switch should support One to One and Many to one		
21	• RFC 792 ICMP		
22	• RFC 1256 ICMP Router Discovery Protocol		
23	• RFC 826 ARP		
24	• RFC 1027 Proxy ARP		
25	• Static Routes		
26	• RFC 1058 RIPv1		
27	• RFC 1723 RIPv2 with Equal Cost Multipath Load Balancing		
28	• RFC 1812 RIP Requirements		
29	• RFC 1519 CIDR		
30	• RFC 1112 IGMP		
31	• RFC 2236 IGMPv2		
32	• Secondary's IP addresses per VLAN Interface		
33	• IP Helper addresses (per router / per interface)		
34	• DHCP Server support		

35	IPv4/IPv6 support		
E	**The switch should support the following Quality of Service**		
1	802.1p (Traffic Class Expediting)		
2	strict priority (SP) or weighted round-robin (WRR)		
3	Marking (TOS Rewrite)		
4	Policy Profiles/Rules		
F	**The switch should support the following Priority (802.1p) Classification Capability**		
1	Source MAC Address		
2	Destination MAC Address		
3	Source IP Address exact match		
4	Source IP best match (Subnet)		
5	Destination IP exact match		
6	Destination IP best match (Subnet)		
7	UDP/TCP source port		
8	UDP/TCP destination port		
9	UDP/TCP source/destination range		
G	**Security Features**		
1	• Standard ACLs		
2	• Extended ACLs		
3	• MAC Address Authentication		
4	• MAC locking (Static/Dynamic)		
5	• 802.1X Port-based Authentication		
6	• MAC-based Authentication		
7	• The switch should support RFC 3580		
8	• The switch should support multiple authentication types per port Simultaneously		
9	• The switch should support multiple authentication types Per Port namely 802.1X, Web		

	based authentication and MAC based authentication		
10	• The switch should be able to do preventive act of blocking worms and viruses which intent to brings down the entire network.		
11	• The switch should be able to control them using Connection Rate Filtering/Throttling that thwarts viruses from spreading by blocking routing from certain hosts exhibiting abnormal traffic behavior.		
12	• The switch should Throttles denial-of-service (DoS) attacks or other malicious behaviors that uses high volume ICMP traffic.		
13	• The switch should be capable of performing a host integrity based on a trusted computing model.		
14	• The switch should be able to limits authorized list for CLI/Web/Telnet/SNMP management access to the switch to particular authorized hosts		
15	User and IP Phone Authentication on any given port		
H	**Network Management**		
1	The switch should support CLI/WEB/SNMP Management		
2	The switch should support multiple Syslog Servers		
3	The switch should support RADIUS Client		
4	The switch should support FTP/TFTP Client		
5	The switch should support SNTP		
6	The switch should support Telnet – Inbound/Outbound		
7	The switch should support Cisco CDP v1/2 or equivalent		

8	The switch should support configuration File Upload/Download		
9	The switch should support RMON – Statistic, History, Alarms, Host, HostTopN,		
10	The switch should support multiple firmware images and configuration files with option for revision roll back		
11	The switch should support Text-based Configuration Files		
12	The switch should support Daylight Savings Time		
13	The switch should support SSH v2 and SSL		
14	The switch should support Multiple local user account management		
15	The switch should support SNMP v1/v2c/v3		

SECTION VIII

EPABX AND TELEPHONE SYSTEM

1.0 TECHNICAL SPECIFICATIONS

1.1 SCOPE:

Supply, Installation, Testing and Commissioning of Digital IP / SIP enabled multimedia voice Communication system for Regional Institute of Allied Health Sciences at Coimbatore. The System shall be latest state of the art Technology exchange based on IP Technology. The System needs to cater to the telephone functions for all the building. The system shall be installed in the Service Room - of the Building. The connectivity of all the floors from the system shall be through copper cables.

Telephone Connection has been proposed so as to cover all the important and required places. The System offered should be equipped for 280 Extensions (i.e. 260 Analog Extensions and 20 Digital Extensions). The offered system should be expandable by adding necessary cabinets and cards to 1000 Extensions without changing/adding the common control cards, and by tie lining two or more exchanges. 1000 users should be achieved with the same system and documentary proof to be submitted for the same.

2.0 DESIGN CRITERIA

The EPABX system shall be Installed and Commissioned in the First Floor – Service Room. The Main System, MDF, FCBC and batteries and other system components shall be installed in this Room.

All the cables shall be terminated in this Room. The complete EPABX system shall be managed by a Desktop PC and associated software to be provided with the

same. The cabling shall be done for the required number of extensions as per the cabling BOQ Enclosed.

The offered EPABX System and its accessories in this case shall be as per the following Specifications.

3.0 GENERAL

1.1 The EPABX System offered shall be TEC approved. Documentary Proof of TEC approval shall be submitted with the offer.

1.2 The EPABX System offered shall be QSIG and SIP Ready. Tenderer shall submit QSIG Test certificate of the EPABX exchange offered from an authorized body.

1.3 The EPABX system shall be ECMA approved QSIG Compliant and the OEM of the server shall necessarily be a member of ECMA.

1.4 The system should support VoIP (Voice over Internet Protocol) / SIP (Session Initiation Protocol). The offered Make and Model with Similar configuration should have been installed in India using IP technology in atleast 5 locations in the last 5 years. Documentary Proof for the same should be enclosed.

4.0 OPERATING AMBIENT CONDITIONS

i) The offered system shall be compatible to tropical climate prevalent in India.

ii) The offered system shall be able to operate in ambient temperature range +5 to +40 degrees Celsius.

iii) The system shall be able to operate in relative humidity of about 30-85%.

5.0 SYSTEM ARCHITECTURE

i) The system topology shall be fully duplicated and decentralized control.

ii) The IP Telephony Server shall support remote shelves & IP Access points. IP Access points shall be centrally administrable from the Host system.

Distributed switching shall be possible on IP Access points also. The system shall have Universal ports for line/trunk cards. Wherein any peripheral card can be inserted in any slot of the peripheral shelf, thereby is enhancing the flexibility of the Configuration.

6.0 CENTRAL PROCESSING UNIT

The Central Processing Unit of the IP Telephony Server shall be a 32 Bit Hierarchical microprocessor with fully distributed controls to share the load, offering hot stand by configuration with transparent switchover on occurrence of fault, covering all control cards, power supply etc.It shall have Pentium / RISC processor and ability of Busy Hour Call Completion (BHCC) of above 100,000.

7.0 STORAGE MEDIA

The system shall provide world's latest technique of storage media, Magnetic Optical disk, Flash EPROM, for higher reliability and fast booting.

8.0 DUPLICATION / SYSTEM REDUNDANCY

System Redundancy: The EPABX offered shall support Duplicated Control Unit in Hot standby mode. The basic system shall be capable of achieving its ultimate capacity without the need of adding /upgrading CPU. The following Duplication shall be provided with the system for:

i) Common Control

ii) Switching Network (TDM/PCM Bus)

iii) Power supply duplication till the shelf level

iv) Tones

v) Main and standby memory

The offered system shall be capable of Hot Swapping of all cards without switching off the system where the necessary cards can be interchanged or replaced even in online conditions.

9.0 OPERATING SYSTEM

The operating system of the IP Telephony Server shall be protected against Loss/alteration of memory due to power failure/unauthorized command or due to any other faulty condition.

10.0 NETWORKING

i) The offered system shall work under the internationally recognized Networking protocol, QSIG for feature transparency throughout the network. The EPABX should support Digital networking of Multi vendor EPABX via QSIG software for feature transparency throughout the network.

ii) The Bidder should have installed the offered system in India where in networking with other make EPABX should have been done through Q-Sig.Documentary proof to be enclosed.

iii) The system shall be capable of integrating with TEC approved PRI/E1 (2MBPS) cards of Direct Inward Dialing and also for connectivity with other voice servers. The system shall support SIP based protocol for internet working of different make IP Telephony Servers.

11.0 SUBSCRIBERS AND TRUNK INTERFACES SUPPORTED

The IP Telephony Server shall support the following:-

i) So Exchange Interfaces with DSS 1

ii) S2 Exchange Interfaces with DSS 1

iii) SIP carrier gateway

iv) Interfaces for Integral connection of radio cells (DECT Standard)

v) a/b Interfaces for connection of analog subscribers

vi) Interfaces for E&M 2/4 wire subscribers

vii) Interfaces for digital 2 Channel subscribers

viii) Interfaces for IP subscribers and IP Trunks

ix) Interfaces for SIP subscribers and SIP Trunks

x) Interfaces for Wireless IP Subscribers and Wireless SIP Subscribers

12.0 TRUNKS

ISDN (INTEGRATED SERVICES DIGITAL NETWORK): The IP Telephony Server shall be ready for ISDN and only the necessary ISDN BRI & PRI Gateways (Basic Rate Interface & Primary Rate Interface) need to be added for functionality.

The system shall be capable of accepting different types of signals for ISDN BRI & PRI, Ring down, 2W/4W E&M (Ear & Mouth) signaling etc.

The system shall support EI/PRI (30 channel PCM) level DID.

The system shall inherently support IP/SIP Trunks. The Hardware for the same provided shall be of OEM Make only**.**

13.0 OPERATOR CONSOLE

The offered Operator console should be IP based operator console. Necessary IP card used to connect the operator console should be supplied and also support IP phones connectivity. Minimum of 100 IP phones should be able to connect to the

same IP Card used for Operator Console. The operator console should support the following features.

- User prompts can be set to different language by user
- Distinctive ringing tones
- Call and traffic display
- Call switching/disconnect/intrusion/answering
- Extending incoming calls without announcement
- Serial calls
- Toggling between connections
- Attendant camp-on for external, internal and tie trunk calls
- Attendant loop transfer to another attendant console
- Automatic recall
- Trunk hold/toggle
- Specific personalized calls
- Night service options

14.0 DISTRIBUTED ARCHITECTURE via IP NETWORK

The EPABX offered shall support the IPDA.

Features of IP Gateway to connect distributed system, Interface to connect IP access points via the internal IP network infrastructure. Supports the following performance features:

- IP interface to support up to 120 B-channels to connected access points
- 2 x 10/100 Base-T interface
- Support of voice-based network protocols via IP
- QoS according to IEEE 802.1 d/q and IETF
- DiffServ
- Integrated echo compensation
- Recognition of DTMF tones according to RFC 2833
- Voice compression according to ITU-T G.711 and G.729AB

- Transparent fax-modem support (FMoIP) according to G.711t

Alternatively configurable in mixed mode as

- IP/SIP-subscriber gateway
- IP-trunking gateway
- SIP-carrier/trunking gateway

15.0 SYSTEM DETAILS

i) System should support Voice, Data and Image (Video) Networking.

ii) System should also support Call Center Solutions for Public Enquiry system. System should support ACD supporting atleast 20 Agents. Documentary proof to be attached.

iii) The systems offered should be fully modular and utilize Universal Port Architecture.

iv) The system should be 100% Non-Blocking with a Switching Matrix to provide more Time Slots than the Total ports of the System Quoted.

v) The systems should support Level DID applications using Analog / E1 Digital Trunks. The system should support modified R2MFC signaling based on Indian Standards.

vi) System should support Optic Fiber Transceivers for terminating the Optic Fiber Cable i.e. the system should have direct Optic Fiber Connectivity interface.

vii) System should have built-in interface for External MOH and Back Ground Music (BGM) as well as External Paging Interface.

viii) All peripheral cards like analog extension, digital extension, trunks cards etc should be hot swappable.

16.0 IP COMPONENTS

The system should support the following attributes:

a) LAN interface, Ethernet with TCP/IP protocol
b) Connection of a server via LAN-LAN router and LAN-WAN (ISDN)

c) Remote connection to a server/host via ISDN directly via S_0
d) Remote access to the server
e) Connection of remote terminals to the server
f) The offered communication system should have the possibility of distributing Cabinets via IP network.
g) There should not be any restrictions concerning system or subscriber-functionality in the distributed architecture
h) The following additional measures should be supported to increase the availability of the system:
a) Survivability concept for signaling and payload in case of fail of the IP-network
b) It should be possible to connect IP work points to the offered communication server
c) The system should provide the same features for IP work points as for traditionally connected subscribers

17.0 IP EXTENSION CARD

a) The system should support IP extension card.
b) This should be an integrated card, which should be pluggable in any of the universal slots.

c) This card should have a 10/100 Ethernet port, which can be connected to the LAN.

d) IP Phones should be able to connect to the LAN and the same should communicate to the EPABX.

e) These IP phones should be able to connect on WAN also.

f) IP phones should be able to be connected on Internet also, if static IP is available.

g) Bidder should submit detailed datasheet of this card

h) The networking IP card should support the following,

- Minimum 30 voice channels should be possible
- Should support G.711, G.723.1, G.729.A
- Should be an integrated solution i.e. card based and to be put in any of the universal slots

i) The system should support feature transparency when IP is used as medium for networking i.e. Intranet or Internet applications. Necessary documentary proof should be submitted

j) The Same IP Extension Card will have to be used for IP Trunking.

k) The Same IP Extension Card should also support SIP users.

l) The Offered system should support SIP Extension and SIP Trunking without any additional interfaces or servers.

18.0 FUTURE EXPANSION REMOTE CABINETS

a) Remote Cabinets should allow the system to be connected in a distributed topology.

b) The system should support remote location of maximum 50 cabinets on such a distributed IP topology.

c) Distance should not be a limitation in such a scenario.

d) The Switching, Trunks, Operator, Voice Mail etc should be centralized.

e) The remote cabinets should be able to use all the main system features including Voice Mail and Call Billing etc.

f) There should be 100% feature transparency between the Main and Remote

system i.e. all the main system features should be available in the Remote system.

19.0 SYSTEM MAINTENANCE

a) System should use Flash-ROM/ MOD for faster booting. Maintenance and Administration terminal should enhance system management with a user-friendly man-machine Interface. It should have the following features.

- System Database Management
- System Backups
- Traffic Data Management. This should on a GUI based console with detailed information about the health of the exchange status of subscriber lines, trunk lines, battery voltage level indication etc.
- Alarm indication on Display and Printer
- Display of Software and Circuit card information on terminal
- System should have Remote Maintenance Modem for on-site PC Programming.
- On Line Diagnostics of the whole exchange should be provided.

20.0 DECT CORDLESS – SYSTEM

a) The system supplied should support DECT. It should be possible to interface standalone / integrated multi cell/multi-subscriber cordless system to the DECT standard available..

b) The offered communication system should support the following system features:

- Voice and Data Communication should be possible from the handset.
- Interface with GAP protocol
- The Handset should support Fax Transfer @ 14.4 kbps
- Roaming facility should be available i.e. same handset can be used in various plants or with different systems at different locations.
- Flexible demand-oriented connect ability of base stations with 4, 8 or 12 voice channels.
- Full integration into the PBX administration and maintenance concept
- System expansion per system up to 100 base stations and up to 500 handsets
- Network-wide roaming
- Downloading and fast hopping for base stations
- ISDN and PBX features should be possible
- Roaming facility should be available i.e. same handset can be used in various plants or with different systems at different locations.
- Back Lighting
- Full privacy is provided on the handset. Voice Encoding / Decoding System technique is 32kbps ADPCM.
- Power Consumption – 10 mw min
- Weight of each handset 100 gm max
- Memory - 100 no speed dial memory
- Scrolling by name or memory location
- Cell Radius – 500 mtr (Open Space)

21.0 SYSTEM EXPANDIBILITY

i) Vendor should specify the maximum expandable capacity of the

quoted exchange and maximum number of remote shelves connected to the main system on IP. Vendor should have installed system with atleast 5 remote shelf with the offered system on IP. Documentation proof to be submitted.

ii) The System should have the capability of connecting the remote Shelves strictly on LAN only using IP (Internet protocol) not through any other type of connectivity. Single system with IP remote should be offered. Individual system in the remote locations should **not** be interconnected on IP Trunking / E 1 / PRI / E & M / LD. Vendor should provide the documentary evidence for the same.

22.0 SUPPORT

1. The Bidder shall have a full-fledged service set up in Tamil Nadu and contact details and the name of the service engineer shall be provided with contact numbers.

2. Adequate spares should be maintained at their office for immediate support. The Bidder shall have a remote maintenance center in India.

In case the Bidder is not the manufacturer then separate letters as detailed below are to be attached

3. Letter authorizing the Bidder to quote for this specific tender

4. Letter assuring that the manufacturer will provide all Service and technical support directly to the Buyer and even on 24/7 basis (if required).

5. This letter shall also specify the infrastructure available in India to enable the above service

6. Service centers in India (address with contact person details)

7. Spares stock centers in India (address with contact person details)

8. Bidders failing to enclose the above letter with necessary details asked for shall be summarily rejected.

23.0 SYSTEM FEATURES

23.1 STANDARD SYSTEM FUCTIONS

The features listed below are all required for system call processing and basically shall be available to all analogue, digital or IP- subscribers:

- Rejection of DID calls, if free, busy or incompletely dialed
- Special audible tones after lifting the handset if features have been activated
- Operation with/without DID
- Reaching certain extensions in incoming traffic
- Transmit DTMF signals to public networks
- Multiple trunk group for reaching exchange and/or tie-trunks
- Multiple trunk groups using code dialing
- Auto-timed diversion of incoming calls
- Technical measures to prevent connections
- Different ringing for internal, exchange, emergency, deadline and direct calls
- Closed numbering
- Prevention of DID to certain extensions
- Toll/code restriction in exchange and trunk-to-trunk traffic
- Music or a brief announcement for calls on hold
- Presetting digits
- Digit repetition

23.2 OPEN NUMBERING

It must be possible to freely assign subscriber numbers and connection locations. The call numbers can be of any length up to seven digits.

23.3 VIRTUAL NUMBERING

It must be possible to reproduce, several identical or itself overlapping, call number plans within a system

23.4 TOLL/CODE RESTRICTION ON EXCHAGE TRAFFIC

Toll/code restriction releases exchange call numbers in accordance with the class of service of the subscriber. It must be able to evaluate up to 22 digits per voice, fax and data service. Subscribers with local access shall also be permitted to reach long distance areas by the assignment of up to 6 partial toll accesses.

23.5 TOLL/CODE RESTRICTIONS ON DEDICATED CONNECTION CALLS

Toll/code restriction releases call numbers for the private network in accordance with the class of service for the traffic via the dedicated connections. It must be able to evaluate up to 22 digits for each voice, fax and data service, each subscriber being able to obtain toll accesses with different call number groups.

23.6 PREVENTING ILLEGAL CONNECTIONS

Using the entries in a connection matrix, traffic relations within and between groups of subscribers and trunks can be released or blocked as required.

23.7 HOT – LINE SERVICE WITHOUT DIALING

It is possible to set up extensions so that when the handset is lifted a connection to a programmed destination is set up (hot-line).

23.8 HOT – LINE SERVICE AFTER PAUSE

Extensions can be set up so that after the handset is lifted, a connection is set up to a programmed destination if no dialing takes place within 20 seconds or only partial dialing takes place.

23.9 TRANSMIT DTMF SIGNALS

Special devices, which can be controlled by DTMF signaling, can be dialed up via outgoing external lines. To do this, both the digital dialing information for digital or IP- telephones and the pulses from analog pulse dialing telephones must be converted to DTMF signaling.

23.10 SYSTEM CALL FORWARDING

A central call forwarding system shall be programmed and activated. The call forwarding system shall support all standard types of call forwarding.

23.11 REMOTE – CONTROLLABLE NIGHT SERVICE

Subscribers with the appropriate authorization must be able to activate night service variants that have been set up both locally and on a network-wide basis.

23.12 ATTENDANT INTERCEPT WITH DIFFERENT CODE NUMBERS

It must be possible to specify 00 to 09 as intercept code numbers so that incoming exchange calls to tenant services for several users can be distinguished at the switchboard position or be appropriately distributed if several switchboard positions are involved. In conjunction with the intercept code number it shall be a possible to display a company name on the switchboard console.

In addition any other number out of the numbering scheme must be configurable, providing the specified functions.

23.13 CALL DATA REGISTRATION, EXTERNAL OUTGOING / INCOMING

The system shall store a call data record (CDR) for each connection so that it is possible to assign charges for outgoing exchange calls to the originator. The CDR shall contain at least the following data:

- Calling party number
- External destination number
- Date
- Day of the year
- Time at which call starts
- Call duration
- Call charge units
- Costs indicated on the display
- Serial number of the CDR
- Number of the trunk circuit

The CDRs stored on the system can be called and processed by the analysis unit.

23.14 CALL DATA REGISTRATION, NETWORK – WIDE

It shall be possible to store call charge data records for calls within the network so that telephone system costs within the network can be assigned to the originating parties. When the data records stored on the system have been processed by the analysis program, it is possible to apportion the costs for the operation of the telephone system equitably.

23.15 VOLUME CONTROL FOR VOICE SERVICE

Because of the combined use of analog, digital and IP telephones, and because of the use of analog and digital lines in the connection paths, the volume may vary considerably from call to call. No matter what the type of call, and under certain circumstances, the size of the network, approximately the same volume shall be ensured by connecting amplifying or attenuating networks on a call-by-call basis.

23.16 DIRECT DIAL UP TO TRUNK OR SUBSCRIBERS

This feature shall allow the direct dial to a terminal without been re-routing via system applications. The feature eases the manual hardware oriented (positional) dial up of analogue and CAS trunks, of B-channels in digital trunks as well as analogue ports. This shall allow faster diagnostics and access to ports with bottlenecks.

23.17 RECORDER ANNOUNCEMENTS

Connecting recorded announcement devices, it shall be possible to play appropriate texts to callers when certain switching states arise. The texts shall be played with the correct timing, i.e. from the beginning. It shall be possible to play back recorded announcements in the following situations:

- Required subscriber busy
- Required subscriber - no answer
- Redial request - destination busy
- Redial request - destination does not answer
- Company announcement and greeting text for calls to the switchboard position
- Waiting announcement for call to the switchboard position
- No immediate answer
- Waiting announcement for call to hunting group
- No immediate answer

It shall be possible to control the announcements individually via a connection matrix. A maximum of 64 different texts shall be available and it shall be possible to connect a recorded announcement simultaneously to up to 50 callers.

24.0 SUBSCRIBER FEATURES

24.1 STANDARD PACKAGE SUBSCIBER FUNCTIONS

The features listed below are prerequisites for extension subscriber communication and basically shall be available to all analogue, digital or IP subscribers:

- Call forwarding with a fixed/variable destination
- Class of service switchover
- Direct call and direct call key function
- Add-on conference
- Multiple conferences with up to 8 participants
- Restriction of internal traffic
- Call interception
- Call transfer after answering
- Call transfer before answering
- Accept call
- Speed dialing – individual and system
- Toggling between two calls
- Consultation hold
- Call back - no answer
- Call back - busy
- Hunt group, linear
- Hunt group, cyclic
- Synchronized recorded announcement if not available
- Deadline set-up
- Relocation of terminals
- Saved number redial
- Station transfer security
- Day of the week, date and time in display
- PIN for personal identification
- Recall enable/block

24.2 ADD – ON CONFERENCE

Extension subscribers can add on a third subscriber to their conversation. The added-on subscriber can also be removed at any time. One or two external subscribers can be added on during an add-on conference.

24.3 MULTIPLE CONFERENCE

Digital extensions shall successively add on up to six further subscribers for the Hospital building, which shall also be external, to the original two participants. Every subscriber of a conference can act independently. The subscribers of the conference have the possibility to go on consultation hold or to do explicit call pickup to add a new subscriber to the conference as long as the maximum subscriber number is not reached yet. The conference can be put on hold to perform another function.

24.4 DIRECT CALLING

Pressing a button, subscribers with a digital or IP- telephone can call a programmed internal subscriber. The direct call is indicated to the called party by means of a special ringing signal. The direct call button has an LED which comes on when the direct call destination is busy. If the key is nevertheless pressed, the direct call destination is alerted by means of a call waiting signal. It shall be possible to set up a maximum of 30 direct call keys for a digital subscriber. If there are several subscribers it must be possible to set up one subscriber as a direct call destination.

24.5 TEAM CALL PICKUP

Subscribers in a pickup group can take calls for another team member at their own telephone. Analog, digital or IP- telephones can be included in a team.

24.6 DIRECTED CALL PICK UP

Directed call pick up of calls from other work points can be activated by either pressing the according function key or by dialing a prefix and the extension number.

24.7 CALL FORWARDING WITH VARIABLE DESTINATION

In addition to call forwarding with a fixed destination, the subscribers shall also have call forwarding with variable destination which they can program themselves.

24.8 CALL DEFLECTION

Subscriber shall have the possibility to call forward an incoming first or second call. The call shall be forwarded to the call forwarding ring now answer destination.

24.9 SUBSCRIBER CONTROL OF FORWARDING

Authorized subscribers shall have the possibility to override call forwarding at a called destination.

24.10 PARK TO SYSTEM

A station or an attendant user shall be able to place a trunk or station connection into a system park slot. Once parked the call shall be retrieved by the same station that parked the call or another station. After having parked the call the station or the attendant user can make another call.

24.11 SINGLE CLASS OF SERVICE SWITCHOVER

Each extension subscriber can be assigned two classes of service. The subscriber can toggle between the two classes of service himself, protected by a procedure.

24.12 CLASS OF SERVICE SWITCHOVER

Class of service for an extension group can be switched over on an individual basis from the switchboard position or at a certain time by the system.

24.13 SPEED DIALING – INDIVIDUAL

Extension subscribers shall have an individual call number memory for a max. of 30 internal or external destinations that are retrievable by pressing a function key. The destinations are entered and modified by the subscribers themselves. Manual suffix dialing after outcall must also be possible. It must be possible to set up the feature for all subscribers.

24.14 SPEED DIALING - SYSTEM

Extension subscribers and attendants shall have – by pressing a function key – access to a central call number memory which can be divided up into a max. of 16 speed calling lists. Each subscriber can be authorized to use two lists each of which contains up to 1000 destination numbers. Suffix dialing after outcall must be possible. All subscribers shall be able to use speed calling-system. Memory capacity: 16.000 destination numbers.

24.15 CHANGING OF CENTRAL SPEED DIALING ENTRIES

A user shall be able to carry out several functions with one central speed call. With this, the chaining contains a sequence of digits which are usually carried out on the keypad. Up to 10 system speed call entries can be chained together.

24.16 CALL INTERCEPTION

Authorized extension subscribers shall be able to register the call number of a caller. It must be possible to set up this feature so that all calls for the authorized subscribers are registered or only those calls marked with a code number by the subscriber. It must be possible to print out the call number of the caller in the case of internal calls, calls via dedicated connections with identification and ISDN exchange calls.

24.17 DISCONNECTION

Authorized extension subscribers and attendants shall be able to go beyond call waiting/busy override and disconnect a call, if a suitable signaling method is available on the previous call path. In the case of subscriber busy, the call can be disconnected to affect one's own further call set up and, if the dedicated connection trunk is busy, a connection can be disconnected.

24.18 PERSONAL IDENTIFICATION NUMBER

The PIN is used to identify the subscriber to the communications system at his own telephone or someone else's. The PIN number, which can have up to 12 digits, is entered manually or by inserting a chip card in the case of digital telephones with a card reader. If entry is made on one's own telephone, the individual class of service is switched over. If the entry is made on someone else's telephone, the person entering the PIN number can use it like his own telephone – this also includes the key assignment. Call charges that accrue at someone else's telephone are assigned to the call number of the person who has entered the PIN number.

24.19 PROJECT CODE NUMBER (PCN)

By manually entering a PCN, before or while an exchange connection is set up, subscribers shall be able to assign the call charges that accrue to a certain

project. The PCN is included in the call charge data record of the call charge registration for the project-related billing procedure.

24.20 DESTINATION KEYS

Subscribers with digital or IP- feature telephones can dial a programmed internal or external destination by pressing a key. It shall be possible to set up destination keys for each telephone. Further destination keys can be supplied by means of an add-on device. The destinations can be stored and modified by the subscriber himself.

24.21 RELOCATION TERMINALS

It shall be possible to move digital telephones within the area covered by a system without any administrative procedures at the operating terminal. This shall be done by entering a logoff code and the PIN before unplugging. In the new room or area, the logon code and the PIN are entered after the device has been plugged in again. The terminal/device shall then operate as it did originally.

24.22 CALL WAITING – TERMINATING

Subscribers with digital or IP- telephones with display shall be able to override an ongoing call for a waiting call. In the busy state, the calls receive the call connect signal, the subscriber receives an alerting tone and the caller is shown on the display. Without terminating the existing call, it shall be possible to take the waiting call and toggle between the two calls. The caller shall hear a special free signal to be informed about his call waiting.

24.23 DEADLINE SET – UP

Extension subscribers can enter a deadline time on their telephone for the next 24 hours. The system shall then call them at this time. Subscribers with digital or IP telephones can enter several deadlines. If the deadline call is not

acknowledged, it is repeated after 5 minutes. If there is again no acknowledgement, the deadline call is cleared.

24.24 CALL CHARGE DISPLAY OR ELAPSED TIME DISPLAY ON DIGITAL OR IP-PHONES

When a call that incurs charges is being made, the display on digital or IP telephones shall indicate the accruing charges, the charge units, or the elapsed time. Every subscriber shall be able to decide whether the accruing charges, the charge units, or the elapsed time is shown on the display. If there is simultaneous communication involving several charge incurring calls (consultation hold, conference) and the accruing charges are chosen, the sum of the charges is shown on the display.

25.0 INTERCOM FEATURE

25.1 VOICE CALLING

Subscribers with a digital or IP- telephone can voice call other digital subscribers if their phones are equipped with open listening and hands free talking without the called party needing to lift the handset. Subscribers can permanently or temporarily protect themselves from voice calling by means of an appropriate procedure.

25.2 HANDS FREE ANSWERING

If subscribers with a digital or IP- telephone are voice-called and their telephone is equipped with hands free talking, their microphone is turned on automatically to permit hands free answering.

25.3 SPEAKER CALL ONE – WAY

Subscribers shall be able to initiate a speaker call, which provides a one-way connection to a single destination of their choice.

25.4 COMMUNITY GROUP CALL

Subscribers with digital or IP- telephones of a defined communication group (max. 100 members) shall be able to call each other without dialing the full extension number, to establish a normal connection.

25.5 COMMUNITY GROUP SPEAKER CALL – TWO – WAY

Subscribers with digital or IP- telephones of a defined communication group (max. 100 members) shall be able to call other members of the same group directly by shortened dialing. Speaker and microphone of the subscriber shall – if available – be activated automatically.

25.6 SPEAKER CALL – ONE WAY – BROADCAST

Subscribers shall be able to initiate a speaker call with a one-way connection to multiple (max. 40) destinations, simultaneously. The speakers of the phones – if available – shall be activated automatically. The first user to answer the announcement via going off-hook, could converse to the announcer and all other speakers shall be deactivated.

25.7 CALL LOG

Call log has to be provided for subscribers with digital or IP- telephones. Both incoming calls and call attempts and outgoing and abandoned calls are entered in the call journal. The user can simply page through the list and use the entry to set up an outgoing call.

25.8 DATA SECURITY FOR DIGITAL OR IP – TELEPHONES

On leaving the workplace, it must be possible for the user to lock the telephone or feature functions and key data for dialing aids against unauthorized use.

25.9 DISPLAY TELEPHONE BOOK

Subscribers with a digital or IP- display telephone who do not have their own PC with ETB at the workplace shall be able to access a centrally maintained telephone book. The dialing pad or an add-on device with alpha keys is used to enter names. After a partial entry, names are shown on the display and it is possible to scroll backwards and forwards in the list. The call is set up by pressing a key. Other functions supply facilities like personal telephone books and call journals for each subscriber.

25.10 INTEGRAL TWO – WAY HANDS FREE INTERCOM SYSTEM FUCTION

Subscribers with digital or IP- telephones can voice call other subscribers with digital telephones if their telephones are equipped with open listening and hands free talking; the called subscriber does not need to lift the handset. If the voice-called subscriber has hands free talking, he can reply directly via the integral microphone. It must be possible for subscribers to override voice calling temporarily or permanently by activating an appropriate function.

25.11 BUZZ

It shall be possible to alert (buzz) a predefined destination with key function by pressing the function key or by entering a code number. Voice communication shall not be provided. The number of the caller shall be shown on the display of the alerted person for a short time. Buzz shall interrupt any other alerting of the predefined destination for the length of the buzz.

26.0 CTI (COMPUTER TELEPHONY INTER – PHASE) APPLICATIONS

The offered system shall support Computer Supported Telephone Applications (CSTA) in order to facilitate integration of LAN and IVRS.

The offered system shall support CTI applications (Computer Telephony Integration) for features like Screen Popup through CLI or DNIS (Dialed Number Identification Service).

26.1 MOBILITY SOLUTIONS

The offered system shall support IP soft phones and integrated DECT solution and VoWLAN Systems.

The system shall be capable of integrating with captive and public paging systems.

26.2 DIAGNOSTIC AND MAINTENANCE FACILITY

The system shall have in built diagnostic features such as Isolation/detection of faulty line/junction and restoration of faulty lines/junctions after rectification.

The offered system shall have remote maintenance facility using dial up connection for remote maintenance with proper password protections. The EPABX shall have auto restart capability to automatically reload the system software after system power is restored to it.

27.0 POWER SUPPLY

Power Consumption of the exchange at full traffic conditions shall be as low as possible. The system shall be able to take normal 230V AC Supply or shall also have the provision of working on DC Supply.

APPROVED MAKES:

1) EPABX	-	ALCATEL / AVAYA / CISCO / SIEMENS / NORTEL

2) ANALOG PHONES - BEETEL / PANASONIC / SIEMENS / ALCATEL

3) VOICE BOX – RJII - KRONE / TVS / FINOLEX

3) MDF - KRONE

4) IDF - KRONE

5) 2 PAIR / 4 PAIR CABLE - DELTON / FINOLEX / RR CABLE

6) 10 PAIR / 20 PAIR / 50 PAIR / 100 PAIR
CABLES - DELTON / FINLOEX / RR CABLES

SECTION IX

PUBLIC ADDRESS SYSTEM

1.0 SCOPE OF WORK

The scope of work under this head shall include designing supplying and installing of Public Address System. The work under this system shall consist of furnishing all materials, equipment's and appliances and labor necessary to install the said system, complete with Speakers, Amplifiers, Mike, Zone selection Panel for interfacing with other systems.

2.0 System Specifications

The Public Address System is designed to serve the dual purposes of making general announcement, playing music or to announce the fire tone under fire condition. These different signals are to be transmitted through the same set of speakers. Hence, different level of priorities shall be allotted to different signals. The music shall be with the least priority and fire tone having next priority and the emergency announcement having the highest priority level.

Public Addressing system shall comprise of:

1. Metal Cabinet Racks
2. Ceiling ring speakers
3. Ceiling ring speakers with volume control
4. Wall Mounted Speakers
5. Booster Amplifiers.
6. System Controller.
7. Routers

3.0 Speakers

3.1 Ceiling Mount type Speakers

The loudspeaker shall have built-in protection to ensure that, in the event of a fire, damage to the loudspeaker does not result in failure of the circuit to which it is connected. In this way, system integrity shall be maintained; ensuring loudspeakers in

other areas can still be used to inform people of the situation. The speaker shall have ceramic terminal blocks, thermal fuse and heat-resistant, high temperature wiring.

The Ceiling speaker unit shall be a 6 W dual-cone loudspeaker with an integrated circular metal grille and 100 V matching transformer. The speaker cabinet shall be of neutral white color.

3.2 Wall Mounted Speakers

The Wall mounted speakers shall have built-in protection to ensure that, in the event of a fire, damage to the loudspeaker does not result in failure of the circuit to which it is connected. The 10 W bi-directional cabinet loudspeakers shall provide good speech intelligibility and background music reproduction in staircase area.

4.0 Booster Amplifiers

The amplifiers shall be protected against overload and short circuits. The amplifier shall have temperature-controlled fan to ensure high reliability at high output power and low acoustic noise at lower power output. Additionally, all booster amplifiers have an overheat protection circuit that switches off the power stage if the internal temperature reaches a critical limit due to poor ventilation or overload.

The amplifier shall have a balanced input and a loop-through connector for easy connection of multiple booster amplifiers to increase the available output power.

The amplifiers shall have 70 V and 100 V outputs for constant voltage loudspeaker systems and a low impedance output for 8-Ohm loudspeaker loads.

5.0 Rack Assembly

Rack assembly is to stack the amplifiers, monitor module, DVR and others. This shall be factory pre-wired and shall have different channels for AC mains cable and Audio signal cables. The rack shall be provided with wheels for easy Movement/ maintenance. One lockable rear door shall be provided. The rack assembly shall operate on 230 VAC.

6.0 System Controller

The System Controller is the heart of the PA system. The controller shall include full system supervision, loudspeaker line impedance supervision, a supervised emergency

microphone on the front panel and a supervised message manager. The messages can be merged to allow even more flexible use of pre-recorded announcements and evacuation messages. The controller shall be used as a standalone system with up to 6 zones, or expanded to up to 60 zones using additional routers. Up to 8 call stations shall be connected.

Interconnections shall be made using standard RJ45 connectors and CAT5 cable. All booster amplifiers connected to system controller shall be supervised. The audio output shall be of

100V, for full compatibility with the public address equipment and EVAC-compliant loudspeakers.

The controller shall have BGM source inputs and a mic /line input with configurable priority, speech filter, and phantom power. The priority levels shall be specified for microphone, call stations and trigger inputs for optimum system flexibility.

The 100 V-technique reduces line losses on longer distances and allows for easy parallel connection of multiple loudspeakers. All zones shall be individually selected from the front panel and the BGM output level in each zone shall be individually set. The BGM output shall be connected to the 70V line, thus it shall be possible to connect a total load of 480 Watts in a two-channel system combined with a 480 Watt booster.

The output of the booster shall also be available as a separate output on 100V and 70V.

A separate 100 V Call Only output is provided for addressing an area where BGM is not required but where priority announcements are.

Configurable Volume Override output contacts shall be available for overriding local volume controls during priority calls.

7.0 Routers

The router is an expansion unit, which adds additional zones to the PA system. Router shall provide outputs and inputs for one or two boosters in a multi amplifier one- or two-channel system.

Router shall provide dual channel operation for calls and BGM. Also single channel operation shall be possible with only one booster.

The router shall have a set of relays for zone-switching the power amplifier output(s) to different loudspeaker groups. Each of the zones can be switched between the call channels, the BGM channel or off.

In order to get a message through although the local volume controls have been set to a low volume level for e.g. background music, volume override relay contacts shall be provided for each zone separately for overriding local loudspeaker volume controls.

Upon a call or an activated trigger input, these contacts shall get activated for the appropriate zones, together with an additional voltage free contact (Call Active) for control purposes.

7.1 Announcements

Announcements shall be made through the microphones and by selecting the required zones. Announcements shall be made in following modes:

1. Individual mode
2. All Call mode

In "All Call" mode, announcement can be made to all the speakers simultaneously. This is useful when any common message to be passed to all. In addition, this is more convenient and fast to address the people during emergencies.

7.2 System Interconnection

The speakers in each zone are connected in parallel and are connected to the relay and switching unit. The cables from each zone are separately routed and are terminated in the relay switching units

8.0 Cable

2-core 1 sq.mm Multi standard copper wires.

8.1 Testing and Commissioning

Entire PA system shall be tested to establish the following.

i. Functionality of the PA system

ii. Combined systems shall be tested for the overriding feature for prioritizing fire alarm and life safety requirements.

iii. Acceptable audibility of the public address in all spaces and record sound pressure levels of the Public address Vis a Vis the ambient noise levels.

The Provision of speakers is proposed so as to cover the entire area uniformly to have better communication system in the Hospital.

9.0 APPROVED LIST OF MAKES

1. Amplifiers - BOSCL/Philips/PLENA/ATE/AHUJA
2. Speakers - BOSCL/Philips/PLENA/ ATE/AHUJA

10.0 ROUND METAL CEILING LOUDSPEAKER

10.1 Technical Specifications

Rated power, Watts	6
Transformer tapping's 100 volt line, Watts	6/3/1.5/0.75/0.25
Transformer Impedance, Ohms	1.67k/3.34k/6.67k/13.3k/40k
70.7 volt line, Watts	3/1.5/0.75/0.375/0.125
Driver impedance, Ohms	8
Effective frequency range, Hz (BS6840)	120-17,500
S.P.L. ,@ 1m,1watt, dB	90
S.P.L. ,@Full power/1m, dB	97
Dispersion at 1,000 Hz, Degrees	180
Directivity Q factor, 1k Hz	2.3
Dimensions front and depth, mm	181 x 70
Net weight, Kgs	0.77
Colour / Finish	White, RAL9016
Material	Steel
Mounting	Snap-on, Metal clip x 2

11.0 TECHNICAL SPECIFICATIONS FOR AMPLIFIER

Model	SPA 1240
Output power RMS 1 kHz, 1% THD	240W
Distortion (THD) 1 kHz, 100V out (80% indicated power)	0.2%
Dynamics	> 90 db
Operating Frequency	32 Hz - 42 kHz
Voltage Gain 100V OUT	81 (38dB)
Input Sensitivity (V RMS)	+ 4 dB 1.23v
Subsonic Filter - 3db, nachylenie	32 Hz, 24 dB/oct
Indicators (LED)	Signal, clip, ready, protect
Regulators, switches Front Back	Signal, vol Priority, priority HPF 240 Hz priority mode (auto/manual)
Cooling	Automatic heat control forced-cooling (From front to back)
Protections	Limiter, subsonic, soft start temp,
Emergency Power	24V DC +/- 17% lub 14-20V AC
Power Supply	230V AC + 10% - 15%
Idle (230V AC)	<160mA
Supply current at 1/8 rated power, pink noise	1.1 A
Supply current at 1/3 rated power, pink noise	1.6A
Filter storage	20000 uF
Max. output voltage	120-130V
Max. power dissipation	600W
Sockets inputs outputs	Signal in, priority in priority, control
Slew rate 100V OUT, Rated impedance	25V / us

SECTION X

LIST OF APPROVED MANUFACTURERS / AGENCIES / MATERIALS

Services / Materials to be consumed in the work shall be of the following manufacturers / agencies. In case the required materials / services are not available or the materials / services available with the manufacturers / agencies mentioned below do not meet the specifications (decision of the E-in-C in this regard shall be final & binding), the contractor shall obtain materials / services from the manufacturers / agencies approved by the E-in-C in writing.

1. LIST OF APPROVED MAKES / AGENCIES FOR CIVIL & PLUMBING MATERIALS

S. No	Materials	Manufacturers / Agencies
1	Ready mixed Concrete	UltraTech, RMC, RAMCO, ACC, Birla
2	Ordinary Portland Cement (Minimum 43 Grade)	UltraTech, RAMCO, India Cements, Birla (Grasim), ACC
3	Reinforcement/Structural Steel (Each LOT shall accompany manufacturer's Test Certificate)	SAIL, TISCO, RINL or BIS approved manufacturers
4	Stainless Steel	Salem Steel or as approved by E-in-C
5	White Cement	JK Cement, Birla White
6	Sand	Only River sand after approval of the sample by E-in-C
7	Bricks, Stones slabs, Lime, Neeru Stone aggregate	Samples to be got approved by E-in-C before use
8	Vitrified Tiles	Nitco, Johnson, Naveen, Euro, Morbito, Somany / Kajaria
9	Flush doors	Kutty Flush Doors, Mysore Boards, Indian Plywood Mfg, Co, 'KIT' Ply' brand or any BIS approved brand
10	Fire check steel doors	Godrej, Sukri, Pacific works controls
11	FRP Doors	Fibrevent, Techno skills or Equivalent (or as approved by E-in-C)
12	Aluminium Fittings	Everite, Garnish,Crown Classic
13	Hydraulic floor Spring	Everite, Garnish, Hardwyn
14	Aluminium Extruded Sections	Jindal, Hindalco, Indalco
15	Aluminium Doors/Windows	As approved by E-inN-C
16	Paints, Distempers	Jenson & Nicholson, Asian, ICI, Nerolac
17	Glazing	Float Glass of Modiguard or Saint-Gobain
18	Water proofing Works	As approved by E-in-C
19	Hydraulic Door Closers	Hardwyn, Everite, Garnish
20	Water Proofing Cement Paint	Showcem India, ICI, Nerolac
21	Ceramic Glazed Floor Tiles	Nitco, Orient, Kajaria, Somany, Naveen
22	Super plasticizer	CICO, MC Bauchemie (India) Pvt Ltd, Roffes Construction Chemicals, Pedilite Industries
23	PVC Flooring	Armstrong

24	False Ceiling (a) Fibre (b) Galvanized Steel (c) Calcium Silicate	 Armstrong, Gyproc (Saint-Gobain) Armstrong, Gyproc (Saint-Gobain) Aerolite, Gyproc (Saint-Gobain)
25	Cast Iron Pipe and Fittings (Soil Pipes)	BIC, HEP, NECO, Ajmera
26	RC Hume Pipes	Indian Hume Pipe Co, Spun Pipe Co., Sementia, CH Patel & Co or Equivalent
27	Stoneware Pipes & Fittings	Dalmia, Parry, TACEL or equivalent
28	Cast Iron Pressure Pipes & Fittings	Tisco, BRM, KESORM or Equivalent
29	GI Pipes (ISI marked)	TATA, Zenith, Jindal, Gujarat Steel, ITC
30	GI Fittings (ISI marked)	'R' Brand, UNIK or equivalent
31	Gunmetal Valves & Fittings	Premier, Leader, Zoloto, or ISI marked brand
32	CI Sluice Valves, Check valves	IVC (Calcutta) Kirloskar/ Upadyaya/or with ISI mark
33	CP Brass Sanitary and water supply Fittings	Jaguar/Essess/SOMA/BILMAT/ Dripless or equivalent approved by E-In-C
34	Vitreous China Sanitary ware	Hindustan, EID Parryware, Cera
35	WC Seats & Covers	Commander, Diplomat, Admiral
36	Polyethylene/Polypropylene CISTERN	EVERLAST, FLUSHFLO, ESYFLO, CHALLENER, CHAMPION, COMMANDER, MARVEL, Slimline
37	CI Fixtures, CI Cover & Frame	Ashok Iron Works/Bombay Iron Works/A Husainji / Ismaelji, Neco, BIC, RIF
38	CPVC Pipes	Astral Polytechnik, Ashirvad, Ajay Industrial corp
39	Curtain/Wall/Structural Glazing	Specialist Agency to be employed with Prior Approval of E-In-C
40	Plywood Products, Parcticle Boards & Veneers	Duroply (Green Marked, BWR Century Plywood, Green Plywood Kitply, Mysore Boards
41	Adhesive	Pidilite, Araldite
42	Plastic Laminates	Formica, Greenlam, Bakelite HYLAM
43	Powder Coatings	Berger/Nerocoat/Jenson & Nicholson
44	Tile Joint Filler	Bal Adhesives & Grouts,"ROFFE" Rainbow Tile Mate, Silicon Sealnet of GE Bayer Silicon/"Zentrival FM" of MC-Bauchemie (India) P Ltd
45	Resin Bonded Glass Wool	Crown Fibre Glass/Rock lloyd or equivalent approved by E-in-C
46	MS Tubes	TATA or equivalent
47	Roof Water Proofing	India Water Proofing, CICO, SIKA
48	Silicon Sealant	GE Bayer Silicone, SIKA
49	Anchor Fastener	Hilti, Bosch
50	Formwork Release Agent	Fosroc, MBT, MC Baucheme CICO, ADO Conmat

51	EPOXY	FOSROC. SIKA Qualcrete, Aradlite MBT
52	Water proofing System	CICO, FOSROC, SIKA, Supreme Siltech Chemicals, ADO Conmat
53	Stainless Steel Sinks	Prestige/AMC/Jayna/Kingston/Neelkanth
54	CP Waste, Spreaders for Urinals	Jaguar / Essess
55	Sensor based Auto Flushing System for Urinals	AOS Systems/Angash
56	SFRC Manhole Covers	Southern Concrete Industries, Rajvaibav Enterprises or equivalent
57	UPVC Pipes/Fittings	Supreme/Prince/ Finolex
58	Mirror	Atul / Modifloat/Saint Gobain/Golden Fish

2.0 LIST OF APPROVED MAKES FOR SEWAGE TREATMENT PLANT

SL.No	EQUIPMENT / ITEMS	APPROVED MAKE
1	Raw sewage pumpset - submersible type	Kishor, Grundfos, Kirloskar, ITT Lowara
2	Air Blower	Kay International , Kamlesh
3	Sludge pump	Kishor, Grundfos, Kirloskar, ITT Lowara
4	Chain pulley block	Indef, ardee, J.K. Morris
5	Axial flow fan	GEC, ABB
6	Pressure sand filter	Ion exchange, Thermax
7	Activated carbon filter	Ion exchange, Thermax
8	Filter feed pump - submersible type	Kishor, Grundfos, Kirloskar, ITT Lowara
9	Reclaimed water pump - submersible type	Kishor, Grundfos, Kirloskar, ITT Lowara
10	Sodium hypochlorite dosing system	Ion exchange, Thermax
LIST OF ELECTRICAL ITEMS FOR STP		
1	Motor	Siemens, NGEF, Crompton, Bharat Bijlee
2	Switches, PCC / LDB	L & T, Siemens, Crompton, GEC, ABB
3	HRC Fuses	Siemens, abb, l&t
4	Contactor	L & T, Siemens, Telemech, Kirloskar
5	Relays	ABB, Easen Reyrole, Kirloskar
6	Meters	GEC, Simco, Automatic Electric
7	Earth Leakage Circuit Breaker	Indo Asian, SCS, ABB, GEC

8	MCBs	LEGRAND, Indo Asian, L&T, Havels
9	Power Capacitor	Crompton, Universal, Asian, NGEF
10	Luminaries	Philips, Wipro, Crompton, GE
11	Cables	Universal, Omega, Torrent, Asian
12	Magnetic flow meter	Yokogawa / Blue star /Krohne marshall / Fisher Rosemount / Frehing or equivalent
13	Ultrasonic sensor	VEGA (CONTECH India Ltd), Endress, Hauser
14	pH sensor and controller	Fisher Rosemount / Endress + Houser

3. LIST OF APPROVED MAKES FOR ELECTRICAL AND SUBSTATION ITEMS

S. No	Materials	Manufacturers / Agencies
1	H.T.Panel	Crompton/ABB/Alsthom/Siemens/Ashok Leyland
2	Transformer	Crompton/kirloskar/Voltamp/Alsthom/(DRY, Cast Resin) / BHEL/ Universal
3	Bus trunking/Rising mains	(Along with all accessories) L&T /Schneider/GE/Control & Switchgear)
4	LT Panels	GE/BB/L&T/SIMENS/SCHNEIDER
5	ACBs	Same as in (4)
6	MCCBs	Same as in (4)
7	MCBs with DBs	Legrand/Hager/Alsthom/Merlin/Gerin/ Havells/Standard/Indo-asian
8	Accessories of HT/LT Panels	As per manufacturer's specified make
9	HT/LT UG cables	Cable corporation/Universal/Gloster/Havells/NICO /Polycab
10	Wiring cables	Polycab/Havells/RR Cables/Finolex
11	Switches (SFU)	GE/ABB/L&T/Siemens/Schneider
12	Modular Switches (SFU)	Legrand/Carbtree/Ess Esskay(signature)MK/clipsal/Northwest
13	Piano Type switches and Boxes	Anchor/Leader
14	Cubicle Type Fuse Unit	Siemens /GE/L&T/Siemens/Schneider
15	SFUs/Isolators	Siemens/GE/L&T/ABB/ SCHNEIDER
16	Starters / Contractor/Bi metal Relay	Siemens/L&T/ABB
17	Push Button/Indicating Lamps (LED type)	Siemens/L&T/ABB
18	CTs	Kappa
19	Control Fuse Base with HRC fuse	GEC / Alsthom

20	Selector Switch	Salezer
21	Measuring Instruments	AE/IMP/Rishab
22	MS Conduit	Supreme /BEC/NIL /or any Other ISI marked
23	PVC Conduit	Precision/Avon Plast/Clipsal
24	Accessories for PVC Conduit	Precision/Avon Plast
25	Capacitors	Universal / Siemens/L&T / GE
26	Relays	L&T/EE/GE
27	Digital Meters	Enercon/Alacrity/L&T
28	Jointing Kits	Rey Chem/3 Birla
29	Luminaires	Philips, Pierlite, Thron, Wipro
30	Fans	Crompton, GE, Khaitan, Usha

4. LIST OF APPROVED MAKES FOR FIRE HYDRANT SYSEM

S. No	Materials	Manufacturers / Agencies
1	Diesel Engine	Kirloskar/Cummins
2	Fire Pumps	Kirloskar/Mather & Platt/Seimens
3	Electrical Motors	Kirloskar / Seimens
4	MS Pipes ('C' Class)	TATA / ZENITH
5	Butterfly Valves	Intervalve / Audco/ Leader
6	BALL VALVE (15-40 mm Dia)	RB/ITAP/Leader
7	Sluice Valves	Kirloskar/Kalpana/UNIK'R' Brand
8	Non-Return Valve (Flap Type C I)	Intervalve/Audco
9	Hydrant Valves	Newage/Minimax/Peter Autokit
10	Hose	Newage, Premier Extra, Padmini, Aqua Dura
11	Fire Extinguisher	Safex/Minimax/Peter Autokit
12	Pressure Guage	HD/Waree/H-GURU/Fiebig
13	Pressure Switch	Danfoss/Indfoss
14	Termination Lugs	Dowells/Usha
15	PVC insulated Copper Wires	FINOLEX/WINCAP/POLYCAB
16	Cables	Universal/CCI/Gloster
17	SFU's/FSU's	Ee/L&T/C&S
18	HRC Fuses	Havells/Ee
19	Over Load Relays	Ee/L&T
20	Single Phase Preventer	L&T/ Minilac
21	Indicating Lamps & Push Buttons	L&T /Technic
22	Air Break Contractors	Seimens/L&T/ABB
23	Sprinkler Head	HD/Tyco/Reliable/Fireasfe
24	Sprinkler Icv	HD/Tyco/Viking/Reliable/Fireasfe/Wormacd
25	Gunmetal Branch Pipe	Newage/Minimax/WINCO/Kailash
26	Threaded pipe fittings	R Brand/Unik
27	Air Release Valve	Rb/Tbs/Cimbrio

28	First Aid Hose Reel Drum	Minimax/Newage
29	First Aid Hose pipe	Padmini/Swastik/Usha Fire
30	Suction Strainer	Grandprix /Jaypee/Kirloskar/Leader
31	Battery	Exide/Amco
32	Pipe Protection	Pipe Kote (4mm Thick)
33	Pipe Support	Hi-Tech /Fabricated As per Site Conditions
34	Nozzle	Newage/Winco/Kailash
35	Foot valve (Gunmetal)	Neta/Leader
36	Foot Valve (Cast iron)	Kirloskar

5. LIST OF APPROVED MAKES FOR FIRE DETECTION SYSTEM

S. No	Materials	Manufacturers / Agencies
1	Addressable Smoke and Heat Detectors and Multi Criteria	Notifier/Edwards/Bosch
2	PVC Insulated Copper Cables	Finolex/Lapp/Belden
3	Addressable Panel	Edwards/Bosch Notifier
4	Duct Detectors/Manual Call Box/input Module/Control Module	Zicon, Firepro, Honeywell, Siemens, Schneider, Bosch
5	Strobe	System Sensor /UL listed
6	Conduit	BEC/Vimco

6. Miscellaneous Items

S.No	ITEM DESCRIPTION	APPROVED MAKES
	PA System components	**Bosch/Ahuja or equivalent**
	EPABX	**Siemens or equivalent**
	Telephone Handset	**Beetel or equivalent**
	CC TV SYSTEM	
1	Cameras with housing	Pelco/Honeywill/Bosch
2	DVR	As above
3	Monitors	As above
4	Co axial cables	LAPP/BELDEN

	ELEVATORS/LIFTS	OTIS, JOHNSON, SCHEINDLER

8. LIST OF APPROVED MAKES FOR HVAC SYSTEM

S.No	ITEM DESCRIPTION	APPROVED MAKES
1	**Air Cooled Screw Chillers**	**Carrier, Trane, York**
2	**Air Handling Units**	**ETA,**
3	**Primary & Secondary Pumps**	**Beacon, Kirloskar, Mather & Platt, Grundfos**
4	**Cooling Coils**	**Blue Star, Carrier, ETA**
5	**HVAC Controls**	**Honeywell, Johnson Controls, Siemens**
6	**Electric Motors**	**ABB, Chrompton & Kirloskar, Siemens**
7	**Variable Frequency Drives**	**Allen Bradley (US), Alstom (France), Danfos (Denmark)**
8	**Pre Fabricated Ducts**	**Voltas, Camduct, Zeco, Alfa Duct, Technoair**
9	**FCUs**	**ETA, Zeco, Clivert**

9.0 LIST OF APPROVED MAKES FOR WATER TREATMENT PLANT

The following are the approved makes for Mechanical equipment. Tenderer shall note that use of the equivalent make shall be subject to approval of the E-in-C.

SL.No	EQUIPMENT / ITEMS	APPROVED MAKES
1	Raw water pump set	Kishor, Grundfos, kirloskar, IIT Lowara
2	Pressure sand filter	Ion exchange, Thermax
3	Softener	Ion exchange, Thermax
4	Sodium hypochlorite dosing system	Ion exchange, Thermax
5	Drinking water pump set	Kishor, Grundfos, kirloskar, IIT Lowara
6	Drainage pump set	Kishor, Grundfos, kirloskar, IIT Lowara
7	Chain pulley block	Indef, Ardee, J.K. Morris