



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
KHARAGPUR, WEST BENGAL 721302

TENDER DOCUMENT

for

**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR
CONDITIONING WORK FOR OF THE FIBRE OPTIC SYSTEM LAB OF
E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR**

NIT No: IITKGP/IW/RAC/E&EC/2018-19 DATED 05.02.2019

Tender Serial No. _____ Issued to:

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1. NOTICE INVITING TENDER

1.1. INTRODUCTION

Indian Institute of Technology (IIT) Kharagpur, hereinafter called IITKGP, invites sealed tenders from the eligible contractors for **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR OF THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR**. Particulars of the project are as following.

1.2. PARTICULARS

1.NIT Number	NIT No. IITKGP/IW/RAC/E&EC/2018-19
2.Name of Work	SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR
3.Location of Work	THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT FLOOR, IIT KHARAGPUR, West Bengal 721302.
4.Estimated Cost(including GST)	₹ 20, 79,379.00 /- (Rupees Twenty Lakhs Seventy nine Thousand Three Hundred and Seventy nine Only)
5.Earnest Money Deposit	₹ 41,500.00 (Rupees Forty one Thousand Five Hundred Only)
6.Time Limit	100 days.
7.Tender Fee	₹ 500/- (Non-refundable)
8.Tender Basis and Mode	Two stage(Technical Bid & Financial Bid)
9.Mode of Payment to IITKGP(EMD/Tenderfee)	Demand Draft / Pay order in favour of IIT Kharagpur payable at Kharagpur.
10.Date, Time & Venue of Pre-bid Meeting	19 th February 2019, 1100hrs, Estate(E&M) Meeting Room, 1st Fl, Old Bldg, IIT Kharagpur. Site visit shall be done on same day after the pre-bid meeting if required.
11.Closing Date & Time for Receipt of bids	28 st February 2019 up to 1500hrs
12.Date & Time for Opening of Technical Bid	28 st February 2019 at 1600hrs
13.Date& Time for Opening of Price Bid	To be intimated to the eligible bidders subsequently.
14. Engineer-in-charge and contact details.	Mr .Soumitra Banerjee, Engineer RAC Tel: 03222-282724, Email: sbanerjee@adm.iitkgp.ac.in
15. Address for tender issue, submission and opening	Office of SE(E&M), 1 st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302
16.Website for full and updated information	https://eprocure.gov.in/cppp/tendersearch; http://www1.iitkgp.ac.in/topfiles/tenders.php

1.3. ELIGIBILITY CRITERIA

- 1.3.1. The bidder must be registered in appropriate class of works with Government organization like CPWD/ PWD/ MES or PSUs or those having experience in similar nature of works awarded by Government / Semi Government Organizations/ Government Funded Autonomous Organization.
- 1.3.2. The bidder must have done at least 1 (ONE) similar work of value of 80% of the estimated cost for HVAC works **or** 2 (TWO) similar works for projects each of value 60% of the estimated cost for HVAC works **or** 3 (THREE) similar work for projects each of value 40% of the estimated cost for HVAC Works with Government/Semi-government/ PSU/ Government Funded Autonomous Organization during last **7 (seven) years** preceding last date of the month of tender submission.
- 1.3.3. The Bidder should have registered Sales & Service office in Kolkata with adequate manpower. List of tools and tackles and resume of the workmen may be provided in the technical BID. Firm should have full-fledged service set up in Kolkata. Organization chart of the service set up should be furnished duly signed by authorized signatory.
- 1.3.4. Either the bidder or his authorized dealer/ Service provider can bid for the tender. An authorization certificate may be produced along with technical Bid.
- 1.3.5. Firm should have valid ISO certification. ISO certificate shall be furnished.

Note:

- (i) The estimated cost is **₹ 20, 79,379.00** /- (Rupees Twenty Lakhs Seventy nine Thousand Three Hundred and Seventy nine Only)
- (ii) The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to the last date of receipt of applications for tender.
- (iii) **Similar works shall means:** Supply installation testing commissioning of Air conditioning system.

1.3.6. Special condition for associate consultant:

~~This work includes an item in Part II of BoQ for detailed design and drawing work including structural and architectural, electrical, S&P. Bidders shall associate themselves with the consultant eligible for comprehensive consultancy work at least for 1 (one) similar project costing 80% of the estimated cost or 2 (two) similar projects for each value 60% of the estimated cost or 3 (three) similar projects each value 40% of the estimated cost.~~

~~The bidder has to submit document in support of eligibility of their associate consultant.~~

- 1.3.7. The bidder or the specialized agency the bidder intends to associate with must be registered with appropriate government authority as a bonafide business entity and must have GST registration certificate and Permanent Account Number of income tax.
- 1.3.8. Electrical work shall be executed by selected bidder through agency holding electrical license and electrical supervisor license valid on date of execution.
- 1.3.9. The validity of the registrations and licenses should be valid as on the date of tender submission.
- 1.3.10. Average annual turnover of the bidder as per ITCC or profit & loss statement shall not be less than 30% of the estimated cost, not having incurred loss in more than two years, during last 5 years ending 31 Mar 2018.
- 1.3.11. Bidder must hold solvency certificate from any scheduled banks for a minimum value of 40% of the estimated cost, issued not earlier than 6 (six) months from the last date of submission.
- 1.3.12. **Special condition for HVAC related Electrical and Civil Work:**

The scope of HAVC shall include following civil and electrical work-

- Opening /Closing / Making hole in existing Masonry wall/ Concrete / Glass structure to facilitate entry and exit of duct / pipe work and finishing it good.



1. Quality of above works shall be assessed by the bidder before quote as per his scheme of execution.
2. All above work shall be executed and finished good to the satisfactory of Engineer- in-charge.

Sd/-

Chief Engineer

On behalf of the Director, Indian Institute of Technology Kharagpur

Copy to:

- 1) Registrar
- 2) SE(C/ E&M)
- 3) Engineer (RAC)
- 4) Assistant / Junior Engineer (Civil/ E&M)
- 5) Notice Board
- 6) Office file



1. INFORMATION TO BIDDERS

A. SCOPE OF WORK

Indian Institute of Technology intends SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR. The application of the lab shall be clean room application to support Micro-/Nano- Robotics fabrication and characterization facility.

The job needs to be executed adjacent to busy traffic area (vehicular/ pedestrian) without causing any disturbances to the normal traffic circulation. Adequate/ safe barricading has to be ensured to segregate construction zone from public circulating area.

- i. The scope of work under this tender comprises the supply, installation, testing and commissioning of Low side Work for HVAC System conforming to the specifications and in accordance with the details of the Bill of Quantity (BOQ) and the drawings issued. The work shall include all minor and incidental items necessary for the proper functioning of the complete system, even though not specifically detailed or mentioned herein.
- ii. The vendor shall work out execution sequence and methodology so as to complete the project within the envisaged time and the estimated cost, duly handling the constraint mentioned above. *Details of other scope of work are listed at Annex II & III.*
- iii. Detailed scope of work is further listed as under: **Particular Conditions**
- iv. Submission of all Shop Drawings, Material Data Sheets and Performance details
- v. Submission of all final documentation including all Test-Reports, Catalogues Instruction Manuals, O & M Manuals, 'As Built' drawings and all other applicable documents as part of Handing-Over process.
- vi. Necessary interface with the IBMS system of the Purchaser including all the hardware required for the same as per I/O summary to be finalised.
- vii. On-site training and familiarization of the Client's operating staff for a period not less than one week in the overall operation of the installed systems
- viii. The proposed drawings are enclosed from **Annexure II**

B. GENERAL INSTRUCTIONS

- i. Bidding documents are to be obtained electronically through websites: <https://eprocure.gov.in/cppp/tendersearch>; <http://www1.iitkgp.ac.in/topfiles/tenders.php>. The tender fee in the prescribed mode must accompany the tender documents issued electronically at the time of submission.
- ii. This bid document shall be read in conjunction with GCC (General Conditions of Contract) available on <http://www1.iitkgp.ac.in/topfiles/tenders.php>.
- iii. The bidder shall visit and inspect the site and obtain all information on his own responsibility and at own cost, which may be necessary for the purpose of quoting and submitting the tender. No excuse or ignorance as to site conditions and local information shall be accepted after awarding of the contract. Access to the site will be granted by the Engineer-in-charge on all working days within working hours.
- iv. IITKGP shall not provide any space at site for labour hutments.
- v. All clarifications about the tender shall be sought by bidder on or before pre-bid meeting. The bidders may make suggestions which shall be considered during the Pre Bid Meeting. Intending bidder(s) may also send their queries or suggestion, if any, through e-mail to the Engineer-in-charge on sbanerjee@adm.iitkgp.ac.in on or before **19th Feb 2019 11.00AM**. No queries shall be entertained after notification of replies to noteworthy queries received till the date of pre-bid meeting.
- vi. Completion certificate issued by Competent Authority will only be considered as credential. If the Completion certificate issued by Competent Authority does not reflect the type of work, then Final bill / Schedule of Quantity of the qualifying works also to be attached along with the Completion certificates. Certificate from private individuals / organizations for whom such works have been executed shall not be accepted.
- vii. The bidding document (consisting of specifications, the schedule of quantities of various types of items to be executed, the set of terms and conditions of the contract and other documents / drawings, if any), Corrigenda, Clarifications to Pre-bid queries can be downloaded from the websites: <https://eprocure.gov.in/cppp/tendersearch>; <http://www1.iitkgp.ac.in/topfiles/tenders.php>. Corrigenda, if any shall be published only on these websites. The institute shall not be responsible for any delay / difficulties / inaccessibility of downloading facility for any reason whatsoever.





- viii. All costs, charges & expenses that may be incurred in connection with the preparation of his tender shall be borne by him and the Institute accepts no liability whatsoever therefore.
- ix. Rates quoted by the bidders shall be inclusive of GST (Goods and Services Tax - Central, State and Interstate) and all applicable taxes. Income Tax and all other statutory deductions like labour cess etc. will be deducted from the bill as per prevailing rules.
- x. Exemption to IITKGP against any tax/ duty/ fee/ surcharge/ charge/ cost, if any, found applicable or sought later from IITKGP after award shall be passed on to IITKGP by the contractor without dispute.
- xi. IITKGP reserves the right to reject any or all of the bids without assigning any reason.
- xii. **Bid Validity:** Bid shall remain valid for 120 days from the date of submission.
- xiii. **Firm Price: Bidder's quoted Rates/Prices for executing the activities under the Contract shall remain firm till completion of the entire work & shall not attract any escalation under any circumstances whatsoever.**
- xiv. If any information furnished by the bidder is found as false / fabricated, then his bid will be rejected and treated as cancelled. Even if the such manipulation is detected at any stage after signing of the contract, it would lead to termination of the contract besides forfeiture of Earnest Money Deposit and liabilities towards prosecution. In such cases the bidder will be debarred from participation in future tendering process in IITKGP for next 05 (Five) years.
- xv. **Earnest Money Deposit (EMD)** of requisite amount and that in prescribed mode or proof of payment thereof shall be enclosed with the Technical Bid explained in following section.
- xvi. **Refund / Conversion of Earnest Money Deposit:** The Earnest Money received shall be refunded to the unsuccessful bidders without any interest after the opening of financial bids. The Earnest Money Deposit of successful bidder shall be retained and converted into part of Security Deposit.
- xvii. **Forfeiture of Earnest Money Deposit:** Earnest Money Deposit will be forfeited in any of the following cases:
 1. The bidder withdraws / modifies his tender during the period of Bid Validity.
 2. The bidder, in case of tie between lowest bids, refuse to submit revised offer.
 3. The bidder does not accept the correction of arithmetical errors of his tender.
 4. The bidder fails to deposit Performance Guarantee and information as per format given in GCC within the stipulated time period before award of the work.

C. SUBMISSION OF TENDER

- i. The sealed tenders shall be received at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302, up to 1500hrs, 28st February'2019 or Corrigenda otherwise.
- ii. Tenders received after the due date and time shall not be considered.
- iii. Tenders shall be submitted in a sealed Master envelope super scribed "SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR" with NIT No. IITKGP/IW/RAC/E&EC/2018-19 as NIT No., containing three separate sealed covers, each clearly super scribed as "Tender Fee and EMD", "Technical Bid" and "Financial Bid" respectively, in the following manner:
- iv. **Envelope-1 (Tender FEE & EMD)** will consist of:
 - i) **Tender Fee for ₹ 500/- (Non-refundable), in the prescribed mode or proof of payment thereof.**
 - ii) **Earnest Money Deposit** of requisite amount in the prescribed mode or proof of payment thereof.
- v. Tender without payment of Tender Fee & Earnest Money Deposit would be summarily rejected.
- vi. **Envelope-2 (Technical Bid)** will consist of:
 1. Covering letter of the offer signed by firm's authorized signatory.
 2. Documents establishing the identity and authenticity of the bidder/ bidding firm
 3. Self-certified copies of all the documents in support of eligibility of bidder.
 4. Self-certified copies of all the documents in support of eligibility of proposed/associated agencies for specialized services.
- vii. **Envelope-3 (Financial Bid)** will consist of the complete tender document, each page duly signed and stamped by the bidder as acceptance of the conditions, Declaration by Bidder and **Financial Bid** all duly filled-in, signed by the bidder or his/her authorized signatory and stamped.



D. EVALUATION OF BIDS AND AWARD OF WORK

- i. The Bid of bidder will be opened on the specified date and time of opening at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 7213 in the presence of willing bidders or their authorized representatives.
- ii. Date, time and place of opening of Financial Bid will be informed after evaluation of Technical Bid to the Technically Qualified Bidders.
- iii. Bids shall, first, be checked for payment of **Tender Fee** and **Earnest Money Deposit**. Only those bids found to have duly paid/ submitted Tender Fee and Earnest Money Deposit shall be considered for evaluation.
- iv. Evaluation of **Technical Bid**: The bids received will then be assessed on the eligibility criteria mentioned at para 1.3 of Notice Inviting Tender. Bids found not meeting the eligibility criteria shall be considered non-responsive and shall be rejected summarily.
- v. IITKGP retains the right to revert back to individual bidders with further clarifications / queries on the Technical Bid. The bidder has to respond to the queries within the specified time mentioned in the covering letter.
- vi. On the date & time specified for opening of Financial Bid or the Revised Financial Bids as the case may be will be opened on specified date and time.
- vii. **EVALUATION OF Financial Bids**: The Financial Bid should contain the complete bid document with duly filled in Schedule of Financial Quote. Financial Bids opened as above will be checked for arithmetical errors.
- viii. The successful bidder shall be issued Letter of Acceptance (LOA) of the bid, and be required to furnish a Performance Guarantee as per General Conditions of Contract, Program Schedule with specific Milestones to be achieved as to complete the work within the stipulated time limit and details of his Technical Staff to be deployed as per ANNEXURE-I
- ix. **Letter of Award (Work Order)** shall be issued to the successful bidder only after receipt of the Performance Guarantee, along with Program Schedule and the details of Technical Staff to be deployed for the work.
- x. **Agreement (Contract)** consisting of complete tender document including conditions, bill of quantities, technical proposal and specialized services, drawings, if any, and acceptance thereof together with any correspondence leading thereto, shall be drawn and signed with the awardee within 10 days of the Letter of Award.
- xi. **Date of start** of work shall be reckoned from the 7th day of the issue of the Work Order.
- xii. **Defect Liability Period (DLP)**: In partial modification to clause no.16 of General Conditions of Contract(GCC), the Defect Liability Period shall be 12 months after the certificate final or otherwise of its completion of work or till the final bill has been prepared.

C. TERMS OF PAYMENT:

- a. 70% towards supply of materials at site.
- b. 20% towards installation.
- c. 5% towards successful commissioning and handing over with all test reports and as-built drawings approved by IIT- Kharagpur.
- d. 5% towards retention amount till the completion of Defects Liability Period.

Period of payment will be minimum 60 days from the date of submission of bills.

2. UNDERTAKING BY THE BIDDER**UNDERTAKING**

I / We have read and examined the Tender document including terms & conditions, specifications, bill of quantities, drawings and designs, general rules & directions, General Conditions of Contract, Special Conditions of Contract and all relevant other documents, publications and rules referred to in the Conditions of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for execution of the work specified for the Indian Institute of Technology Kharagpur within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for 120 days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of Rs. ----- has been deposited in cash / demand draft of a scheduled bank / Pay order as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said Director, Indian Institute of Technology Kharagpur or his authorized officer shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that the Director, Indian Institute of Technology Kharagpur shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein.

Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / We shall treat the tender documents, drawings and other records connected with the work as secret / confidential documents and shall not communicate information derived there-from to any person other than a person to whom I / We am / are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Seal & Signature of Contractor

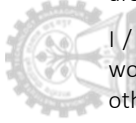
Postal Address

Dated

Witness

Address

Occupation



ANNEXURE-I

3. TECHNICAL STAFF OF CONTRACTOR

DISCIPLINE	NAME	QUALIFICATION	EXPERIENCE	CONTACT NUMBER
Overall Project In-charge				
Engineer - Structure and Civil Works				
Engineer - Electrical & Mechanical Works				
In-charge - Safety, Health & Environment				

Seal & Signature of Contractor



भारतीय प्रौद्योगिकी संस्थान खड़गपुर

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

4. PARTICULAR CONDITIONS

Indian Institute of Technology intends air-conditioning of the fibre optic system lab of E&EC department at 1st floor. The application of the lab shall be clean room application to support Micro-/Nano- Robotics fabrication and characterization facility.

1. AIR-CONDITIONING

DESIGN CRITERIA

1.1 OUTDOOR DESIGN CONDITIONS :

Outdoor Design Conditions for Kharagpur are based on Weather data compiled and published by ISHRAE (WeDco) for Kolkata and past experience corresponding to 2 % annual cumulative frequency of occurrence and the outdoor design conditions have been considered as follows:

Design Conditions	DRY BULB		Mean Coincident WBT		RH
	Deg F	Deg C	Deg F	Deg C	%
SUMMER	110	43.3	83	28	33
MONSOON	94.4	34.66	82	28	60
WINTER	56	13	48	9	55

1.2 INDOOR DESIGN CONDITIONS

Based on past experience, indoor design conditions for centrally air-conditioned spaces shall be as follows:

SPACE	Temperature Deg C	Relative Humidity %	Remarks
Student sitting area	26±1.1	60±10 % at full load condition	
Lab area	23±1.1	70±10 % at full load condition	

Note: Winter Heating is not envisaged.

1.3 MECHANICAL VENTILATION

Area	Air Changes Per Hour(ACH) as per NBC	Remarks
Toilets	15	

1.4

BUILDING CONSTRUCTION DATA

The Building construction data for calculating the building air-conditioning load is as below.

- i. External Wall : $U = 1.81 \text{ Watt / Sqm}^{\circ}\text{C}$
(0.32 Btu / HrSqft^oF) (230mm thick brick wall)
- ii. Roof (Exposed to sun) : $U = 1.316 \text{ Watt / Sqm}^{\circ}\text{C}$
(0.23 Btu / HrSqft^oF)
- iii. External Glass Specifications : Glass with following details:
 $U = 5.8 \text{ Watt / Sqm}^{\circ}\text{C}$
(1.02 Btu / HrSqft^oF)



Solar heat gain Coefficient: 0.8

1.5 OCCUPANCY AND INTERNAL HEAT GAIN

SPACE	Occupant Density	Equipment Load	Lighting Load	Fresh Air
Student sitting area	75sft /person	125W/ Person	Average 1 W/sft	Asper ASHRAE 62.1 2004 or ACPH @1.5 , whichever higher
Fiber Optic Lab	5 persons	4kW	Average 1.5 W/sft	Asper ASHRAE 62.1 2004 or ACPH @1.5 , whichever higher

2. COOLING ESTIMATE

Estimated cooling loads are tabulated in table-2.

TABLE -2

PRELIMINARY COOLING ESTIMATE FOR FIBER OPTIC SYSTEM LAB- E&EC DEPT, IIT KHARAGPUR

S.No	FLOOR	AREA PARTICULARS	AREA(sq ft)	PERSON	EQUIP LOAD (kW)	COOLING CAPACITY (TR)	D/CFM	IDU CAP
1	1 st Floor	Student sitting area	495	8	0.50	3.7	1400	2x 2.0TR HWU
2		Fiber Optic Lab	400	5	5.0	6.09	3500	1x 8.0 TR Dx AHU with condensing unit
TOTAL			2,548.00					

3. PLANT SELECTION

The selection and design of air-conditioning systems for lab is based on many factors and considerations. Important Design considerations for air-conditioning system for clean room are:

- Supplying airflow in sufficient volume to support the cleanliness rating of the room.
- Introducing air in a manner to prevent stagnant areas where particles could accumulate.
- Conditioning air to meet clean-room temperature, humidity and filtration requirements.
- Ensuring enough conditioned makeup air to maintain the specified positive pressurization.

Besides the room preparation in terms of materials and finishes play an equally important role in meeting these requirements. The idea is to minimize the internal generation of contaminants from the surfaces.

Clean room design contains much more than traditional temperature and humidity control. Design must consider aspects such as control of particulate, microbial, electrostatic discharge, gaseous contaminants, airflow pattern control, and pressurization and industrial engineering

aspects. A clean room differs from an ordinary ventilated/ air conditioned room mainly in three ways:

1. Increased air supply: The increased air supply is an important aspect of particle control. Normal air-conditioning systems are designed for 0.5 to 2 air changes per hour essentially based on the occupancy level or as determined from the building exhaust levels. A clean room would have at least 10 air changes per hour and could be as high as 600 for absolute cleanliness. The large air supply is mainly provided to eliminate the settling of the particulate and dilute contamination produced in the room to an acceptable concentration level.
2. The use of high efficiency filters: High efficiency filters are used to filter the supply air into a clean room to ensure the removal of small particles. The high efficiency filters used in clean rooms are installed at the point of air discharge into the room. Room pressurization is mainly provided to ensure that untreated air does not pass from dirtier adjacent areas into the clean room.
3. Room pressurization: The clean room is positively pressurized with respect to the adjacent areas. This is done by supplying more air and extracting less air from the room than is supplied to it.



4.0 SYSTEM PROPOSED

Air conditioning of lab shall be done with air cooled dx type condensing unit with scroll compressor and DX type air handling unit with 3stage filtration level.

LAB AREAS:

There shall be one air-handling unit (constant volume) serving in the lab. HEPA filters shall be used upstream of the air handling units to effectively prevent bacterial contamination. The AHU's shall have high static pressure fans to sustain the pressure drop across the HEPA filters. The supply and return air ducts along with the AHU shall be of GSS construction. The AHU & the condensing unit shall be located outside of the room (corridor shade side).

Following are the components and description of technical details of the AC system proposed.

1. Dedicated AHU with small foot print consisting of cooling coil placed in terrace serving these areas mentioned above. A survey of site may be conducted in advance. Major Components of the AHU are listed below.
 - a. Double skin 43 mm thick PUF insulated with thermal break profile and inner and outer skin thickness as 22 and 22g respectively.
 - b. Refrigerant condenser coil with DX condensers and type of refrigerant as R22 / R407C or equivalent ecofriendly refrigerant.
 - c. Pre filter on inlet of fresh air & return air.
 - d. Microvee filters with efficiency of 99% down to 5 microns
 - e. Low vibration / noise generation to civil structure and acoustics in the room.

Note: No heater has been considered.

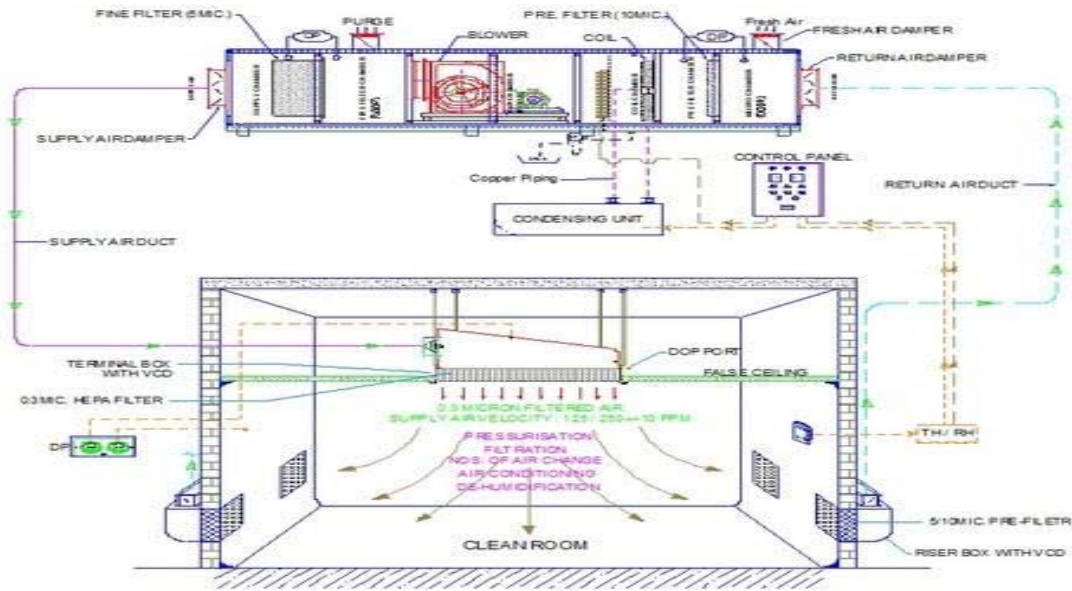


2. Thermal and acoustic insulation for ducting to reduce thermal loss and reduce noise inside the area. Thermal and acoustic insulation material shall be nitrile rubber. Using of glasswool is strictly prohibited.
3. Laminar flow air diffusers with Hepa filters having an efficiency of 99.97% shall be used to diffuse the conditioned air into lab. Return air shall be taken through the grills mounted near the floor and taken back to the air handling equipment. The air velocity in the laminar flow diffuser shall be restricted to 70 – 100 fpm.
4. Thermostat sensing both Temperature and Rh shall be located in lab to control AHU located in terrace.

AIR HANDLING UNIT



AIR FLOW PATTERN & PROPOSED SYSTEM

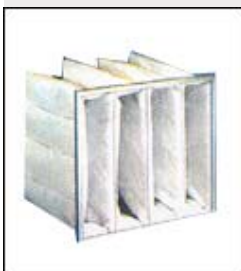


PRE- FILTER:



Type	:	Box & flange
Frame	:	Anodised Aluminum
Media	:	HDPE , Nonwaven High temperture Fabric
Efficiency	:	99% efficiency down to 5 microns
Recommended final pr. drop	:	3.5 –7 mm wc
Velocity across the filter	:	Less than 500 fpm
Size	:	Customized size


MICROVEE FILTER:



Type	:	Box & flange
Frame	:	Anodised Aluminum
Media	:	Thermally bonded synthetic filter media
Efficiency	:	99% down to 5 micron
Recommended final pr. drop	:	7 - 15 mm wc
Velocity across the filter	:	Less than 500 fpm
Size	:	Customized size



HEPA FILTER:

	Type	: Box & flange
	Frame	: aluminium & s.s.
	Sealant	: Polyethylene
	Media	: Micro Glass fibre paper / pleated
	Efficiency	: 99.97% down to 0.03 micron
	Recommended final nr. drop	: 30 – 45 mm wc.
	Velocity across the filter	: Less than 300 fpm

4. Additional scope need to be considered by AC vendor:

- a. Any type of civil work like foundation of outdoor unit, any wall cutting and making same good etc.
- b. Drain to be terminated to the nearest drain point.
- c. Any type of painting if required.
- d. Cost of Electricity and Water

All signal/control/power wiring/Earthing are included in HVAC scope of works including their terminations. Similarly supply and installation of all MCC/ circuit breakers/SFU/Isolators/Capacitor banks/Cabling works are included in HVAC contractor's scope of works.



5. TECHNICAL SPECIFICATIONS

1.0 Scope

1.1 Supply Installation, testing and commissioning of the split air-conditioners meeting in all respects the intents of the specifications. The supply of the units shall comprise:

- a) Out door unit
- b) Indoor Unit (AHU)
- c) Refrigerant piping connecting the two and drain piping
- d) Electrical wiring from the socket – outlet through the indoor and outdoor units with provision for local remote control.

2.0 Outdoor Unit

2.1 The outdoor condensing unit shall comprise a compressor, condenser coil, condenser fan, refrigerant connections and a casing. The compressor shall be hermetic type resiliently mounted for quiet operation. The compressor drive shall be a single phase motor refrigerant cooled and shall have an inbuilt over load protector. The unit shall be capable of frequent starting and stopping without causing any over load.

2.2 The condenser coil shall be a copper tube with aluminium fins. The tube diameter shall be not less than 10mm with a wall thickness of 0.4 mm copper. Tube shall have aluminium fins adequately bonded through a process of mechanical expansion. The number of fins shall not exceed 520 per meter (13 per inch) and the number of rows in each case shall be for the specified output. The condenser fan shall be a multi-blade propeller type designed for low noise and directly driven by a totally enclosed fan motor. The refrigerant connections shall be brought out into plain stub ends.

2.3 All the components shall be enclosed in a casing formed from heavy gauge 1.6mm galvanized sheet steel totally rust inhibited.

3.0 Air Handling unit:

3.1 The Air Handling unit shall be floor mounted type and suitable for outdoor installation. The unit shall consist of following specification:

Outer skin	0.8 mm Pre- coated GI
Inner Skin	0.8 mm Plain G.I
Frame work	Thermal break Al profile with thermal barrier.
Thickness of insulated panels	43 mm thick, CFC Free PUF injected (Density: 40 kg / Cu. m.)
Material of Drain pan	20 G SS-304 Tray duly insulated with 13 mm closed cell Nitrile insulation.
Unit Base	G.S.S base channel



DX COIL: (R-410)

Make Of Coil	As per approved make
Coil Casing / Blank offs	GI
Material Of Tube	Copper
Tube Dia (mm / inch)	9.52 mm / 3/8" O.D.
Thickness of tube (SWG / mm)	25 SWG / 0.50 mm
Header Material	Copper
Thickness & Material of fins	0.15 mm Plain Aluminum
No. of Fins per inch (FPI)	11 / 12

FAN & MOTOR:

Fan make	Comefri / Kruger/Nicotra / Equivalent
Motor make	ABB / CROMPTON /BHARAT BIJLEE /Equivalent

DOUBLE SKIN FLOOR MOUNTED HORIZONTAL AIR HANDLING UNIT SHALL HAVE: (with weather proof canopy)

- Mixing box with manually operated FA & RA damper in **Al** constructions.
- Filter section with 50 mm thick (EU-4) **box type pre filter** & 305mm thick (EU-5) bag type fine filter mounted on GI common filter frame.
- Coil section with **6 row** deep DX cooling coil with single number of distributor.
- Heater section with GI strip type heater in 3 bank construction of suitable capacity.
- Fan section with imported DIDW centrifugal **backward curved** fan, Drive set with V-belt & **Motor (EFF-1)**.
- Fine filter section with **305 mm thick (EU-13) flange type HEPA filter**.
- AHU shall have VFD with VFD compatible motor.

OPERATING PARAMETERS:

Air Qty(CFM)	3500
SP (mm wg)	100
Unit Model	Vendor to specify
Fan Type	Backward curve
Fan Diameter	Vendor to specify
Fan Speed (RPM)	Vendor to specify
Fan Outlet Velocity (m/s)	Less than 10
Shaft Absorbing Power (Kw)	Vendor to specify
Motor Rating (kw)	3.7 (approx.)
Coil Area(Sq.ft)	Not less than 7.4
Cooling Coil RD	6
Coil capacity	8.0



Distributor	1
Filter area (sq. ft)	Not less than 7.4
Heater (KW)	1.2
Length (mm)	Vendor to specify
Width (mm)	Vendor to specify
Height (mm)	Vendor to specify

4.0 Installation

- 4.1 The outdoor unit shall be installed as decided by the Indian Institute of Technology-Kharagpur. The indoor unit shall be ceiling suspended as shown on drawings/ as per the requirement of client.
- 4.2 Refrigerant lines shall be inconspicuously and generally as shown in the drawings and as directed on site. The suction and liquid lines shall be bonded together and insulated with 6mm thick elastomeric tubing. All power wiring shall be drawn from the nearest socket outlet and shall include the control wiring, power wiring, on-off switch with speed controller.
- 4.3 All pipe sizing shall be done taking into account the length and rise.
- 4.4 A 25mm insulated drain pipe shall be provided as shown on the drawing and as directed on site.

5.0 Testing

- 5.1 The unit shall be tested for establishing the capacity and power consumption. Tests shall be carried out in accordance with IS 5141 – 1969 (revised upto date) computed results shall tally with specified capacity and power consumption figures furnished with the tender offer.
- 5.2 On completion of piping the system and the piping shall be tested using Nitrogen gas by raising the pressure to 1.5 times the working pressure and holding the test pressure for 3 hours.
- 5.3 Tests shall be carried out on
- the compressor and drive motor side
 - condenser side for heat rejection
 - Cooling coil for cooling capacity
 - Evaporator air volume
- 5.4 A test certificate from prototype factory tests will be acceptable.

6.0 Mode of Measurement

- 6.1 Each unit shall be measured as one item of work which shall consist of:
- Outdoor unit
 - Indoor unit
 - Refrigerant and drain piping (with insulation)
 - Electrical power control wiring, room thermostat and control panel
 - Refrigerant charge & oil



- n) Erection
- o) Commissioning and testing

7. REFRIGERENT PIPING.

7.1 Scope.

The scope of this section covers supply, installation of refrigerant piping & drain piping with insulation as specified here & as shown in the drawings.

7.2 Refrigerant copper Piping

- 16/18 gauge copper tubing shall be used to make connections to equipment's wherever required.
- Flare fittings e.g. flare nuts; tees, elbows, reducers etc. shall be of brass.
- The pipes and fittings shall be connected by means of welded joints. The connections to gauges, controls etc. (if any) shall be with soft copper tubing and flare fittings.
- Refrigerant piping routing shall be decided by Engineer – in – Charge.
- The refrigerant piping installation shall be as per drawing.

7.3 Drain Piping.

- All condensation drainage shall be pitched in the direction of flow to ensure adequate drainage with an adequate trap seal to prevent leakage / infiltration.
- Provide pitch of 20 mm per meter for a smooth drainage of condensate.
- Condensate drain piping fixing shall be as per drawing.
- The routing of Drain Piping shall be decided by Architect/ Engineer – in – Charge.
- The material for the drain pipe is GI.
- Drain piping supporting shall be as per drawing.

7.4 Suction Line Insulation.

The Suction Line shall be insulated with 19mm thk. Nitrile Rubber Insulation covered with aluminium foil (As per Specified with K Value of 0.027-0.029 K Cal/Hr.MDeg C at 0-16 Deg C)

7.5 Drain Piping Insulation.

The drain pipes shall be insulated with 25mm thick TF quality EPS insulation (density 16kg/cum) finished with 26 G al cladding.

7.6 Mode of Measurement.

- Refrigerant pipes with insulation shall be in linear measure along the center line of the pipe including accessories, supports etc and paid for per RMT.
- Condensate drain pipes with insulation shall be in linear measure along the center line of the pipe including accessories, supports etc and paid for per RMT.

AIR DISTRIBUTION

1.1 Scope

The scope of this section comprises of supply, fabrication, installation and testing of all sheet metal ducts and supply, installation, testing and balancing of grilles and diffusers, in accordance with these specifications and the general arrangement shown in the drawings. The duct work will conform to IS standards/codes and relevant ASHRAE Guidelines. For this purpose it is contractors responsibility to arrange at site all necessary equipments like drilling machine, welding machine, etc. and necessary work force. The duct rates mentioned in the BOQ are inclusive of nuts, bolts, sheets, supports, gaskets etc. complete and duly installed.



1.2 Duct Material

The material for various application of air distribution ducting shall be as follows : -

Application	Material
1) Air Conditioning.	Cold rolled sheets continuous galvanised with a zinc coating of 120GSM as per IS: 277 – 1977.
2) Supports & Duct Flanges.	Mild Steel Structural Steel Sections.
3) Gasket.	Foamed rubber.
4) Bonding	Mastic Sealant.

1.3 Duct Fabrication.

The ducts shall be fabricated from galvanised steel sheets (GSS) class VIII conforming to ISI:277 – 1962 (revised) or aluminum sheets conforming to IS:737 – 1955 (for aluminum ducts, if any). The thickness of the sheets should be as follows :

Thickness of Sheets for Rectangular Duct Construction.

Maximum Side	Thickness of Sheets	Gauge
Upto 750 mm.	0.63 mm	24
From 751 to 1500 mm	0.80 mm	22

1.4 All galvanized plain sheets shall be reasonably flat and free from twist. The zinc shall be clean, even and free from galvanised spots. Sheets shall not crack or peel during bending or fabrication. All sheets shall be procured from approved manufactures.

1.5 . All ducts for air conditioning and ventilation shall be rectangular in cross section and fabrication in accordance with the following table.

Maximum Size. (mm)	Minimum Thickness (mm)	Transverse Joint.	Bracing.
Upto 300	0.63 (24 SWG).	S-Drive, Pocket or bar Slips on 2.5 m centers.	None.
301 to 600	0.63 (24 SWG)	S-Drive, Pocket or bar Slips on 2.5 m centers.	None.
601 to 750		S-drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres.	25X25X3 mm angles, 1.2 mm from joint.
751 to 1000	0.80 (22 SWG)	Drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres.	25X25X3 mm angles, 1.2 mm from joint.
1001 ot 1500			



			40X40X mm angle conn- -ections, or 40 mm pocket bar slips with 35X3 mm bar reinforcing on 2.5 m centers.	40x40X3 mm angles, 1.2 mm from joint.
1501 to 2250	1.00 (20 SWG).	40X40 mm angle connec-	-tions, or 40 mm pocket or 40 mm bar slips, 1 m maxi- -mum center with 35 X 3 mm bar reinforcing.	40x40X3 mm diagonal angles or40X40X3 mm angles, 60 mm From joint.
2251 and above.	1.25 (18 SWG).	40X40 mm angle connec-	-tions, or 40 mm pocket or 40 mm bar slips, 1 m maxi- -mum center with 35 X 3 mm bar reinforcing.	40x40X3 mm diagonal angles, or40X40X3 mm angles, 60 mm From joint.

1.6 All duct shall be fabricated and installed unless otherwise stated as per IS : 655 – 1963 with amendment – 1 (1971 edition.)

Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight. The gauges, joints and bracing for sheet metal duct work shall further conform to the provisions as shown on the drawings. The internal ends of slip joints shall be made in the direction of air flow. Ducts larger than 1000 mm shall be cross-broken. Duct sections upto 1200mm length may be used with bracing angles omitted. Tapering angle should not be more than 30°. Change in dimensions and shape of ducts shall be gradual. Curved elbows shall have a centre line radius equal to one and half of the duct. All Air turns of 45° or more shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes arranged to permit the air to make the turns without appreciable turbulence. Guide vanes shall be fabricated out of 0.63 mm (24 SWG) thick G. S. sheets and equally spaced on side runner to be riveted /bolted to duct sheets. Guide vanes shall be securely fastened to prevent noise or vibration. GI splitter dampers complete with brass metal lever shall be installed at each bifurcation/trifurcation point of duct for proper flow of air quantity in each duct. Joints, seams sleeves, splitters, branches, take-offs and supports are to be as per duct details as specified.

1.7 Duct Installations

All ducts shall be installed as per the drawings and in strict accordance with approved for construction drawings prepared by the contractor.

During the construction the contractor shall temporarily close duct openings with sheet metal covers / polyethylene sheets to prevent debris-entering ducts and maintains them clean.

All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the buildings, whether or not the same are shown on the drawings. Where it becomes necessary to avoid beams or other structural work, plumbing or other pipes and / or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained as approved or directed by the Architect/Consultants.

If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points by any path available, subject to the approval of the Architect/Consultants.

All duct work shall be of high quality approved galvanised steel sheet, guaranteed not to crack or peel on bending or fabrication of ducts.



All ducts shall be rigid and shall be supported from the ceiling / slab by means of MS Rods of 8 mm (3/8") dia with MS angles at the bottom as shown in the drawing. The rods shall be anchored to RC slab using Anchor/dash fasteners. A rubber gasket of 5 mm thickness shall be provided between duct and angle to avoid metal-to-metal contact and vibration. Double nuts will be provided under angle supports.

The hanger spacing for duct supporting shall be not more than 2 meter.

Where ducts touches with wall or ceiling or beams or columns or floor, a rubber gasket of 5 mm thickness shall be provided between them.

All flanges, bracing and supports are to be mild steel and are to be essentially given a coat of red oxide primer.

Fire retarding flexible canvas / Rexene connections not less than 100 mm and not more than 200 mm are to be fitted to the delivery of all IDU's.

1.8 Duct Supports.

Duct supports shall be as follows:

Duct Perimeter (mm)	Support.	Location.
Upto 1800	40 X 40 X 3 mm MS angle with 9 mm tie rod.	At Transverse Joints.
Over 1800 to 2500	40 X 40 X 6 mm MS angle with 12.5 mm tie rod.	At Transverse Joints.
Over 2500	50 X 50 X 6 mm MS angle with 15 mm tie rod.	At Transverse Joints.

1.9 Volume Control Damper (VCD) & Duct damper

- The Volume Control dampers & Duct Dampers shall be lever operated and complete with locking devices, which will permit the dampers to be adjusted and locked in any position, and clearly indicating the damper position.
- The dampers shall be of splitter, butterfly or louver type. The damper blade thickness shall not be less than 1.25 mm (18 gauge).
- Manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.6 mm thick galvanised steel sheets and blades shall not be more than 225 mm wide.
- For air balancing an opposed blade damper with quadrant and thumbscrew lock should be provided.
- At the junction of each branch duct with main duct VCD's must be provided. At the delivery of all IDU's VCD's must be provided.
- The dampers shall be of Extruded aluminium.
- Installation of VCD's shall be as per drawings.

1.10 Fire Damper

- Dampers could be fusible link type as indicated in BOQ.
- Fire dampers shall be provided at the delivery of all IDU's.
- The dampers shall be of multiple blade type. The blades shall be constructed with minimum 1.8 mm thick aluminium sheets. The frame shall be of 1.6 mm thick. Other materials shall include return spring, locking device and temperature sensor.
- Installation of fire damper shall be as per drawings.



1.11 Standard Grilles and diffusers

- The supply and return air grille/diffuser shall be fabricated from extruded aluminium sections of thickness not less than 1.5 mm. The supply air grille/diffuser shall have single / double louvers. The front horizontal louvers shall be of adjustable type. The rear vertical louvers shall be of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers.
- The damper blades shall also be of extruded aluminium. The grille flange shall be fabricated out of aluminium-extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.
- The ceiling type square/circular diffusers shall be of aluminium-extruded section with flush or step down face.
- All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom. (The centre portion should be spring loaded for easy removal and fitting).
- All grilles and diffuser shall be epoxy powder coated of 15 Micron in approved colour.
- Diffuser and grille shall be installed as per drawings.
- The linear grilles shall be provided with End Pieces at ends.
- Fresh air fan and fresh air intake as per BOQ.

1.13 Testing and Balancing

After completion of the installation of the complete air distribution system all ducts shall be tested for air leaks. All dampers of supply air diffuser and supply air grille shall be balanced as per user's requirements. The entire air distribution system shall be balanced using approved anemometer.

1.14 Mode of Measurement.

All sheet metal ducting complete with duct supports, turning vanes, canvas connections erected in position shall be measured externally and paid per unit. All dampers shall be excluded in the duct area.

All manual control/splitter including Fire & Volume control damper sections with operations linkages, locking quadrant, sheet steel enclosure, frame, erection, supporting etc. shall be measured on the basis of quantity as mentioned in BOQ and will be paid as per unit rate.

Fresh air louvers with bird screen, damper, frame, ducting, erection & sealing shall be measured on the basis of quantity as mentioned in BOQ and will be paid as per unit rate.

Grilles/diffuser including volume control damper, installation etc. will be measured on the basis area and paid per unit area.

1. ACOUSTIC & THERMAL INSULATION

1.1 Scope

The scope of this section comprises of supply, fabrication, installation and testing of Acoustic Material and Thermal insulation as per specification.

1.2 *Duct Thermal Insulation*Thermal Insulation:

The ducts shall be insulated with 19mm thick Al foil faced nitrile rubber (Class: O). All joints shall be sealed with 50 mm wide adhesive based aluminium tape. The thermal conductivity of the material shall be not more than $0.032 \text{ W/(m}^0 \text{ K)}$ and density not less than 33 kg/m^3 .



1.3 *Duct Acoustic Insulation*

Acoustic Insulation:

- a. Acoustic insulation of duct shall be with 12 mm thick rigid board of fibre glass wool of density 48 kg/m³ and covered with 32 G Perforated Aluminium sheet and fastened with sheet by screw and washer with pitch not less than 12 inch.
- b. Acoustic insulation shall be as per drawing after cleaning the internal surface of the duct to make it free from dirt and dust.

1.4 **Mode of Measurement.**

Acoustic Insulation shall be calculated on the basis of the prime duct size and paid for per unit area. All duct thermal insulation shall be measured on the basis of duct prime surface area with addition of insulation thickness and paid for per unit area.

8. **ELECTRICALS**

8.1 Scope.

The scope of this section covers supply, installation & Testing of cables, Control Panel with Voltmeter & Ammeter connecting Indoor Unit & Outdoor Unit as per specification.

8.2 Electrical.

- The supply should be complete with appropriate earthing as per IE Rules.
- Each Unit should have a separate control panel. The control panel shall consist of Voltmeter & Ammeter with selector switches.
- Depending on the number and capacity of units to be installed, each unit should have separate control through a main incoming switch with adequate capacity of approved makes.
- Each ODU should have separate SFU adjacent to the unit / within the unit and visible from the unit.
- Electrical cabling should be done with armoured copper cable of approved makes only.
- Fuse switches should be HRC cartridge type with visible indication.
- The cabling shall be done as per drawings or instruction from Engineer – in –charge.
- The cabling supporting shall be done as per drawing.

9. Civil work related to Air conditioning & Ventilation work.

All civil work related to Air Conditioning & Ventilation work such as – Cutting of holes for passage of ducts, Drain Piping, Opening for Fresh Air etc. & making good of same will be done by the Air Conditioning Contractor. The Rates for each item as mentioned in BOQ should include the cost for Civil work related to that item.



5. TECHNICAL DATA SHEET

Contractor should furnish technical data of the equipment and accessories offered by him as per the scheme and bill of quantities. Some sample technical data sheets are enclosed for the contractor to understand the expected technical data. Similarly the technical data for all other equipment are supposed to be enclosed with offer. Manufacture's printed data sheet for all components should be enclosed along with technical data sheet.

Sl.No.	Description	Unit	Condition of services
	Air Handling / Fan coil Unit		
1	Unit no./model no.		
2	Manufacturer		
3	Operating weight	KG	
4	Overall dimension	M	
5	Dimension of coil	M	
6	Finned area	Sq. M	
7	No. of rows	Nos.	
8	Fins per cm	Nos.	
9	Tube Dia	MM	
10	Thickness of tubes	MM	
11	Fin Material		
12	Air quantity	M3/hr	
13	Fan outlet velocity	M/s	
14	No. of Blower	Nos.	
15	Dia. of Blower	MM	
16	Fan speed	RPM	
17	Total static pressure	MM WG	
18	Motor rating	HP	
19	Type of air filters / Thickness / No		



Sl.No.	Description	Unit	Condition of services
	Type & Make of Electrical items		
1	Electric starters		
2	Electric switches		

Sl.No.	Description	Unit	Condition of services
	Duct Insulation Make		

Sl.No.	Description	Unit	Condition of services
	Supply air Diffusers/Grilles		
1	Material		
2	Face Velocity	M/Min	
3	Pressure drop across Supply air diffusers/Grilles		
4	Adjustable/fixed vol. Control dampers		
5	Finish		

Sl.No.	Description	Unit	Condition of services
	Return air Diffusers/Grilles		
1	Material		
2	Face Velocity	M/Min	
3	Finish		

Sl.No.	Description	Unit	Condition of services
	Cables		
1	Manufacturer		
2	Type		
3	Conductors		
4	Insulation		
5	Armour		



LIST OF APPROVED VENDORS

Sl No	Item	Manufacturer
1.	AHU	Systemair/ Flaktwood/ Citizen/ Trane
2.	Condensing Unit	Bluestar/ Voltas/ Daikin/ Carrier/ Hitachi
3.	Split Units	Daikin/ Hitachi/ Carrier/ Toshiba/Mitsubishi Electric/ Bluestar/ Voltas/ O General
4.	Control Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
5.	Power Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
6.	Cable tray	Legrand/OBO/MK-Honeywell
7.	CU Pipe	Rajco/ Nippon/ Mandev
8.	GSS Sheet	Tata/ Jindal/ Sail
9.	Air distribution product	Caryaire/ Dynacraft / Systemair/ Air master
10.	Thermal insulation	Armaflex/ K-flex/ Armacell
11.	VFD	Danfoss/ ABB
12.	Electrical panel	EAP/ System Syndicate/Power and Control/ RNG



Note: For items not covered in the above list or in case of non-availability of preferred make of any item listed above, the make / brand to be used in the work, should have prior approval from the Engineer-In-Charge.

ENVELOPE 3**6. BOQ WITH SCHEDULE OF RATES**

Name of the work: SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR THE FIBRE OPTIC SYSTEM LAB OF E&EC DEPARTMENT AT 1ST FLOOR, IIT KHARAGPUR

SR. NO.	DESCRIPTION	UNIT	QTY.	UNIT RATE	TOTAL AMOUNT
1	DX type Air Handling Unit				
1.1	Supply installation testing and commissioning of double skin air handling unit with mixing plenum, Filter, Coil, expansion valve, capillary and Fan sections of 43mm panel thick duly sandwiched with PU and with thermal bridging having outer skin made out of 0.8mm GI preplasticised and inner skin of 0.8mm prepainted complete with backward curved centrifugal fan having efficiency more than 60% , coil section with 6RD copper coil having fins as per spec, with HEPA, Microvee filters with efficiency as per spec and washable prefilter section with prefilters having efficiency of 90% down to 10 microns. The drive unit comprising of TEFC Class F motor shall be installed on a common base and isolated from the bottom casing through spring mounts. AHU shall be as per the detailed spec. Price shall be inclusive of Required Seamless heavy gauge Copper piping with nitrile rubber insulation, 1st charge Refrigerant, cable, cable tray if required, communication cable etc with termination.				
1.11	8.0 TR and Air flow: 3500CFM	NO.	1		
1.12	VFD of suitable capacity	NO.	1		
1.2	Supply, installation & testing of Condensing unit comprising of Multiple hermetic/semi-hermetic type scroll compressors, condenser coil, fan etc as per the spec.				
	Capacity: 8.5 TR each	NO.	1		
2.0	Supply and erection of GSS ducting with flexible connection with insulated flexible duct for grilles as given in specification.				
	24 G	Sqm	300		
	22 G	Sqm	80		
3.a	Supply, installation & testing of Thermal insulation of supply/return air duct (inside the room) with 19mm thick Al foil faced nitrile rubber (Class: O) and joint sealed with Al tape as per specification.	Sqm	150		
3.b	Supply, installation & testing of Thermal insulation of supply/return air duct (Exposed area) with 19mm thick nitrile rubber (Class: O) and finished with glass cloth.	Sqm	230		
3.c	Supply, installation & testing of Acoustic insulation for Supply air duct using Accoustic with 10 mm thick class 1 rating Open cell nitrile rubber with density of 140 - 180 kg / m ³ .	Sqm	15		
4.a	Aluminium Powder coated Grille for supply/return air with al collar damper.	Sqm	4		
4.b	Fresh air arrangement with GI vcd, bird screen & cowl.	Sqm	RO		
5.0	Supply and installation of Fusible link type Fire Damper of atleast 90 minutes fire rating made out of 18g x 400mm for Supply/ return air wall opening .	Sqm	1		
6.0	Duct Dampers at IDU Opening	Sqm	1		

7.0	DRAIN PIPING				
	Supply, installation, testing & commissioning of in position the following pipes cut to required lengths and necessary fitting with 6 mm thk.Nitrile Rubber Insulation having weather protective coating.				
7.1	25 mm dia. CPVC pipe.	MTR	10		
7.2	32 mm dia. CPVC pipe.	MTR	RO		
8.0	Supply, Installation, Testing & Commissioning of AHU panels for AHU blower (VFD + back-up DOL Starter).Price shall be inclusive of electrical panel, if required, communication cable etc with termination etc as per requirement.	NOS	1		
9.0	Supply and installation of Copper Armored XLPE/PVC multi-stranded Cable 1.1KV Rating Size –3C X 4 Sq.MM	Rmt	60		
10.0	Supply, Installation, Testing & Commissioning of cable tray- 150mm wide	Rmt	60		
11.0	Supply, Installation, Testing & Commissioning of Hi Wall mounted Air cooled non ducted split units of following Capacities with cordless remote including interconnecting refrigerant Copper piping with 6mm thick armaflex insulation & electrical cabling suitable for operation in AC 220V single phase 50 cycles supply & 25mm dia 6mm thick armaflex insulated drain piping and Staging/ foundation for Out Door Unit Installation at rooftop as per the requirement at site. The required cu. Pipe, drain pipe & cable from IDU to ODU upto 10 mtr shall be included in quoted price.				
	I.D.U & ODU Capacity – 6000 kcal/hr (2.0TR) each	NOS	2		
SUB TOTAL					
GST@18%					
Total with GST					

