INDIAN INSTITUTE OF TECHNOLOGY: DELHI
HAUZ KHAS, NEW DELHI-110016.
TENDER NOTICE

No. IITD/DW/24(E)/EE(E)/2012/ 94 **Dated:- 05.03.2012**

Executive Engineer(E) I.I.T. Delhi, Hauz Khas, New Delhi-16. On behalf of B.O.G. Invites sealed Expression of Interest from reputed firms for pre-qualification for the following work :

S. No.	Name of Work	Estimated Cost (in ₹.)
1.	**Construction of the clean room on the ground floor and first floor of Block VI for Nanoscale Research Facility (NRF) in Academic area at IIT Delhi.**	**12.00 Crores**

Details of Work :-
Indian Institute of Technology Delhi (IITD) is planning to set up a Nanoscale Research Facility (NRF) at its campus at New Delhi for advanced materials and devices. This requires construction of class 100 and Class 1000 clean rooms.

Last date & Time of submission of tender : 04.04.12 upto 3:00 P.M. AD – 118
Date & Time of opening of tender (same day) : 04.04.12 at 3:30 P.M. AD – 118

The complete EOI document can be downloaded free of cost from our website www.iitd.ac.in and may be submitted without any fee as per above schedule. Late/Delayed bid shall not be considered.

Director, IIT Delhi reserves the right to accept or reject any or all bids either in part or in full without assigning any reasons thereof.

For Detail please see our website **www.iitd.ac.in**

Executive Engineer (E)
On behalf of B.O.G IIT Delhi.

Copy to:
1. I.E. 2. AEE (P) 3. D.R (A/Cs) : for opening of Tenders on **04.04.2012 at 3.30 PM** in the office of E.E (E).
4. A.R. (Audit) 5. S.W. 6. Office Copy 7. Notice Board.

cc:
C.S.S., IIT DELHI: - Display of Tender notice on website at IIT Delhi for wide publicity.

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

Expression of Interest (E O I)

EE (E), IITD on behalf of BOG invites Sealed Expression of Interest from reputed firms for pre-qualification for the following work:

Sl No	Name of the job	Enquiry ref number
01	Construction of the clean room on the ground floor and first floor of Block VI for Nanoscale Research Facility (NRF) in Academic Area at IIT Delhi.	

Estimated Cost: **Rs. 12.00 Crores**

Details of Work:
Indian Institute of Technology Delhi (IITD) is planning to set up a Nanoscale Research Facility (NRF) at its campus at New Delhi for advanced materials and devices. This requires construction of class 100 and class 1000 clean rooms.

Last date & Time for Submission :
Date / Time for opening of E O I :

The complete EOI document can be downloaded free of cost from our website www.iitd.ac.in and may be submitted without any fee as per above schedule. Late/Delayed bid shall not be considered.

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Executive Engineer (E)
IIT Delhi
(On behalf of BOG)

1. Dr. Harsh (Member)

2. Dr. TUMS Murthy (Member)

3. Mr. Christi John (Member)

4. Prof. R. Pinto (Member)

5. Prof. Vikram Kumar (Member)

6. Prof. M. Jagadesh Kumar (Member)

7. Prof. Manish Sharma (Member)

8. Mr. Sanjay Gupta (Member)

Approved

9. Prof. M. Balakrishnan (Chairman)

Director

1/3/12

INDIAN INSTITUTE OF TECHNOLOGY DELHI

Executive Engineer (E)
Indian Institute of Technology Delhi
Hauz Khas, New Delhi -110016

Reference No. IITD/NRF/EE (E)/2012 Date.....

Expression of Interest (EOI)

For

Construction of the clean room on the ground floor and first floor of Block VI for Nanoscale Research Facility (NRF) in Academic Area at IIT Delhi.

1.0 Invitation of EOI:

IITD has initiated Nanoscale Research Facility (NRF). In 2010 core faculty members joined and initiated the academic and research activities of the NRF, with the vision to become the pioneers of modern interdisciplinary sciences by integrating emerging disciplines of sciences and to nurture and sustain a vibrant comprehensive programme in research and developments. The mission of the NRF is to promote goal-oriented innovative interdisciplinary research by interfacing modern technology with applied engineering sciences to address human welfare, and training scholars to be next generation scientists.

Indian Institute of Technology Delhi (IITD) is planning to set up a Nanoscale Research Facility (NRF) at its campus at New Delhi for advanced materials and devices. This requires construction of class 100 and class 1000 clean rooms. These research laboratories will be on the ground floor and, first floor of Block VI. Nanoscience and nanotechnology involve studying and working with matter on an ultra-small scale typically in the tens of nanometer range. It is a broad and interdisciplinary area of research and development activity that has been growing exponentially in the past few years. It is widely recognised as having potential benefits in areas as diverse as drug development, water decontamination, information and communication technologies, and production of stronger but lighter materials. Nanotechnolgy is expected to play important role in providing solutions to some of the most crucial problems facing the society including energy security and terrorism. Indeed nanotechnologies are fast emerging as a force which could transform the society in near future.
The project focuses at setting up a world –class Nano fabrication Facility at IIT Delhi with resources for all aspects of research on molecular and mesoscale devices: synthesis of nanomaterils, nanofabrication of Nanoscale devices applications and their characterization and analysis. A unique aspect of this proposal is the opportunity for collaboration across many departments and centres in IIT Delhi. The idea of IITD is to provide a state-of-the-art laboratory environment replete with all R&D amenities to its scientific manpower to help them achieve the desired goal. The scope of work includes formulation and execution of suitable installation plans in the existing space in consultation with the end users.

NOTE: A tentative drawing has been provided in the document at **Annexure A** which shall give general idea of the lay-out and dimensions of the site. The bidder(s) are advised to make a visit to the existing laboratory facilities in NRF IITD prior to bidding in order to assess the exact quantum of work to be undertaken and to be able to propose their best solution meeting the requirement of NRF IITD. With this objective in sight, IITD invites Expression of Interest from the firms fulfilling the Eligibility Criteria given in the successive paragraph.

2.0 Eligibility Criteria:

1. The bidder should have executed similar works in India costing at least 1 work of Rs. 9.6 Crores or 2 works of Rs. 7.2 Crores or 3 works of Rs. 4.8 Crores each in last seven years. 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 date of completion to last date of receipt & application of EOI.

2. The bidder should have average annual turnover of Rs. 3.6 Crores during the last five years ending 31st March, 2012.

3. The bidder should not have incurred loss in more than 2 years during the last 5 years ending 31st March 2012.

4. The bidder should have a current solvency of Rs. 4.8 Crores (duly issued by a scheduled bank of India as per **Annexure B**).

5. The bidder should have certification regarding safety and quality from any accreditation agency of International Standards for clean Rooms.

The "similar work" means supplying, installing, testing and commissioning class 100 and class 1000 Clean Rooms or execution of class 100 & class 1000 clean rooms.

NOTE:

1. For points No. 1 to 5 above the bidder is required to substantiate his claim supported by financial statement of accounts (including balance sheet, profit and loss account and auditors reports) duly certified by a Chartered Accountant.
2. In case of private works, the firm shall be required to submit the TDS certificates issued from the paying authority for the authenticity of works.

3.0 Scope of Work:

The scope of work shall be to set up class 100 and class 1000 clean rooms with required/necessary accessories and furniture to be taken up as a **Turnkey Project**.

The details are as follows:

1. IITD shall provide the covered free space of approximately 800 sq ft on the ground floor, 5,280 sq ft on the first floor of the Block VI. The approximate requirement of Class100 and class 1000 clean rooms are given below:

Clean room 1 (Class 100): E-beam Lithography:	800 sq.ft.
Clean room 2 (Class 1000): Optical Lithography:	400 sq.ft.
Clean room 3 (Class 1000): General:	1200 sq.ft.
Clean room 4 (Class 1000): General:	1200 sq.ft.
Clean room 5 (Class 1000): Wet Chemistry:	400 sq.ft.

This has been mentioned in the drawing at **Annexure A**. It can be re-designed keeping in view maximum flexibility of all systems and maximum freedom of movement for the people working in the labs. It will be ideal to have separation of supply of services, accessories and furniture in the system for the sake of safety, flexibility and better mobility.

2. The furniture and accessories of the clean rooms should be modular type, designed in such a manner that it produces a maximum utilization of space and ensures easy conduct of clean room work.

3. The clean room design and layout should include AC ducting, wiring, water supply lines, gas supply lines, fire safety, drainage etc. for efficient functionality.

4. The scope of the work also includes third part certification of clean rooms as per standard.

4.0 Submission of & marking of the EOI:
The bidder is expected to furnish all relevant information in the columns of the "Bidder Response Outline Sheet" provided at **Annexure C** along with the filled in check-list provided at **Annexure D** and any other information relevant to this project which may be a factor behind considering the bidder for pre-qualification for this project and may submit the same by hand/post **latest by**..... at the following address:

The Executive Engineer (E)
Room No. AD-118
Indian Institute of Technology Delhi
Hauz Khas
New Delhi 110016
India

The envelope must be clearly marked with following:
(a) Expression of Interest (EOI) for pre-qualification for "**Construction of Clean Rooms for NRF as a turnkey project.**"
(b) Bid No./ Date

(c) Last Date of submission of the bid and its opening.

Any bid not submitted in the prescribed manner will be summarily rejected.

5.0 Selection and award Criteria:

The bidders who fulfill the eligibility criteria enumerated in section 2.0 shall be called for a presentation on their product and the solution conceived by them for NRF IITD. The dates for presentation will be chosen by IITD which will be communicated to bidder(s) giving bidder(s) reasonable time.

On the basis of the presentations given by the eligible bidder(s) and on the Bidder Response Outline Sheet provided in this document, the technical committee of IITD shall shortlist firms. The shortlisted firm(s) will be issued Request for Proposal (RFP).

Bidders are required to fill the check list for Submission of Expression of Interest.
Shortlisting will be done as per marking scheme given in **Annexure E**

Details of the Annexure to this document:
Annexure A: Technical requirement and drawings
Annexure B: Solvency Certificate
Annexure C: Bidder Response Outline Sheet
Annexure D: Checklist for Submission of Expression of Interest
Annexure E: Marking Scheme

Annexure A

CONSTRUCTION OF CLEAN ROOMS
IITD, New Delhi

TECHNICAL

Contents

1. Proposal

Indian Institute of Technology Delhi (IITD) is planning to set up a clean room facility at its campus at New Delhi for nanoscale research and development of Advanced materials and devices. This Nanoscale Research Facility (NRF) will be established in Block VI after remodeling and reallocating existing space. The plan involves setting up of a Class 100 clean room about 800 sq. ft. in area, on ground floor of Block VI. This will be dedicated to electron beam lithography (EBL) and Scanning Electron Microscopy (SEM). This clean room will also have laminar benches for spinning and development of electron-beam resists.

The plan also includes setting up of 4 clean rooms of Class 1000 each on the first floor of Block VI with a total area of 3200 sq.ft. These clean rooms will be constructed by dismantling the entire existing partitions and doors. These clean rooms will house various facilities required for nanoscale research including general purpose optical lithography, wet processing, plasma processing including plasma deposition and etching.

Since there is no space for housing air-conditioning units for the e-beam lithography clean room on the ground floor, a separate extension will have to be built adjoining the lithography clean room. This extension can also be used to house the nitrogen plant on the ground floor. The extension with a concrete slab/steel structure aligned with the first floor can be used for the installation of air handling unit for part of the first floor clean rooms. The size of the extension is proposed to be 48 feet (aligned with three window sections of existing structure) x 12 feet width (projecting out into the open).

The total projected electrical load is 750 KVA. This electrical supply will be received by one main LT panel located on the ground floor (R.H.S.) of Block VI. The supply for this panel will be provided from the power house LT transformer and 380 KVA x 2 DG Sets. On the receiving end, the main LT panel will provide power to various loads such as AHUs and UPS (300 KVA x 2). There will be two other LT panels which will be used to distribute power from two 300 KVA UPS to various electrical equipment loads.

2. Design Layout

The layout of the clean room has been optimized based on the requirements for various functional areas and available space. As a thumb rule, the ratio of clean room space to utilities space is about 50:50 for class 100 clean rooms; this changes to about 60:40 for class 1,000 clean rooms (excluding the visitor's corridor). The total available space is about 2000 sq.ft. (including 580 sq.ft. new extension and 640 sq.ft. utilities space on extreme right, but excluding corridor space) on ground floor; and 6000 sq.ft. (including new extension) on the first floor i.e. 8,000 sq.ft. in total. The clean room on ground floor is 800 sq.ft. and that on first floor is 3,200 sq.ft., the total being 4,000 sq.ft.

The optimized design layout is shown in drawing IITD/D001 for ground floor class 100 e-beam lithography and IITD/D003 for first floor class 1000 clean rooms. The external walls are shown in green and clean room walls in red. The drawings IITD/D002 and IITD/D004

show utilities such as AHUs, Nitrogen Plant, UPS and LT panels, all shown in blue. The clean rooms are flanked by main visitor corridor on one side and service corridor on the other, both on ground and first floor. The area (in sq.ft.) of various clean rooms are as follows:

Clean room 1: E-beam Lithography	:	800 sq.ft.
Clean room 2: Optical Lithography	:	400 sq.ft.
Clean room 3: General	:	1200 sq.ft.
Clean room 4: General	:	1200 sq.ft.
Clean room 5: Wet Chemistry	:	400 sq.ft.

There are 2 air-curtains, one each at the entrance to visitors corridors; two change rooms (gowning rooms), three air showers and a set of 3ft + 3ft equipment doors which also serve as emergency doors. The entrance to service corridors and to AHU rooms is as shown in the drawings. There will also be three dynamic pass boxes, one for clean room 1 (on ground floor) and two for clean rooms 3 and 4 (on first floor). Drawings IITD/D002 and IITD/D004 also show ducting layouts (schematics) for clean rooms on both ground and first floor. The visitor corridors will be enclosed from outside with brick wall from ground to 3 feet level and with aluminum-glass sections above brick wall upto the ceiling. The visitor corridors will also have false ceiling at 8 feet level from the ground. The air-conditioning for ground floor visitor corridor will be provided by package AC unit serving the characterization area as shown in IITD/D002. For first floor visitor corridor, there is a separate air-handling unit.

The details of the five clean rooms are as follows:

a) **Clean Room 1, EBL:** The room has an area of 800 sq.ft., height of 8 feet, volume 6400 CFT and is designed to be class 100 (ISO 5) with a positive pressure of 20 pascal. This room has 225 air-changes per hour (ACPH); so the total flow required is 24,000 CFM and an exhaust flow of 1000 CFM. The entry of this room is via a change room (at a positive pressure of 10 pascal) and an air shower (see drawing IITD/D001). One air-handling unit (AHU 1) of 24000 CFM is used to service this room (see Table 1). The fresh air supply to AHU 1 is through another FAHU1 of 4000 CFM capacity.

   Air-conditioning required is calculated to be a basic of 24 TR and a further 16 TR for heat load which includes equipment load (5 KW), heater for humidity control (25 KW), personnel (4 persons) and 1000 CFM fresh air (15 KW). Proposed air-conditioning is 40 Tr (16 x 2 Tr + 8 x 1 Tr) air cooled condenser units and is given in Table 2.

b) **Clean Room 2:** This room has a total area of 400 sq.ft., height 8 feet, volume 3,200 CFT and is designed to be class 1000 (ISO 6) with a positive pressure of 20 pascal. This room will have 120 air changes per hour which gives the total flow rate of 6,500 CFM (AHU 2), with an exhaust of 800 CFM. The entry to this room is through Clean Room 3 (see drawing IITD/D003). One air-handling unit (AHU 2) of 6,500 CFM is used to service this clean room (see Table 1). The fresh air supply to AHU 2 is through another FAHU1 of 4000 CFM capacity.

Air-conditioning required is calculated to be a basic of 6 Tr, and a further 10 Tr for heat load which includes equipment load (5 KW), heater for humidity control (15KW), personnel (2 persons) and 800 CFM fresh air (10 KW). Proposed air-conditioning is 16 Tr (8 x 2 Tr) air-cooled condenser units and is given in Table 2.

c) **Clean Room 3:** This room has a total area of 1200 sq.ft., height 8 feet, volume 9,600 CFT and is designed to be class 1000 (ISO 6) with a positive pressure of 20 pascal. This room will have 120 air changes per hour which gives the total flow rate of 20,000 CFM (AHU 3), with an exhaust of 2000 CFM. The entry to this room is through a change room (at a positive pressure of 10 pascal) and air shower (see drawing IITD/D003). One air-handling unit (AHU 3) of 20,000 CFM is used to service this clean room (see Table 1). The fresh air supply to AHU 3 is through FAHU1 of 4000 CFM capacity.

Air-conditioning required is calculated to be a basic of 18 Tr, and a further 24 Tr for heat load which includes equipment load (10 KW), heater for humidity control (30 KW), personnel (8 persons) and 2000 CFM fresh air (30 KW). Proposed air-conditioning is 44 Tr (11 x 4 Tr) air-cooled condenser units and is given in Table 2.

d) **Clean Room 4:** This room has a total area of 1200 sq.ft., height 8 feet, volume 9,600 CFT and is designed to be class 1000 (ISO 6) with a positive pressure of 20 pascal. This room will have 120 air changes per hour which gives the total flow rate of 20,000 CFM (AHU 4), with an exhaust of 2000 CFM. The entry to this room is through change room (a positive pressure of 10 pascal) and air shower (see drawing IITD/D003). One air-handling unit (AHU 4) of 20,000 CFM is used to service this clean room (see Table 1). The fresh air supply to AHU 4 is through another FAHU2 of 4000 CFM capacity.

Air-conditioning required is calculated to be a basic of 18 Tr, and a further 24 Tr for heat load which includes equipment load (10 KW), heater for humidity control (30 KW), personnel (8 persons) and 2000 CFM fresh air (30 KW). Proposed air-conditioning is 44 Tr (11 x 4 Tr) air-cooled condenser units and is given in Table 2.

e) **Clean Room 5:** This room has a total area of 400 sq.ft., height 8 feet, volume 3,200 CFT and is designed to be class 1000 (ISO 6) with a positive pressure of 20 pascal. This room will have 120 air changes per hour which gives the total flow rate of 6,500 CFM (AHU 2), with an exhaust of 2000 CFM. The entry to this room is through Clean Room 3 (see drawing IITD/D003). One air-handling unit (AHU 5) of 6,500 CFM is used to service this clean room (see Table 1). The fresh air supply to AHU 5 is through FAHU2 of 4000 CFM capacity.

Air-conditioning required is calculated to be a basic of 6 Tr, and a further 18 Tr for heat load which includes equipment load (10 KW), heater for humidity control (15KW), personnel (2 persons) and 2000 CFM fresh air (30 KW). Proposed air-conditioning is 24 Tr (8 x 3 Tr) air-cooled condenser units and is given in Table 2.

f) **Main Corridor:**

A dedicated package unit installed to serve the characterization rooms on ground floor will provide air-conditioning to the main/visitor corridor on ground floor. A dedicated air-handling unit (AHU 6) is proposed to provide air-conditioning to the main/visitor corridor on the first floor. Both these corridors are to be enclosed with brick wall upto 3 feet from ground and aluminum-glass enclosure above the brick wall. A false ceiling at a height of 8 feet is to be provided to keep the heat load a minimum and also to cover the electric cables and other service lines installed above the 8 feet level. With an area of 1280 sq.ft. and height 8 feet, the volume of each corridor is 10,240 CFT. To keep the dust level at minimum, it is proposed that the corridors be at a slightly positive pressure of 10 pascal with a nominal 10 ACPH. The total flow rate required in corridor is 1700 CFM. Thus, the proposed flow rate for AHU 6 is 2000 CFM. It is proposed that an air curtain be used at the entry to each corridor. The AHU will have standard 15 micron and 5 micron washable filters as standard similar to the AHUs used for the clean rooms.

Air-conditioning required for first floor corridor is calculated based on total volume, flow rate and 4 persons (in the area on average) and is given in Table 2 (AHU 4). The condenser units of 10 Tr (5 x 2) capacity is proposed for first floor corridor.

3. Design Considerations

3.1 Air handling:

Based on design layouts given in drawings IITD/D001 and IITD/D003, area, height and thus the volume and ACPH of each clean room, the total flow rate is calculated. Providing fresh air compensation for exhaust and a small margin, the AHU flow rate for each clean room is proposed and given in Table 1. In all, there are 5 AHUs for clean rooms and 1 AHU for the first floor main corridor. All AHUs will have a fresh air in-take damper (also fire damper) at the return-air side and balancing damper at the supply (delivery) air side. There are two fresh air AHUs (FAHU 1 and FAHU2).

3.2 HEPA Filters:

The HEPA filters of 99.97% efficiency are designed to be 4' x 2' standard size, having 400 CFM airflow capacity. The HEPA filters selected for the functional areas are based on the extent of area to be covered on the clean room ceiling which is in turn is governed by clean room standards. As shown in Table 1, in order to have maximum coverage of HEPA filters on the ceiling, only 400 CFM HEPA filters are used. Number of HEPA filters required for each clean room is also indicated in Table 1.

3.3. Air-conditioning:

Cooling of the clean rooms and maintaining a temperature of 22 ± 2°C (with 44°C ambient) depends upon the area (volume) of the clean rooms and the heat transfer from outside the clean rooms through the clean room walls and also due to heat transfer in the supply/return air ducts and AHU body. Further, cooling is required to compensate for the heat dissipated in the clean room such as equipment, heater (for humidity control), personnel (at the rate of 0.3KW per person) and loss of conditioned air due to exhaust. Air-conditioning required for the clean rooms has been calculated based on HVAC calculations and given in Tables 2.

Table 2 shows the clean room temperature (22 ± 2°C), relative humidity levels, various heat dissipation loads, total cooling required and the number of condenser units required for each room. All condenser units are chosen to be of air-cooled type (Total = 198 Tr) to be installed just outside the clean room complex. The air cooled condenser units are reliable, efficient and simple to maintain as opposed to huge water cooled compressors which require cooling towers and water pumps which are difficult to maintain in the long run.

3.4 Clean room walls

The Clean room complex has external brick walls and also glass-aluminum windows which serve as shield for the internal clean room walls. The floor to ceiling height upto the bottom of the beams is 9 ft. 6 inches. Hence, the maximum height possible for clean room ceiling is 8 feet which leaves a bare minimum of 16 inches for installation of ducts over the clean room ceiling below the beams (assuming 50mm thick clean room ceiling panel).

The bottom of the ceiling has to be coated with antifungal paint from inside for protection of the clean room ceiling. The existing floor is covered with floor tiles which are reasonably clean; however, the surface will have to be prepared for coating of epoxy on the clean room floors. Clean room walls are proposed to be of powder coated 100 mm thick GI panels, each panel having double walls (1 mm thick GI sheets) with fire-resistant Poly Urethane Foam (PUF) in between. The ceiling will be walkable type with 50mm thick powder coated double walled GI panels (1 mm thick GI sheets) with fire-resistant Poly Urethane Foam (PUF) in between. The powder coating is 60-80 μm thick. The clean room ceiling will be supported from the main ceiling with sufficiently load bearing fasteners and hangers. All clean rooms will have 3 feet (W) x 7 feet (H) doors for personnel entry, and double leaf 6 feet (W) x 7 feet (H) doors for equipment loading. The return air for all clean rooms will be in the return air risers integrated in the riser wall panels.

3.5 Clean room floor:

Clean rooms will have two types of flooring. In Clean Room 1 (Class 100), a raised access floor shall be installed. This floor will be at 200mm (top surface) above the base floor and will be formed from 600mm x 600mm x 42mm (T) pedestals to support the perforated tiles. The pedestals shall be supported on base floor with supports epoxy-glued to the base floor. The tiles shall be of Al alloy with ~ 25% perforation for return air and will have a load bearing capacity of 1500 Kg/M^2 (or 150 Kg/ Sq.ft., point load of $50Kg/5cm^2$) and will have a ESD sheet vinyl finish.

In other class 1000 clean rooms, ESD type conductive epoxy flooring will be done with adequate chemical resistance and with following physical properties.

Bond strength (ASTM C-882) 2110 p.s.i.
Flexural strength (ASTM C-580-68) 6,075 (7 days)
Compressive strength (ASTM D-695) 9,910
Absorption (ASTM D-570) 0.6%
Hardness (Shore D) 65 @ 24 hours, 75 @7 days
Thermal shock- 40 Hrs. @ 10 degrees F. 3min @ 212 degrees, F, Shock water 33 Degrees F.

3.6 Change rooms, Air Showers, pass boxes

The change rooms (gowning area) 2 in all, will be assembled by using the powder coated double-walled GI panels. Each change room will have an air shower made of 304 SS with electronic locking facility for control of personnel entry and exit. Also, each change room will have a set of SS 304 garment cabinets and storage furniture for storage of clean room clothing, shoes, head-covers, gloves etc.. Further, each clean room will be provided with one dynamic pass box for quick exchange of items/wafers required in the clean rooms. All clean rooms will have energy efficient white lighting on ceiling, except the Litho room which will have low intensity yellow lighting.

WORK DETAILS:

4.1 Civil Work

Civil work includes the following:

a) Removal of all unwanted internal partitions on ground and first floors as per drawings IITD/D001 and IITD/D003. All surfaces are to be repaired and coated with antifungal paint.

b) All floors to be cleaned and tiling to be redone if required. No tiling is required in clean room areas as the clean rooms will have epoxy flooring to be implemented by clean room vendor at the end.

c) Visitor corridor is to be covered with brick wall upto 3 feet level and aluminum glass partitions upto to the ceiling. Visitor corridors will also have false ceiling at 8 feet level.

d) The grills on the brick walls (other than clean room walls) will be replaced with aluminum/glass windows on both sides of the rooms.

e) Extension on Ground/First floor: The extension will be of 48' x 12' dimensions. The projected section will be 12 feet which will match the existing structure. This extension will be of I-shaped steel sections with load bearing capacity of 50 kg/sq.ft. On the ground, there will be a concrete floor to house AHU 1 and FAHU 1 (for clean room 1) and Nitrogen Plant. On the first floor, AHU 2 and AHU 3 for clean rooms 2 and 3 respectively will be installed. 9" x 6" x 3/8" I-sections of structural steel will have to be used for beams; there will be 8 column sections (12" x 9" x 3/8") supporting the frame of steel beams which will support 8mm thick steel checker plates. The extension will have a roof of FRP/polycarbonate sheets. There will also be brick walls upto 3 feet level from ground floor; at higher level, there will be aluminum/glass windows which will also match with the main building.

4.2 Electrical Work

The electrical work includes the following:

a) A LT transformer at power house to provide 750 KVA of load for the laboratories.

b) 380 x 2 KVA DG sets near the power house which will provide standby power.

c) A main receiving LT panel with 1200A ACBs (2 nos with over-current, short-circuit, earth-fault protection) for incomers with isolators. The outgoing MCCBs are as

follows: 630A (3 nos) for 300 KVA (2 nos) UPS; 400A (1 no); 250A (2 nos); and 125A (6 nos).

d) 300 KVA (2 nos) on-line double-conversion UPS with a minimum of 15 minutes battery backup using sealed maintenance free (SMF) batteries.

e) Two secondary LT panels, one for each UPS, with following MCCBs with over-current, short-circuit and with fault-protection;
Incomer (from UPS): 630A; Outgoing: 250A (2 nos); 150A (2 nos), 125A (4 nos) and 63A (4 nos)

f) Chemical earthing: 1 Ohm earthing, one each for two 300 KVA UPS and main receiving panel; the secondary panels will have a separate earthing. In all, 4 nos. chemical earthing are required.

4.3 Clean Room Body

Modern clean rooms are constructed using double layered panels, varying from 50 mm to 100 mm thick; panel sheet is fabricated from powder coated GI sheets, thickness in the range 1 mm to 0.5 mm; the GI sheets are separated by the fire resistant and insulating foam material. The ceiling is usually of 50 mm thick powder coated GI panels, usually walkable, suspended from main roof, using load-bearing fasteners and hangers.

4.3.1	Clean room wall panels, 100mm thick, 1mm powder coated G.I. sheets, with fire resistant PUF foam Size: 1100mm (W) x 2500mm (H) Total Area: (Riser panels area: 270 sq.M. included)	560 Sq.M.
4.3.2	Cleanroom ceiling panels, 50mm thick, 1mm powder coated G.I.Sheets, with fire resistant PUF foam Size: 1100mm (W) x 2500mm (L) Total area:	460 Sq.M.
4.3.3	Clean room compatible double glazed windows (to be fitted on clean walls) Size: 900mm x 750mm	14 Nos.
4.3.4	Clean room compatible flush doors (to be fitted on clean room walls) Single leaf doors (900mm x 1250mm) Double leaf doors (1800mm x 2150mm)	 8 Nos. 5 Nos.
4.3.5	PVC Covings with Aluminum Backing	350 RM
4.3.6	Return Air Riser panels (integrated in wall panels)	270 Sq.M.
4.3.7	Epoxy Flooring	400 Sq. M.
4.3.8	Perforated raised flooring	70 Sq.M.

4.3.9 Wall/Ceiling cutouts (for doors, windows, filters, lights & grills, etc.) 300 Nos.

4.4 Air Handling and ducting

4.4.1 Air Handling: The air handling requirements are based on the airflow required in each clean room which in turn is dependent on the ISO class, volume of the room, exhausts, etc. Based on this, airflow requirements have been calculated and categorized into a total of 6 Air handling units (6 AHUs) as shown in Table 1. Each AHU has a centrifugal blower of appropriate rating, a heat exchanger, filters at both input (15μ at return and fresh air intake) and supply (3μ at delivery) ends, damper for fresh air, balancing (fire) damper and heater for humidity control at the delivery end. Body of all AHUs will be of powder coated GI with 40 mm thick internal PUF insulation. A dedicated Air-Handling unit (AHU 6) is used to provide air-conditioning to Main Corridor on first floor.

AHU 1, 24000 CFM, 150 mm static:	1 No.
AHU 2, 6500 CFM, 150 mm static:	1 No.
AHU 3, 20000 CFM, 150 mm static:	1 No.
AHU 4, 20000 CFM, 150 mm static:	1 No.
AHU 5, 6500 CFM, 150 mm static:	1 No.
AHU 6, 2000 CFM, 50 mm static:	1 No.
FAHU1, 4000 CFM, 75 mm static:	1 No.
FAHU2, 4000 CFM, 75 mm static:	1 No.

4.4.2 Ducting:

All ducting will be fabricated out of high zinc GI sheets, 20 gauge for main ducts and 22 gauge for branch ducts. The layout of main ducts from each of the 5 AHUs is shown in drawing D002 and D004 along with the location of each of the 5 AHUs. All ducts are supported from the ceiling and terminated (for joints) in flanges.

Since the floor to ceiling height is limited to 9'6 inches, the concept of supply air plenum is proposed as follows:

Clean Room 1, Class 100: AHU 1 will supply air over Service corridor via main supply air duct into the supply air plenum formed between clean room ceiling and concrete slab above. The concrete slab will be treated with an antifungal paint and lined with poly propylene sheets to form a supply air plenum. The return air will be through perforated raised flooring, 8" height over the base flooring, and will be returned to AHU 1 via service corridor to return air duct of AHU 1 in the AHU room as shown in drawing IITD/D002A and IITD/D002B.

Clean Room 2, 3, 4 & 5, Class 1000: AHUs 2, 3, 4 & 5 will supply air over Service corridor via main supply air duct into the supply air plenum formed between clean room ceiling and concrete slab above. The concrete slab will be treated with an antifungal paint and lined with poly propylene sheets to form a supply air plenum. The return air will be through return air riser panels; from riser panels air will be collected by return air ducts and will be returned to respective AHUs over the service corridor as shown in drawing IITD/D004.

- Main Ducts, 20 gauge — 800 Sq. M.
- Branching Ducts, 22 gauge — 700 Sq. M.
- Poly propylene sheets, 4mm — 500 Sq. M.

4.4.3 Thermal Installation:

Supply Air ducts insulation with 25mm thick nitrile rubber insulation with aluminized surface — 1000 Sq. M.

Return Air ducts insulation with 19mm thick nitrile rubber insulation with aluminized surface — 800 Sq. M.

4.5 Air-filtration

Prefiltration: These are located in the AHU section; generally 15μ type at the return air/ fresh air intake region before the heat exchanger (dx) coils and 3μ type at the delivery end after the AHU blower but before the balancing damper. The total number of prefilters (2' x 2' area each) depends upon the AHU flow rate, and are included in the cost of the AHU.

4.5.1 HEPA: High efficiency particulate air type filters have 99.97% efficiency for 0.3μ particulates and above; these terminal HEPA filters form the important components of the clean room structure. These filters can be fabricated (with imported HEPA materials) in various sizes and flow rates. In this proposal, a standard design of 4' x 2' size is adopted having flow rate, 400 CFM.

For Clean room 1 (Class 100) ULPA filters will be used.

Terminal HEPA/ULPA Filter box will be SS 304 perforated plate:

ULPA filters, Size: 1220mm x 610mm x 160mm (400 CFM) — 60 Nos.
HEPA filters, Size: 1220mm x 610mm x 160mm (400 CFM) — 128 Nos.

4.5.2 Diffusers

Supply & Installation of AL. sq. four way type Air Diffuser (Supply & Return) with 18G, G.I. powder coated Box with Aluminum Collar Damper:

Size : 600mm x 600mm — 20 Nos.
500mm x 500mm — 15 Nos.
300mm x 300mm — 15 Nos.

4.5.3 Fire damper with Blades of formed 1.6mm Galvanized steel, Axis of Plated solid steel stubs, Bearing of Permanently sealed Bronze oil lubricated, Linkage of Plated steel on Blade type Actuator of 74°C UL rated fusible link or 74°C Electro Thermal Link, Sleeve of 18 GA Galvanized steel 400/485 mm, Side seals of Metallic Compression type 6 Nos.

4.6 Air-conditioning

4.6.1 Cooling of the clean room and maintaining a temperature of 22 ± 2°C (with 44°C ambient) depends upon the area (volume) of the clean room and the heat transfer from outside the clean room through the clean room walls and also due to heat transfer in the supply/ return air ducts and AHU body. Further, cooling is required to compensate for the heat dissipated in the clean room such as equipment, heater (for humidity control), personnel (at the rate of 0.3KW per person) and loss of conditioned air due to exhaust.

Air-conditioning required for the clean rooms has been calculated based on HVAC calculations given in Tables 2 (AHU 1 – AHU 6).

Condensing Unit:
Air cooled condensing unit of absolute capacity comprising of scroll compressor complete with 5 M of refrigerant piping (liquid & suction) with nitrile rubber insulation of 19mm thick for suction line, powder coated M.S stand for mounting outdoor condenser units, with first charge of refrigerant, oil & necessary controls of following absolute Capacity (ALL AHUs).

Air Cooled Condenser with Scroll Compressor- 16 x 2 + 11 x 8 + 8 x 6 + 5 x 6 = 198 Tr

4.7 Miscellaneous components

4.7.1	Thermostat with timer	-	6 Nos.
4.7.2	Humidistat	-	5 Nos.
4.7.3	Steam based Humidifiers	-	5 Nos.
4.7.4	Aluminum Powder coated T sections, Fasteners & Suspenders (1/2" threaded GI) for ceiling panels	-	Lot
4.7.5	Electric Panel for Air Handling Units with VFDs	-	8 Nos.
4.7.6	Cu. Piping with installation, leak detection & insulation	-	120 RM
4.7.7	Grills and Dampers (Al. powder coated, perforated type for return air risers, 900mm x 300mm)	-	40 Nos.
4.7.8	Magnahelic Gauges with SS Box	-	15 Nos.
4.7.9	Lighting, High efficiency (@ 12.5W/M^2)	-	90 Nos.

Light Fitting of 600mm x 600mm (3 x 2 SS bottom Frame clear Acrlyic Cover, Al cover, Body MS powder coated), Cabling, switch Box from

main DB, and Electrification: Each fitting has 2 x 36W CFL (29100 Lumen)

4.7.10 Power cables:

440V, 150A, 3.5-core, Al armoured, 90 Sq. mm.	-	150 RM
440V, 60A, 3.5-core, Al armoured, 35 Sq. mm.	-	200 RM
440V, 40A, 3.5-core, Cu, 10 Sq.mm.	-	200 RM
230V, 20A, 3-core, Cu, 4 Sq.mm.	-	300 RM

4.7.11 Power Points

440V, 40A MCCBs, 3-Phase (4 pole)	-	24 Nos.
230V, 15/5A x 4	-	24 Nos.

4.8 Miscellaneous Units:

4.8.1	Air Showers, SS304, 2500mm x 1500mm	-	3 Nos.
4.8.2	Dynamic Pass Boxes, SS304	-	3 Nos.
4.8.3	Garment Cabinets	-	5 Nos.
4.8.4	Air curtain, fan filter (3μ) unit - 4 x 2 ft for Main entrance to visitor corridors	-	2 Nos.
4.8.5	Clean Room Furniture	-	Misc. Lot

4.9 Building Management System (BMS)

Colour LCD Display Unit for Displaying Parameters including AHU No., Room Name, Parameter to be displayed like Temp., RH, Pressure, Set points for each and indication of normal operation and 2 levels of Alarms with sensors and cables. **Lot**

4.10 Addressable Fire Detection/Suppression system: Lot

Single panel, cross zone detection, auto manual operation;
Suppression agent: Novac1230 fire suppression fluid (harmless to humans & equipment and environment friendly).

The suppression schemes are based on following four blocks for Novac1230:
Sprinkler system is used for Service Area and Utility areas.

4.9.1 Block 1: Fire panel
4.9.2 Block 2: Clean Room 1
4.9.3 Block 3: Clean Room 2 & 3
4.9.4 Block 4: Clean Room 4 & 5
4.9.5 Spinkler System: Service Corridor & Utility areas
4.9.6 Miscellaneous charges such as FRLS (200 Mtrs) Cable Manifold & Piping required for entire project in Lumpsum
4.9.7 Installation

4.11 Access control system and Internet:

4.10.1 Biometric lock with finger print based access control, scratch free, optical sensor, eSSL make with user capacity upto 1500.

4.10.2 Internet and Wireless Networking: D-link WiFi Access point (100 Meter Range, 8 Nos.) and D-Link WiFi Ethernet (LAN) card 64 Kbps (10 nos.) and cabling.

4.12 Validation and Commissioning: **Lot**

Annexure A

Clean Room Construction Schedule

1) Site Preparation:

same as discussed- Not a part of clean room tender

2) Installation of ducts for air distribution:

- All ducting shall be carried but using G.I. sheets with zinc coating of 160 to 180gm/m^2
- Thickness of G.I. sheets- main duct: 20 gauge
  Thickness of G.I. sheets- branch duct: 22 gauge
- All duct-sections shall be joined with end flanges stiffened with rectangular M.S. angle frame made from 25mm x 25mm x 3mm angles, duly coated with primer.
- All rectangular ducts longer than 300mm shall be cross-broken between adjacent stiffeners.
- All duct-sections shall be joined with stiffener angle flanges/frames with 6mm metalized bolts with about 100mm spacing. All joints shall be sealed with silicone glue.
- All bends shall have internal throat radius equal or greater than duct width for minimum air-impedance.
- All ducts shall be supported/hung from the ceiling using pre-coated M.S. angles 30mm x 30mm x 3mm size and galvanized steel roads 8mm dia and expanding masonry anchor fasteners of 8mm dia.
  The vendor shall provide certificates of G.I. sheets used- thickness, zinc coating level, joining bolts and anchor fasteners.

3) Erection of clean room body

- Clean room wall panels shall be 100mm thick with fire-resistant foam (PUF or equivalent) and 1mm thick G.I. sheets on both sides; G.I. sheets shall have 2mic coating 160-180 gm/m^2 and powder coating of 60micron thickness on exposed surface. Some wall panels will be riser panels, as per design. The height of the wall panels shall be 2600mm; wall panels shall be erected with appropriately matching G.I. U-Sections, 1mm thick, bolted on the floor with zinc coated screws with 300mm intervals.
- Cut-outs for doors, windows and pass boxes shall be made in the wall panels before erection.
- Clean room ceiling panels shall be 60/80mm thick with fire-resistant foam (PUF or equivalent) and 1mm thick G.I. sheets on both sides; G.I. sheets shall have zinc coating of 160-180 gm/m^2 and powder coating of 60 micron thickness on exposed surfaces. The ceiling with galvanized steel rods 8/10mm dia with expanding masonry anchor fasteners on the ceiling side and appropriate aluminum sections on the panel sides. After carrying out water leveling of the ceiling, the end-sheets shall be anchored on the wall panels using 40mm x 40mm x 3mm aluminum angles.
- All cut-outs on the ceiling panels for lights and HEPA filters shall be carried out before the final fittings.

The vendor shall provide certificates of wall and ceiling panels used, zinc and powder coatings used, and joining both and anchor fasteners.

4) Installation of clean room doors, windows, pass boxes, HEPA filter housing and light fixtures

- Clean Room compatible single leaf and double leaf doors along with door frames with specified sizes (in BOQ) shall be installed; similarly clean room compatible windows and pass boxes shall be installed with appropriate frames (sizes given in BOQ). All doors, windows and pass boxes shall have clean room compatible beadings. HEPA filter housing and light fixture housing shall be installed on the ceilings with appropriate clean room compatible beadings. HEPA housings shall be connected with flexible coupling to branch ducts. HEPA housings shall have HEPA filter loading from inside the clean room. All covings (except the floor to wall) shall be of aluminum with ~ 75mm radius.

  The vendor shall provide all certification for clean room compatible doors, double glazed windows, pass boxes, filter housings and light housings.

5) Installations of Air-handling units (AHUs)

- The AHUs shall be brought to the site in knocked down condition and installed at locations shown in the drawings. The body of all AHUs shall be made of 20 gauge GI sheets panels (with zinc coatings of 160-180 gm/m^2) with 60 powder coatings, with 40mm PUF insulation, fitted on non-flap aluminum extruded frame (with thermal break) with mixing box, prefilter plenum, 8 row dx coil section with mist eliminator, fan section with DIDW centrifugal blower, heater plenum, 5/3μ filter section, supply air plenum with desiccant and humidifier.
- AHU shall be mounted on a GI frame fabricated with 100mm x 50mm x 5mm C-sections, with zinc coating of 160-180 gm/m^2. The motor and the blower shall have vibration isolation dampers.
- Volume-control dampers- one each for return air, fresh air, supply air and fire retardant. The damper size shall be as per AHU inlet/outlet (Return-air/supply-air) design fabricated with GI (zinc coating 160-180 gm/m^2) with non-vibrating damping valves, giving a ~90% clearance in open condition and a graduation indicating percentage of open area.
- All the dampers shall be bolted to the return air/fresh air/supply air (as the case may be) using high quality neoprene gaskets and 8mm zinc coated bolts. High quality canvass will be used between the AHU and supply-air/return-air duct to isolate AHU vibration from the duct.
- AHU control panel with built-in safety for fan motor, meters and outdoor condenser units shall be mounted close to AHU room. All cabling shall be carried out with armoured copper cables with appropriate current rating.
- All clean room joints shall be sealed with silicone sealant and clean room be cleaned.

- AHU shall be switched-on for a preliminary blow down to check for any leaks, if found, shall be sealed with silicone sealant.

The vendor shall provide all certification as appropriate for all the AHUs installed including AHU body, motor blower and dampers.

6) Installation of outdoor condenser units

- Outdoor condenser units (as per air-conditioning table) shall be installed on steel stands outside the respective AHUs; all the required cabling and copper piping for refrigerant shall be carried out.
- Thermostat shall be mounted at appropriate locations and cabling done for the control panel
- Nitrogen leak testing of all refrigerant piping shall be carried out, followed by filling of required amount of refrigerant gas.
- The compressor shall be turned on and preliminary test carried out.

The vendor shall provide all the certification of outdoor condenser units and refrigerant gas.

7) Installation of HEPA filters, surface mounted CFL ceiling lights and all electrical fixtures in clean room

- HEPA filters, 600 x 600 mm^2, 500 CFM capacity shall be mounted in all clean rooms
- Surface mounted CFL lights, 36W x 2 nos. on each of light housing shall be installed and tested.
- All clean room compatible electrical fittings will be installed as per BOQ and tested for insulation and supply voltages.

The vendor shall provide all certification for HEPA filters, CFL Lights and electrical fittings.

8) Installation of Fire detection/suppression system, CCTV cameras and Biometric access

- Smoke detectors and fire suppression nozzles shall be installed in clean rooms as per zone-wise design given in BOQ.
- Fire control panel shall be located at a convenient location and all cabling shall be carried out.
- Fire suppression NOVAC 1230 Fluid containing cylinders shall be installed and cabling carried out.
- System shall be tested in dry condition.
- CCTV cameras shall be installed as per approved design layout and tested.

The vendor shall provide all certifications on NOVAC 1230 Fluid, cylinders, smoke detectors, nozzles and CCTV cameras.

9) Epoxy Flooring

The flooring material shall be conductive Epoxy and the material shall also include and appropriate select silica sand filters. Primer and resinous flooring material to be in accordance with manufacturer's recommendations.

Physical Properties (neat)

Bond strength (ASTM C-882) 2110 p.s.i.
Flexural strength (ASTM C-580-68) 6,075 (7 days)
Compressive strength (ASTM D-695) 9,910
Absorption (ASTM D-570) 0.6%
Hardness (Shore D) 65 @ 24 hours, 75 @7 days
Thermal shock- 40 Hrs. @ 10 degrees F. 3min @ 212 degrees, F, Shock water 33 Degrees F.

Chemical Resistance- The resinous flooring system shall be resistant to spills and/or extended exposure as indicated from the following chemical for a period of up to 12 months; Distilled water, seawater, sulfuric acid 10%, hydrochloric acid 36%, hydrocholoric vapor, sodium hydroxide 20%, diacetone alcohol, octanol, Xylene, toluene, skydrol, octane, citric acid 50%, fatty acid (linseed), lattice (dairy products), carbon tetrachloride, isopropyl alcohol, methyl isobutyl carbinol, mineral spirits, detergents anionic 2%, calcium hypochlorite 5%.

Flammability, Finished resinous flooring shall not support combustion and shall be self-extinguishing.

Color shall be, as specified by IITD. Pigments selected shall be compatible with the resinous flooring system.

Preparation of surface:

The concrete surface which is to receive the resinous flooring system must be dry, clean and free from contamination. Any loose or corroded segments of existing concrete shall be removed and the area patched with a grouting compound as described and supplied by the manufacturer of the resinous flooring system. Any sealant or release agent on existing concrete surfaces shall be removed by mechanical means.

Any cracks in the concrete shall be evaluated by the Engineer. In the event that the Engineer decides that it cost effective and necessary, all cracks (if any exist) shall be injected by Epoxy Injection resin (non-moving cracks) flexible chemical grout (moving cracks), depending on whether the engineer determines the cracks to be moving or non-moving cracks. The cost and specifications of these repairs (if necessary) be quoted separately as a option at the end of the selection.

Resinous flooring system shall be installed at a minimum depth of 2mm thick in strict accordance with the manufacturer's installation instructions, by an applicator trained and approved by the manufacturer.

Primer: Apply a coat of primer if recommended by the manufacturer for the specific application at a rate recommended by the manufacturer.

Base cove: A base cove of 3-4 inches high will be applied to all wall surfaces where noted in the section on the drawing. The base cove (if any required) shall be installed so as to have a 1 inch radius at the bottom of it.

Base-coat: Apply a trowel coat of Epoxy resin at a thickness so as to insure a total thickness of the system of not less than 1mm.

Top coat: A top coating of Epoxy shall be applied in a manner and thickness of 2mm.

10) Validation and Commissioning:

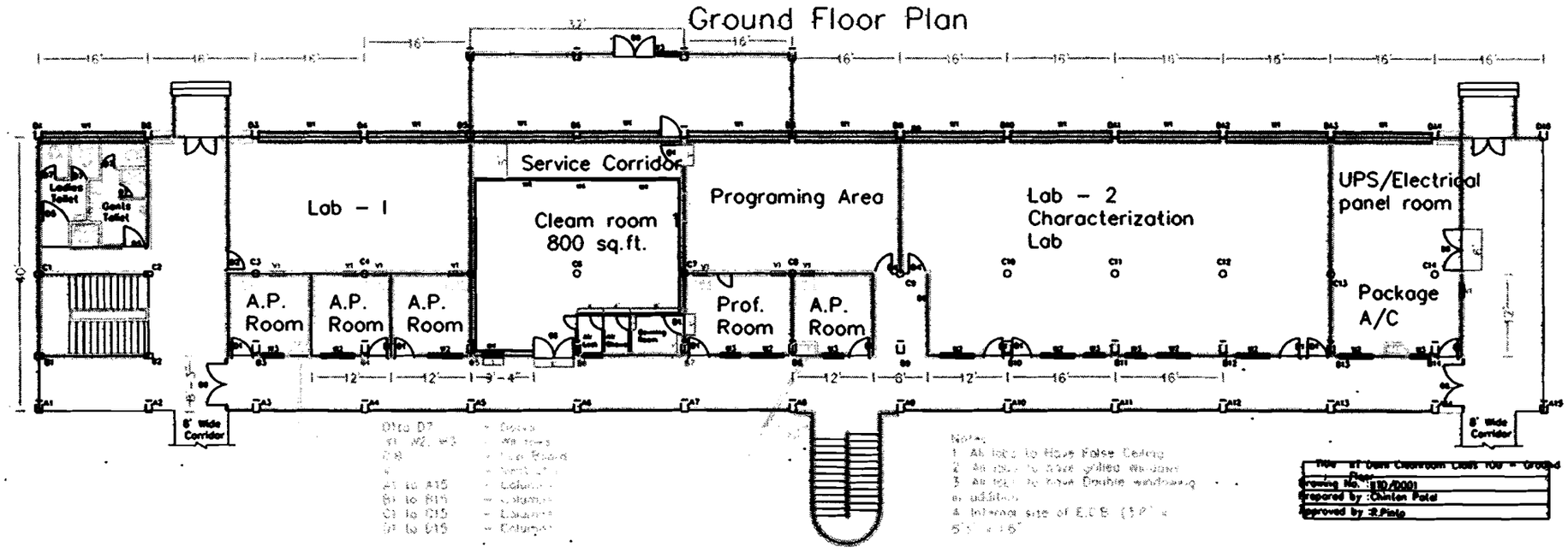
The vendor shall validate the clean room test parameters using an approved third party. The validation parameters are:

a) Temperature control
b) Humidity control
c) Particle count- 100cm below HEPA filters and at various locations in the clean room.
d) Pressure in various locations in the AHUs and in clean rooms
e) Fire suppression protocol and tests
f) CCTV test and validation

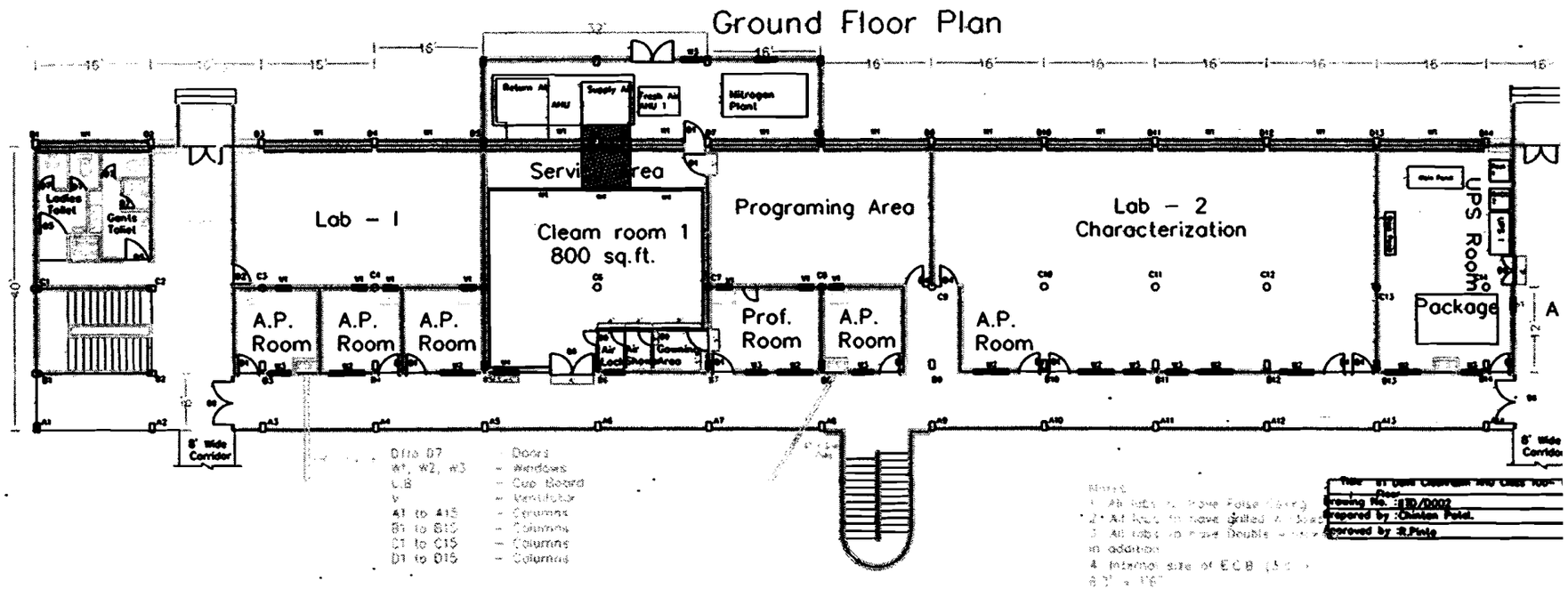
Payment terms: 10% of project cost at the successful completion of each stage.

Note: The vendor shall choose only among the approved makes for all the sub-items.

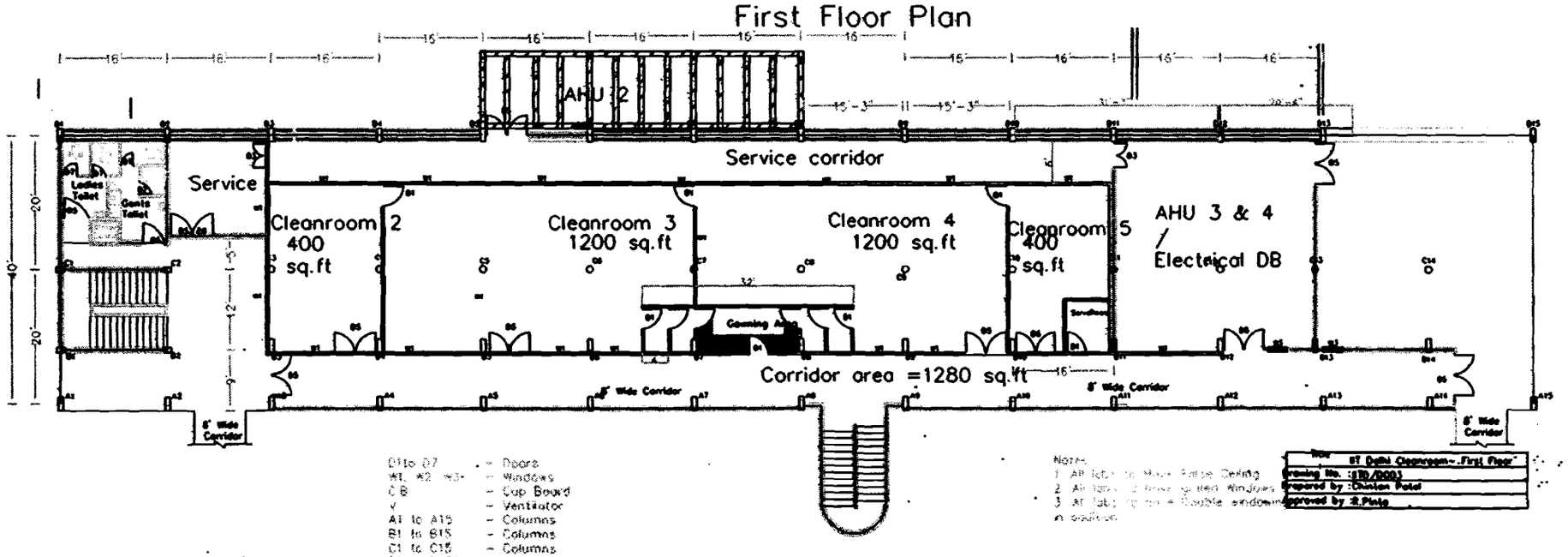
Ground Floor Plan



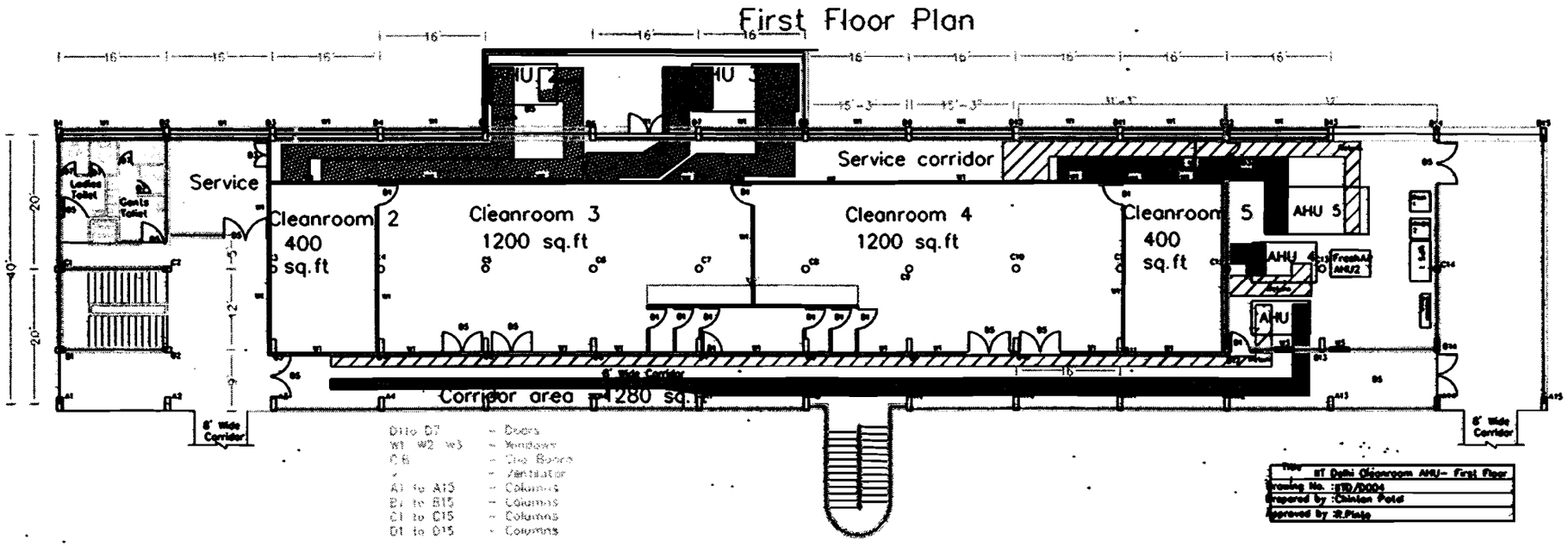
Ground Floor Plan

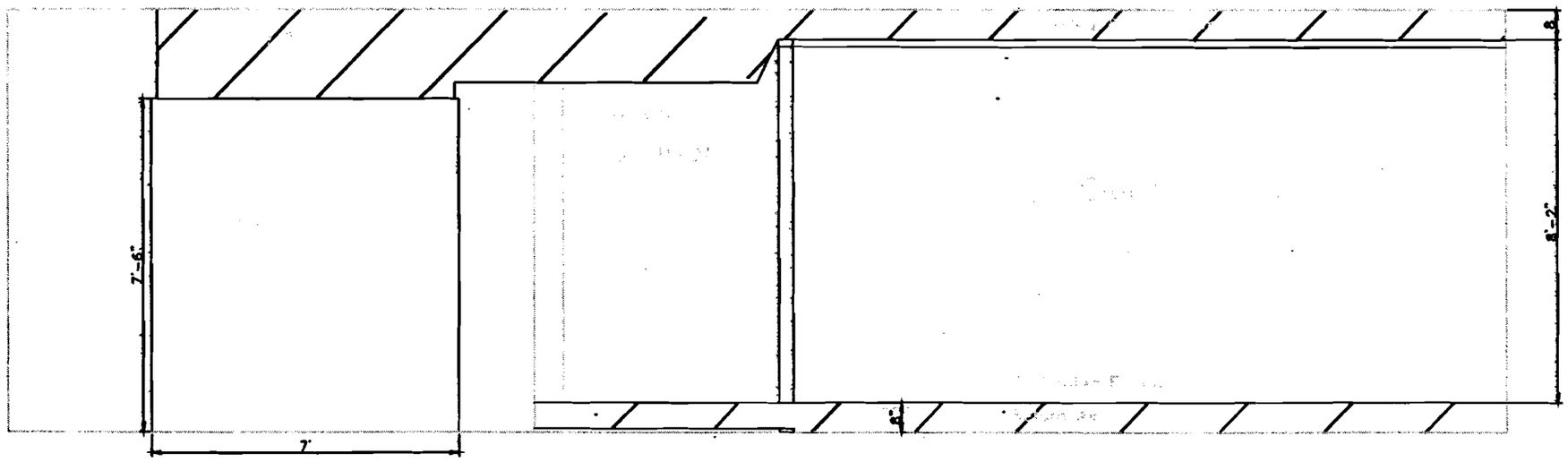


First Floor Plan

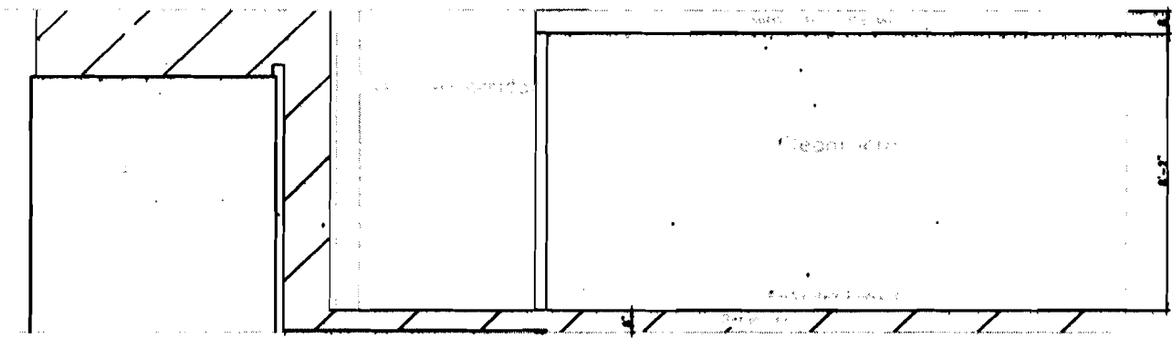


First Floor Plan





Title	IIT Delhi Cleanroom Class 100 AHU Supply
Drawing No.	:IITD/D002 A
Prepared by	:Chintan Patel
Approved by	:R.Pinto



Title	IIT Delhi Cleanroom Class 100 AHU Return
Drawing No.	:IITD/D002 B
Prepared by	:Chintan Patel
Approved by	:R.Pinto

IITD Clean Room Design

Table 1: Air Handling

Room Function	Area Sq.ft.	Height ft.	Volume (CFT)	Class	Air velocity ft/ min	Air changes per hour (ACPH)	Room Pressure Pascal	Flow rate CFM	Exhaust Flow Rate CFM	Fresh Air Flow Rate CFM	HEPA % of ceiling	No. of HEPA filters 4' x 2'	AHU CFM
Clean Room 1 (EBL)	800	8	6400	100	50	225	20	24000	1000	1000	60	60 (400 CFM)	24000 AHU 1
Clean Room 2 (Optical Litho)	400	8	3200	1000	50	120	20	6400	800	800	32	16 (400 CFM)	6500 AHU 2
Clean Room 3 (General)	1200	8	9600	1000	50	120	20	19200	2000	2000	32	48 (400 CFM)	20000 AHU 3
Clean Room 4 (General)	1200	8	9600	1000	50	120	20	19200	2000	2000	32	48 (400 CFM)	20000 AHU 4
Clean Room 5 (Wet Chem)	400	8	3200	1000	50	120	20	6400	2000	2000	32	16 (400 CFM)	6500 AHU 5
Main Corridor (First floor)	1280	8	10240	General	--	10	10	1700	--	200	--	15µ filters	2000 AHU 6
Fresh Air Handling (Clean Rooms 1, 2, 3)	--	--	--	--	--	--	--	3800	--	--	--	15µ filters: 2' x 1' - 2 nos.	4000 FAHU 1
Fresh Air Handling (Clean Rooms 4 & 5)	--	--	--	--	--	--	--	4000	--	--	--	15µ filters: 2' x 1' - 2 nos.	4000 FAHU 2

IITD Clean Room Design
Table 2: Air-conditioning

Room No.	Area Sq.ft.	Height ft	Volume (CFT)	Class	Air changes per hour (ACPH)	Temp (C) +/- 2°C	Humidity % Rel +/- 5%	AHU CFM	Equipment + Heater + Personnel + Fresh Air, KW	Total Cooling (TR)	Air-cooled condensors (TR)
Clean Room 1 (EBL)	800	8	6400	100	225	22	45	24000	5 KW + 25 KW+ 15 KW	24 basic + 16 eqp etc.	AHU 1 40 (16 x 2 + 8 x 1)
Clean Room 2 (Optical Litho)	400	8	3200	1000	120	22	50	6500	5 KW + 15 KW+ 10 KW	6 basic + 10 eqp etc.	AHU 2 16 (8 x 2)
Clean Room 3 (General)	1200	8	9600	1000	120	22	50	20000	10 KW + 30 KW+ 30 KW	18 basic + 24 eqp etc.	AHU 3 44 (11 x 4)
Clean Room 4 (General)	1200	8	9600	1000	120	22	50	20000	10 KW + 30 KW+ 30 KW	18 basic + 24 eqp etc.	AHU 4 44 (11 x 4)
Clean Room 5 (Wet Chem)	400	8	3200	1000	120	22	50	6500	10 KW + 15 KW+ 30 KW	6 basic + 18 eqp etc.	AHU 5 24 (8 x 3)
Main Corridor (First floor)	1280	8	10240	General	10	22	55	2000	--	8	AHU 6 10 (5 x 2)
Fresh Air Handling (Clean Rooms 1, 2, 3)	--	--	--	--	--	--	--	4000	--	10	FAHU 1 10 (5 x 2)
Fresh Air Handling (Clean Rooms 4 & 5)	--	--	--	--	--	--	--	4000	--	10	FAHU 1 10 (5 x 2)

Total number of Split A/c Condenser units = 16 x 2 + 11 x 8 + 8 x 6 + 5 x 6 = 198 Tr

Annexure B:

7.0 Solvency certificate

FORM OF SOLVENCY CERTIFICATE FROM A NATIONALIZED/SCHEDULED BANK WITH WHOM THE FIRM HAS BANKING RELATIOSHIP

This is to certify that to the best of my knowledge and information M/S.....
.....
having its office at ..... is a customer of our bank are/is respectable and can be treated as good for any engagement upto a limit of Rs...../-(Rupees.....).

This certificate is issued without any guarantee of responsibility on the Bank or any of the officers.

Signature

For the bank

NOTE: In case of partnership firm, certificate to include names of all partners as recorded with the bank. (Bank Solvency for pre-requisite should not be less than Rs. 6.00Crores and should be issued not prior to three (3) months from the scheduled bank.

Annexure C

8.0 Bidder Response Outline Sheet

The bidder(s) are required to provide the information in the bidder response outline sheet at **Annexure C**, which, along with their presentation content, will be taken into consideration while short listing firm(s) for issue of RFP. All the headings indicated below must be addressed in the sequence shown, providing as much relevant detail as possible. Additional headings and information may be provided by the bidder(s) where they are required to include additional details or explanations.

Sr. no.	Item Head	Bidder Response (Please make a reference here to any sheet attached separately)
1.	Description Of The Bidder(s) (Specifically include legal status, ownership, and the name of the person within the company who is responsible for this project.	
2.	Descriptions Of Any Proposed Third Parties (Provide similar information to that required in 1. above)	
3.	Relationships Between Bidder(s) And Any Nominated Third Parties. (Provide descriptions of the trading, commercial and legal relationships with any third party nominated in the response)	
4.	The Bidder(s) General Understanding Of The Project Requirements And The Proposed Total Solution. (Separate sheet may be attached, if need felt)	
5.	The Main Features Of The Proposed Solution And Any Areas Of Risk	
6.	Upgrade Strategy (Describe the strategy suggested for future upgradation of clean rooms and any impact this strategy may have on operation etc)	
7.	Implementation Activities And Timing (Provide detailed time schedule for the proposed implementation activities including the delivery & installation)	
8	Maintenance And Support: Describe the maintenance and continuing technical support services, escalations etc that will be provided for the proposed clean rooms).	
9	Requirements For Office Staff Involvement: (Details of the requirements of involvement of IITD in the project activities.	
10.	Benchmarking/Testing Procedures: (Details of the proposed benchmarking/ testing procedures for the clean rooms esp. that of services ventilation system, waste disposal system etc).	

11	Warranties and Guarantees (if any): (provide standard conditions and extension chances of the warranty)	
12	Experience In Appropriate Fields: (experience of the Bidder(s) in the supply, installation and maintenance of similar laboratories).	
13	References: Details of relevant references (including contact names and numbers)	
14.	Patents/ design patents /registered designs/ registered trademarks etc. awarded to the bidder: (Name the component for which patents, design patents etc. has been awarded. Separate sheets/docs may be attached)	
15.	Certified safety and quality standards: provide the details of the safety and quality standard certificates provided and/or applicable to the bidder)	
16	Idea of design and colors (aesthetics): Provide idea of design of color and shades for creating a pleasant working clean room environment. Bidder may attach brochures illustrating the color and feel of their designs).	
17	Payments Schedule And Trading Terms: (A description of the Bidder(s) preferred Schedule of Payments and Trading Terms for component, works and services that will be undertaken).	
18	Other Relevant Information: (Any other information, details, and observations that the bidder(s) considers relevant to the understanding and acceptance of their proposed solution).	
19.	The firm should provide a declaration on non-judicial stamp paper that they have never been black listed by any other Government Institute/International organization	
20	Each NRF clean room should be designed and built to compliance to international standards such as Federal Standard/ ISO USA, European standards.	

Signature
Name of the bidder:
Date :
Rubber seal of the bidder

Annexure D

9.0 **Checklist for Submission of Expression of Interest**

The following check-list must be filled in and submitted with the EOI document:

S No	Check Points	Yes/No
1	The documents in support of executing one similar work costing not less than Rs 9.6 Crores or two similar works, each costing not less than Rs. 7.2 Crores or three similar works each, costing not less than 4.8Crores, out of which one work should be of class 100 during last seven years ending March 31, 2011.	
2	The documents in support of annual financial turnover of Rs. 3.6 Crores during the last three years ending 31st March, 2011.	
3	Document showing the firm has not incurred loss in more than 2 years during the last 5 years ending 31st March, 2011.	
4	The documents supporting that the bidder has a current solvency of Rs. 4.8 Crores.	
5	The documents supporting that the bidder has certification regarding safety and quality from any accreditation agency of International standards relating to class 100 and class 1000 clean rooms.	
6	The documents showing that the bidder has installed at least one class 1000 clean room in India which has been working successfully for the last three years.	
7	Whether all the parameters given in the bidder response outline sheet have been fulfilled?	
8	Certification of the bidder's training/capability.	

Signature
Name of the bidder:
Date :
Rubber seal of the bidder

Annexure E:
10.0 Marking Scheme

Sr. no.	Item Head	Maximum Marks
1	The Bidder(s) General Understanding Of The Project Requirements And The Proposed Total Solution. (Separate sheet may be attached, if need felt)	50
2	Implementation Activities And Timing (Provide detailed time schedule for the proposed implementation activities including the delivery & installation)	10
3	Maintenance And Support: Describe the maintenance and continuing technical support services, qualifications of key professional, escalations etc that will be provided for the proposed laboratories).	10
4	Benchmarking/Testing Procedures: (Details of the proposed benchmarking/ testing procedures for the clean rooms esp. that of services ventilation system, waste disposal system etc).	10
5	Presentation	20

Note: The IIT Delhi may carry out the independent assessment of the work executed by the firm to assess the performance of clean room executed by them.