

**Gujarat University**  
**Navrangpura, Ahmedabad - 380 009, India**



**Tender Ref. No. GU087\_2018\_06**  
**Website : [www.gujaratuniversity.ac.in](http://www.gujaratuniversity.ac.in)**

**Online e-tender document for the purchase of Scientific Equipments for Department of Physics of the University under DST-FIST program**

Gujarat University, Ahmedabad (GU) invites online e-tender for **Supply of “Scientific Instruments / Equipments” as per details and specifications shown in the Annexure-I.**

Following are important details:

<b>Event / Items</b>	<b>Date</b>
Tender Document Downloading Starts from	<b>Date : 30.07.2018</b>
Last Date for downloading Tender documents and submitting Online Tender	<b>Date : 27.08.2018 Time: 1600 Hours</b>
Last Date for Submitting Physical Documents of Tender including DDs and Supporting Documents to The Head, Department of Physics, University School of Sciences, Gujarat University, Ahmedabad - 380009	<b>Date : 30.08.2018 Time: 1600 Hours</b>
Opening of Tender Technical Documents	<b>Date : 06.09.2018 Time : 1500 Hours</b>
Opening of Commercials	<b>Will be notified later</b>
Estimated Cost of Equipments	<b>Approx. Rs. 100.00 lacs</b>
Tender Processing Fee (Non Refundable)	<b>Rs. 5,000.00</b>
EMD	For equipments costing Rs 5 lakhs or less For equipments costing more than Rs 5 lakhs
	<b>Rs. 25,000.00 Rs. 50,000.00</b>
Delivery Period	<b>As per Tender</b>
Validity of the Quoted Price	<b>120 Days</b>
Contact Details (Restricted Time: 1100 to 1700 Hrs.)	<b>+91 - 79 - 26 30 3041</b>

**Please note that Commercial offer MUST be submitted in the ONLINE form only.  
Do not quote prices in the Hard Copy Submitted.**

### **Important Terms and Conditions:**

1. If the supplier/firm is manufacturer/authorized dealer/sole distributor of any item, the Certificate to this effect should be attached.
2.
  - a) The “Technical offer” should include the detailed specifications of main Item/equipment and its accessories. All items should be numbered as indicated in the **Annexure-I**.
  - b) Compliance report stating that specifications of the equipments meet the tender specifications is to be attached item vice.
  - c) The one part of the offer should be placed in separate sealed envelope clearly marked “**Technical Offer**”. This includes DDs for tender fees, EMD, all Supporting Documents and should be super scribed with tender number, name of the item/equipment and tender due date.
  - d) The bidder may download the tender document from the University website [www.gujaratuniversity.ac.in](http://www.gujaratuniversity.ac.in) or [www.nprocure.com](http://www.nprocure.com)
3. Fax and Email quotations are not acceptable.
4. Quotations should be valid for 120 days from the tender due date. The quotation should clearly indicate the period of delivery, warranty terms etc. **A minimum of three years warranty is required from the date of commissioning.**
5. The Quoted prices ( in Indian Rupees only ) must be inclusive of supply, delivery at Physics department, all taxes and levies, customs clearance charges, transportation, loading, unloading, installation, testing, commissioning, insurance (if any) and warranty of the required instruments / equipments.
6. Relevant literature pertaining to the items quoted with full specifications (and drawing, if any) should be sent along with the Technical Offer, wherever applicable.
7. The Suppliers should submit copies of suitable documents in support of their reputation, credentials and past performance about the product/equipment which they have supplied to premier educational Institution(s). Without these documents the tender may be rejected by the University.
8. The tender document must be accompanied by copy of PAN, Certificate of firm/company registration, GST/TIN/VAT registration (Sales tax) and service tax registration.

9. The quantity shown against each item is approximate and may vary as per demand of the Gujarat University, Ahmedabad at the time of placing order.
10. The vendor must be able to provide the product/items within specified time period as prescribed in the Purchase Order. Failing which the EMD will be forfeited. Furthermore on completion of the stipulated time period, Purchase Order will be cancelled and award will be given to another qualified bidder with the negotiated terms & conditions.
11. Imported supplies should be delivered by air and quoted for CIP, Ahmedabad. Vendor / supplier should insure the equipment for the consignment transportation from the vendor's warehouse to The Department of Physics, Gujarat University, Ahmedabad. Gujarat University will not be responsible for any damage or loss of the item/equipment.
12. **For Import purchase/ indigenous purchase 'Advance Payment' is not allowed in any case. 100% payment will be released after completion of the supply/delivery, successful installation, commissioning and submission of performance bank guarantee.**
13. Gujarat University, Ahmedabad is exempted from payment of Excise Duty and is eligible for concessional rate of Custom Duty. Necessary certificate will be issued on demand. The bidders will have to make all necessary arrangements for the clearance of imported goods. **Hence, the price should include these charges, if any. No extra cost will be borne by the Gujarat University.**
14. In the event of any dispute or difference(s) between the vendee Gujarat University, Ahmedabad and the vendor(s) arising out of non-supply of material or supplies not found according to the specifications or any other cause whatsoever relating to the supply or purchase order before or after the supply has been executed, shall be referred to the concerned authority of Gujarat University, Ahmedabad who may decide the matter himself or may appoint arbitrator(s) under the arbitration and conciliation Act 1996. The decision of the arbitrator shall be final and binding on both the parties.
15. All disputes including arbitration (if any) shall be subject to Ahmedabad jurisdiction only.
16. Gujarat University, Ahmedabad reserves the rights to accept/reject any offer in full or in part or accept any offer other than the lowest offer without assigning any reason thereof. Any offer containing incorrect and incomplete information shall be liable for rejection.
17. Only those financial offers will be opened whose technical offers are found suitable by the expert committee appointed for the concerned instruments/equipments. No separate information shall be given to individual bidders. The Departmental Committee reserves its right to select or reject any or all of the items/equipments mentioned above without assigning any reasons.

18. In case the supplier requires any elucidation regarding the tender documents, they are requested to contact to The Co-ordinator/ Deputy Co-ordinator, DST-FIST programme, Department of Physics, University School of Sciences, Gujarat University, Ahmedabad - 380009
19. Demand drafts from the Nationalized Bank / Scheduled Bank of (i) non-refundable Tender fee and (ii) EMD should be drawn in favour of **“DST-FIST Physics”** payable at Ahmedabad.  
**The EMD of the successful bidder will be returned to them without any interest after completing the successful installation, commissioning and submission of performance bank guarantee. The earnest money of unsuccessful bidders will be returned to them without any interest.**
20. The Gujarat University reserves the right to consider or reject any or all tender.
21. **Pre - Qualification Criteria:**  
**Authorization:** The bidder(s) should be the Manufacturer/Authorized/Licensed dealer. ‘Letter of Authorization’ from Original Equipment Manufacturer (OEM)/Principal on the same and specific to this tender should be enclosed. An undertaking from the Original Equipment Manufacturer (OEM) is required stating that they would facilitate the bidder on a regular basis with technology/ product updates and extend support for the warranty as well.
22. **Performance Guarantee Bond:**
  - a. **Three Years comprehensive** Performance Guarantee Bond is mandatory.
  - b. Successful supplier/firm should submit performance guarantee as prescribed and to be received in the office of The Head, Department of Physics, University School of Sciences, Gujarat University, Ahmedabad - 380009 before the date of commencement of supply or 30 days from the date of acceptance of the purchase order, whichever is earlier. The performance guarantee bond to be furnished in the form of Bank Guarantee as per given proforma of the tender documents, for an amount covering 5% of the value of quantity of material on landed cost basis.
  - c. The Performance Guarantee should be established in favor of **“The Registrar, Gujarat University, Ahmedabad”** through any Nationalized Bank/Schedule Bank Situated at Ahmedabad with a clause to enforce the same on their local branch at Ahmedabad.
  - d. **Validity of the performance guarantee bond shall be for a period of Three Years, i.e. entire warranty period from the date of issue of installation and commissioning certificate.**

23. **Delivery:** The item/equipment should be delivered and installed at the respective Department within the period as specified in the purchase order and be ready for use within three weeks of delivery unless otherwise prescribed.
24. **Penalty:** If the suppliers fails to deliver and place any or all the Equipment or perform the service by the specified date, penalty at the rate of 1% per week of the total order value subject to the maximum of 10% of total order value will be deducted.
25. **Training:** Supplier needs to provide adequate training at The Department of Physics, Gujarat University, Ahmedabad to the nominated person by Gujarat University, Ahmedabad at supplier's cost.
26. **Installation & Warranty Declaration:** Suppliers must give the **three years** comprehensive onsite warranty including spares and labour as required from the date of successful installation of item/equipment against any manufacturing defects.

**Installation must be done within stipulated time period from the date of delivery of the item/equipment as specified in the purchase order.**

Any deviation in the material and the specifications from the accepted terms may liable to be rejected and the suppliers need to supply all the goods in the specified form to the satisfaction / specifications specified in the Purchase order and demonstrate at the their own cost.

**27. Address for Communication:**

The Head,  
Department of Physics, University School of Sciences,  
Gujarat University, Ahmedabad - 380009  
Contact: +91 79 26 30 3041 (11:00 hrs to 16:00 hrs , On working days only )

**(Note:** Physical documents of tender should be submitted to the above mentioned office only and **NOT** to The Registrar's office or any other office of The University.)

Sd/-  
Registrar  
Gujarat University  
Ahmedabad

**Form A**  
**PARTICULARS TO BE FILLED BY THE BIDDER**

1. Name of the Supplier:
2. Complete Address of the Supplier:
3. Availability for demonstration of instruments at Gujarat University, Ahmedabad: Yes/No [Please √]
4. Cost of the Tender enclosed: Yes/No [Please √] If yes,
  - a.) Name of the Bank \_\_\_\_\_
  - b.) Amount in (INR) \_\_\_\_\_
  - c.) Demand Draft No. \_\_\_\_\_
  - d.) Last Validity date of the enclosed DD \_\_\_\_\_
5. Earnest Money Deposit enclosed: Yes / No [Please √] if Yes,
  - a.) Name of the Bank \_\_\_\_\_
  - b.) Amount in (INR) \_\_\_\_\_
  - c.) Demand Draft No. \_\_\_\_\_
  - d.) Last Validity date of the enclosed DD \_\_\_\_\_

6. Communication details of the concerned contact person to whom all references shall be made regarding this tender enquiry. [NOTE: Any changes after submission of Tender documents kindly update The Co-ordinator/ Deputy Co-ordinator ,DST-FIST Programme, Department of Physics, Gujarat University, Ahmedabad]

a.) Full Name:

b.) Complete Postal Address:

c.) Telephone No.:

d.) Fax No.:

e.) Mobile No.:

f.) E-mail:

g.) Website Address:

**Note : Demand Drafts must be complied with CTS 2010 standards prescribed by Reserve Bank of India.**



**PARTICULARS FOR PERFORMANCE GUARANTEE BOND**

(To be typed on Non-judicial stamp paper of the value of Indian Rupees of Two Hundred) (TO BE ESTABLISHED THROUGH ANY OF THE NATIONALISED BANKS (WHETHER SITUATED AT AHMEDABAD OR OUTSTATION) WITH A CLAUSE TO ENFORCE THE SAME ON THEIR LOCAL BRANCH AT AHMEDABAD. BONDS ISSUED BY CO-OPERATIVE BANKS ARE NOT ACCEPTED.)

To,  
The Registrar  
Gujarat University,  
Ahmedabad - 380 009.

**LETTER OF GUARANTEE**

WHEREAS Gujarat University, Ahmedabad (Buyer) have invited Tenders vide Tender No..... Dt..... For purchase of ..... AND WHEREAS the said tender document requires the supplier/firm (seller) whose tender is accepted for the supply of instrument/machinery, etc. in response thereto shall establish an irrevocable Performance Guarantee Bond in favor of “ **The Registrar, Gujarat University, Ahmedabad**” in the form of Bank Guarantee for Rs. .... [5% (five percent) of the purchase value] which will be valid for entire warranty period (Three Years) from the date of installation & commissioning, the said Performance Guarantee Bond is to be submitted within 45 (Fourty Five) days from the date of Acceptance of the Purchase Order.

NOW THIS BANK HEREBY GUARANTEES that in the event of the said supplier/firm (seller) failing to abide by any of the conditions referred to in tender document/purchase order/performance of the instrument/machinery, etc. this Bank shall pay to Gujarat University, Ahmedabad on demand and without protest or demur Rs ..... (Rupees.....).

This Bank further agrees that the decision of Gujarat University, Ahmedabad (Buyer) as to whether the said supplier/firm (Seller) has committed a breach of any of the conditions referred in tender document/purchase order shall be final and binding.

We, ..... (Name of the Bank & branch) hereby further agree that the Guarantee herein contained shall not be affected by any change in the constitution of the supplier/firm (Seller) and/or Gujarat University, Ahmedabad (Buyer).

Notwithstanding anything contained herein:

- a. Our liability under this Bank Guarantee shall not exceed Rs..... (Indian Rupees ..... only).
- b. This Bank Guarantee shall be valid up to .....(date) and
- c. We are liable to pay the guaranteed amount or any part thereof under this bank guarantee only and only if Gujarat University, Ahmedabad serve upon us a written claim or demand on or before..... (date).

This Bank further agrees that the claims if any, against this Bank Guarantee shall be enforceable at our branch office at ..... situated at .....  
.....  
(Address of local branch).

Yours truly,  
Signature and seal of the guarantor:  
Name of the Bank:  
Complete Postal Address:  
Date:

## ANNEXURE - I

### Technical Specifications:

**Quote must have a compliance report on all the specifications.**

**Important Note :** The Quoted prices ( in Indian Rupees only ) must be inclusive of supply, delivery at Physics department, all taxes and levies, customs clearance charges, transportation, loading, unloading, installation, testing, commissioning, insurance (if any) and warranty of the required instruments / equipments.

Department of Physics, Gujarat University intend to purchase (1) X-RAY Diffractometer System for phase identification of powders and characterization of polycrystalline samples and thin films. The primary tasks will be Powder diffraction and Grazing Incidence XRD (GIXRD) with built-in or upgradable to Phi, Chi, Rocking Curve and Reciprocal Space Mapping of thin films. (2) FTIR Spectrometer (3) Semiconductor Characterization System (4) Tube sealing Unit under the DST – FIST program of the department.

The proposed systems should be equivalent with or better than each of the specifications listed in the technical requirement section.

Sr. No	Name of Equipment	Specifications	Unit	Quantity
1.	X-RAY Diffractometer	<p><b><u>Basics system for rapid powder diffraction</u></b>  <b><u>Floor model only</u></b></p> <p><b>1) X Ray Tube :</b></p> <p>a) Sealed X Ray tube with line and point focus</p> <p>b) Anode Material: Copper</p> <p>c) Operating Power : 1.8 KW or more  AERBCERT of 60 kV, 60 mA should be Submitted</p> <p><b>2) X Ray Generator :</b></p> <p>a) Suitable X Ray generator for item no 1</p> <p>b) KV range : 0-60KV, in step of 1KV</p> <p>c) mA range = 5-60 mA, in step of 1mA</p>	Number	01

		<p><b>3) Goniometer :</b>  High-accuracy, high-precision goniometer with most modern advanced technology to <b>eliminate manual realignment should be provided.</b></p> <p>a) Vertical or Horizontal, Theta-Theta geometry  b) Two theta range: 1 to 140 deg. or better  c) Scanning mode: Theta-Theta coupled and decoupled  d) Step size: 0.0001 degree  e) Radius: 240 mm or more  f) Scan type : Step or continuous  g) 2-theta linearity over full range : <math>\pm 0.01</math> degree or better  h) FWHM for Silicon or Lab<sub>6</sub> std first peak : 0.03 degrees or better</p> <p><b>4) OPTICS :</b></p> <ul style="list-style-type: none"> <li>- <u>For Powder applications</u>: Fixed Slit based optics both on incident and primary beam side for phase identification and quantification measurements of phases. The slits should facilitate low angle measurements from typically 0.5 deg 2theta.</li> <li>- <u>For GIXRD measurements</u> – A parabolic Mirror (like Goebel Mirror or similar) for parallel beam measurements should be quoted along with long soller slits on the secondary beam path.</li> <li>- A flat crystal monochromator on secondary beam side.</li> </ul> <p><b>5) SAMPLE STAGE :</b> The system should be ready or future upgradable to integrated motorized Chi and Phi rotations and motorized Z translations into one sample stage with minimum space requirements, and should be capable for RSM and Rocking Curve measurement.</p> <p><b>6) DETECTOR:</b></p> <ul style="list-style-type: none"> <li>• A Scintillation Counter / Xe Proportional Counter Detector should be quoted.</li> <li>• Alternatively a solid state detector for ultra fast recording of diffraction patterns will be preferred with minimum specifications as below: <ul style="list-style-type: none"> <li>• Minimum 190 strips/pixel.</li> <li>• Should work both in scanning (step and continuous) and static mode.</li> <li>• Should work in 0D and 1D mode. The switchover of the mode</li> </ul> </li> </ul>		
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		<p>should be via the software and no realignment or repositioning of the detector should be done.</p> <ul style="list-style-type: none"> <li>• Large angular capture typically 3deg 2theta.</li> <li>• Minimum count rate <math>1 \times 10^8</math> cps with linearity at this count rate to be minimum 98%.</li> <li>• Background noise : <math>&lt; 1</math> cps across the whole detector</li> <li>• Spatial resolution : <math>75 \mu\text{m}</math> or less. The detector resolution should preferably not change with change in sample to detector distance.</li> <li>• Point Spread Function: 1pixel/strip.</li> <li>• The detector should have capability to remove secondary fluorescence from metal samples. Mechanism should be explained in details.</li> </ul> <p><b>7) Optics alignment</b> Optics alignment should be automatic (through PC) or optics should be pre-aligned so that switchover from powder to GI mode need not require realignment and should not consume time.</p> <p><b>8) ELECTRONICS:</b> The system electronics should have an integrated shutter control and be capable of monitoring and controlling all Diffractometer functions such as angles, counts, slits, generator safety, etc.</p> <p><b>9) SOFTWARE :</b> The software should be capable of simultaneous diffractometer control, data collection and analysis, peak search, search-match, profile fitting and elaborate pattern treatment such as data <i>smoothing</i>, <i>background subtraction</i>, <i><math>k\alpha_2</math> stripping</i>, etc.</p> <ol style="list-style-type: none"> <li>i. Phase Identification using ICDD PDF2 / PDF4 Database</li> <li>ii. Indexing and Unit cell refinement to obtain lattice parameters</li> <li>iii. Peak Profile fitting, Whole powder pattern fitting</li> <li>iv. Crystallite Size – Strain analysis and Crystallinity estimation.</li> <li>v. Rietveld Refinement along with quantitative phase analysis</li> <li>vi. 3D Plotting of crystal structures</li> <li>vii. Software for simulation, collection and analysis of reflectivity curve (XRR).</li> </ol>		
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		<p><b>10) COMPUTER CONTROL UNIT:</b> A desk top PC should be provided for all operations of the XRD with minimum i5 or higher processor, DVD-RW drive facility, &gt;500GB HDD, &gt;16GB DDR RAM, 21’’ LCD Monitor, Minimum 4USB drives, Windows 7 operating system.A colour deskjet printer should be provided. Suitable PC with machine control, optics and /or sample height alignment and data acquisition software preloaded. Optics mounted should be identified by software and software should guide user for any mismatch. User should be able to export data in ASCII format.</p> <p><b>11) Water Chiller</b> Appropriate close cycle air cooled water chiller for X-ray source cooling. Water tank and heat exchange mechanism may preferably be made of high quality SS to avoid copper scaling in water path.</p> <p><b>12) UPS:</b> Suitable standard UPS should be supplied for continuous running of the system along with chiller.</p> <p><b><u>Future upgradability :</u></b> The system should have built in (ready) one or all or future upgradable to all of the following tasks</p> <ol style="list-style-type: none"> <li>1) Micro Area diffraction</li> <li>2) Rocking Curve (RC)</li> <li>3) Reciprocal Space Map (RSM)</li> <li>4) Pole Figure (PF)</li> <li>5) SAXS Attachment for Small angle x-ray scattering analysis of nanomaterials / powders in transmission mode.</li> </ol> <p><b>Miscellaneous</b></p> <p><b>1) Calibration Standards</b> The vendor must provide standard NIST samples, Silicon or LaB6, for powder diffraction application and Line position &amp; Line profile should be demonstrated after installation. For rest of the applications standard or known samples should be provided with results to compare afterword.</p> <p><b>2) Installation &amp; Commissioning</b> Installation, Commissioning and On-site training by representative of manufacturer at site.</p>		
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		<p><b>3) Warranty and AMC</b> As per the University rules; a minimum warranty of 03 years.</p> <p><b>4) Documentation Required</b> a) List of essential spares supplied free of cost with the instrument should be given separately. b) The complete set of hardware and software manuals should be provided both in soft and hard copy format.</p> <p><b>5) Safety Measures</b> Should conform to highest international safety standards and regulations for x-radiation and vendor should provide certificate stating the radiation doses for the supplied model.</p> <p><b>6) User List</b> Vendor should provide list of the users like educational &amp; research institutes, universities, IITs where they have supplied such system in <u>last 5 years</u>.</p>		
2.	<b>FTIR Spectrometer</b>	<p>Wavenumber Range - 7800~375 /cm</p> <ul style="list-style-type: none"> <li>• Resolution - 1 /cm</li> <li>• Signal Noise Ratio - 30000:1 (resolution@4 /cm , sample and background scan for 1 min@2100 /cm)</li> <li>• Detector - High performance sensitive</li> <li>• Beamsplitter - Coated KBr</li> <li>• Light Source - Long life, steady state infrared emitter</li> <li>• Electronic System - 24bit A/D converter at 500KHz, USB 2.0</li> <li>• Power – 100 - 240VAC, 50/60Hz</li> </ul> <p><b>Related accessories :</b> Sample cards, Solid, Liquid cells, Air cells, ATR, Cuvettes</p>	<b>Number</b>	<b>01</b>
3.	<b>Semiconductor Characterization System</b>	<p><b>To be quoted as single unit</b> <b>DC Characterization system :</b> Dual channel system source meter (SMU).</p> <ul style="list-style-type: none"> <li>• The System should be capable of sourcing/ measuring voltage or current on both channel simultaneously</li> </ul>	<b>Number</b>	<b>01</b>

- System should have 6 ½ digit source and measurement resolution.
- System should be capable of pulsing 10A current simultaneously on both channel.
- Voltage capability: 200 mV to 200 volts with resolution of 100 nV
- Current capability: 100 nA to 1.5A DC or better with resolution of 1 pA.
- System should be able to have GPIB, Ethernet, RS 232 communication
- System should be provided with cable compatible of doing four wire measurements on both channels simultaneously.
- System should have 16 MB internal memory for stand-alone operation.
- Software should have functions like voltage/current sweep/ steps, should be able to store the data and graphs
- Accessories: As required for full operation

**AC characterization System:**

Precision LCR meter should be provided with following specifications

- Test frequency : 20Hz to 10 MHz

Measurement Parameters and ranges

- Impedance (Z), Phase Angle ( $\theta$ ), Inductance (L), Capacitance (C), AC Resistance (Rac), Quality Factor (Q),Dissipation Factor (D), Admittance (Y), Conductance (G), Reactance (X), Susceptance (B), DC Resistance (Rdc)
- R, Z, X, Rdc : 0.1m $\Omega$  to 100M $\Omega$  or better
- L : 0.1nH to 100kH
- C : 0.1pF to 1F
- D : 0.00001 to 9.9999
- Q : 0.1 to 9999.9
- $\theta$  : -180° to +180°
- Basic Accuracy for parameter measurements:  $\pm 0.1\%$  (R, Z, X, G, Y, B, L,C)
- System should possess LCD display

	<ul style="list-style-type: none"> <li>• Graph mode : The Graph function must be available in the instrument. If frequency sweep is selected with start/stop frequency, the result should be displayed in form of graph of measured parameter on LCD display of instrument.</li> <li>• Multi step mode : The instrument should be capable to run a series of measurements in sequence as per user defined steps.</li> <li>• Interface : RS-232C, GPIB</li> <li>• Power source : AC 230V , 50Hz, Single Phase</li> <li>• The system should be provided with Test Fixture for SMD / Chip Components as well as capable of External DC bias source Up to <math>\pm 200V</math></li> <li>• Cable Length : <math>\geq 25</math> cm</li> </ul>		
<b>4.</b> <b>Tube Sealing Unit</b>	<p>Quartz tube sealing system should consist of following specification.</p> <ul style="list-style-type: none"> <li>• Compressor with cylinder and PNG flame with controllable pressure.</li> <li>• Trolley mount vacuum Pumping system and Vacuum collar having compatibility for leak tight joint with quartz tube.</li> <li>• Diffusion pump: Having pumping speed of 280 lt/s or better to achieve <math>1 \times 10^{-6}</math> mb 45 min after high vacuum valve opened.</li> <li>• Rotary Pump: High vacuum rotary pump having pumping speed of min. 12 M3/hr or better</li> <li>• Digital vacuum gauge to measure vacuum in the range of 0.5mbar to <math>1 \times 10^{-6}</math> mbar</li> <li>• Safety devices: The thermostat switch fitted to cooling fin housing of DP protected from excessive heating and over load protection device for vacuum pump motor and D.P.</li> </ul>	<b>Number</b>	<b>01</b>