

Centre of Excellence for Green Energy and Sensor Systems  
BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR  
HOWRAH-711 103

P.O: Botanical Garden, Howrah-711 103, West Bengal,India

Ref.: Tender Advt. No. CGE 6211 in "The Times of India", dated 08.11.2011

(University Project Code: DRC/MNRE/CEGESS/HS/006/11-12)

Under

MNRE project "Advanced Research on Thin Film Silicon Solar Cells and PV Systems"  
(Sanction Letter: 31/40/2010-11/PVSE)

Notice Inviting Quotations

Sealed quotations are invited from bonafide suppliers for of the following items.

Item 01: Plasma Enhanced Chemical Vapor Deposition System (PECVD)	1no.
Item 02: Magnetron Sputtering	1no.
Item 03: Reactive Ion Etching (RIE)	1no.
Item 04: Thickness Profilometer	1no.
Item 05: Modular Photoluminescence System	1no.
Item 06: Chemical Balance (2 types)	1no. each
Item 07: High Resolution Field Emission Scanning Electron Microscope	1no.

Bidding documents may be downloaded from the website ([www.becs.ac.in](http://www.becs.ac.in)) and bidders can submit quotations as per instructions in the document.

Last date of submission of bid is 25th November, 2011 upto 3.00pm

Registrar

(A. Code: DRC-T022/11-12)

## SECTION-I: General Conditions and Important Instructions for Bidders

1. Bidders are to submit the original tender documents with technical specifications and price details in sealed envelope to Prof. Hiranmay Saha, Principal Investigator, DST PROJECT, "Solar Photovoltaic Hub at BESU", Govt. of India at Center of Excellence for Green Energy and Sensor Systems (CEGESS), Bengal Engineering and Science University, Shibpur, Howrah– 711103, West Bengal.

2. Bidders are to submit Technical Bid and Price Bids separately in two sealed envelopes.

(i) PART I: TECHNO-COMMERCIAL BID - giving Detailed Specifications, International Standards (BIS/INTERNATIONAL), Catalogues, List of users & Technical Details/ Operating Parameters, Pre-Installation, Requirements, payment terms, warranty etc.

(ii) PART II: PRICE BID - giving full Prices in Indian Rupees and/or in Foreign currency for

(a) Main Equipment.

(b) Essential Accessories & Spares.

The contents of the envelope (Technical Bid / Price Bid) should be mentioned on its top. All the sealed envelopes should be placed in a common sealed envelope, superscripted with the Ref. Advertisement No. and date along with the bidders name and address.

3. Bidders are to submit this tender document in original after accepting the terms and conditions.

4. A) Preference will be given to reputed indigenous manufacturers having proven track record with service and maintenance capability in Kolkata/ India.

B) For vendors quoting on behalf of Foreign Principals should provide a complete customer list in India and abroad with service capabilities in Kolkata/ India.

5. Last date of receipt of tender by BESU Shibpur is 25th November, 2011 (Friday) at 3.00 pm. Tenders received late will not be accepted under any circumstances. Tenders will be opened in the room of Head Center of Excellence for Green Energy and Sensor Systems (CEGESS), Bengal Engineering and Science University, Shibpur, Howrah– 711103, West Bengal on a subsequent day and time to be notified to the bidders. In case the University remains closed on the said date, tenders will be opened on next working day at the same time.

### 6. Bid Prices

6.1 The Bidder shall indicate on the appropriate price schedule form, the unit prices and total bid prices of the goods it proposes to supply under the contract.

6.2 Prices indicated on the price-schedule form shall be entered separately in the following manner:

#### (a) For Goods manufactured within India

(i) The price of the goods quoted Ex -works including taxes already paid.

(ii) VAT and other taxes like excise duty etc. which will be payable on the goods if the contract is awarded.

(iii) The charges for inland transportation, insurance and other local services required for delivering the goods at the desired destination as specified in the price schedule form.

(iv) The installation, commissioning and training charges including any incidental services, if any:

**(b) For Goods manufactured abroad**

(i) The price of the goods, quoted on FCA (named place of delivery abroad) or FOB (named port of shipment), as specified in the price schedule form.

(ii) The charges for insurance and transportation of the goods to the port/place of destination.

(iii) The agency commission charges, if any.

(iv) The installation, commissioning and training charges including any incidental services, if any.

6.3 The terms FOB, FCA, CIF, CIP etc shall be governed by the rules prescribed in the current edition of the Incoterms published by the International Chambers of Commerce, Paris.

6.4 Where there is no mention of packing, forwarding, freight, insurance charges, taxes etc. such offer shall be rejected as incomplete.

6.5 The price quoted shall remain fixed during the contract period and shall not vary on any account.

6.6 All lots and items must be listed and priced separately in the Price Schedules. If a Price Schedule shows items listed but not priced, their prices shall be assumed to be included in the prices of other items. Lots or items not listed in the Price Schedule shall be assumed to be not included in the bid.

6.7 The purchases made by the purchaser for scientific purpose are exempt from excise duty and Custom Duty at a concessional rate is leviable.

7. All Vendors / Agents must submit full details and requirements for Installation & Commissioning of the Equipment as per Technical Specifications submitted by them.

(i) Water Supply (Filtered, Flow rate).

(ii) Civil Works including Foundation, Flooring.

(iii) Mechanical and Fabrication work required.

(iv) Ambient Temperature Control (if required, as applicable).

(v) Cooling requirement (if any).

(vi) Electrical and Power requirements.

(vii) Space and Dimensions for Installation of the equipment as per the Quotation of the Vendor.

(viii) Requirements of Special Gases, if any.

8. The manufacturer selected shall provide Training in operation and application of the Instrument for the R&D work to user Scientists at BESUS.

9. The University will not issue any C or D form availing of concessional Sales Tax/ VAT. The University will issue Customs Duty Exemption Certificate or Excise Duty Exemption Certificate for foreign purchase, if required.

10. The equipments are to be supplied at the Center of Excellence for Green Energy and Sensor Systems (CEGESS), Bengal Engineering and Science University, Shibpur, Howrah– 711103, West Bengal between 11.00 am and 4.00 pm from Monday to Friday except holidays. The bidders will be responsible for any breakage, damage or defect in the equipment detected subsequently.

11. (a) For Indian purchase (This clause is applicable only for Indian purchase and not applicable for foreign purchase):

Bills in triplicate should be presented for payment within 15 days of Supply / Completion of work. No Advance Payment can be made. All bills are to be accompanied by Order copies and Challan Receipt. The Order Number is to be noted on both the Challan and the Bill. Payment will be made on submission of Proper Bills, Challans etc, by A/C Payee Cheque and no cash payment will be made under any circumstances.

Or

(b) For Foreign purchase (This clause is applicable only for foreign purchase and not applicable for Indian purchase):

Payment will be made through Letter of Credit/Bank Transfer. AWB, Packing list, Warranty Certificate, etc should be provided.

12. All payments are subjected to statutory deductions as and when applicable.

13. Earnest Money Deposit:

a) Earnest money deposit, as specified against different items, in the form of Demand Draft / Pay Order drawn in favour of the "Registrar, BESU, Shibpur " and payable at Kolkata shall have to be paid together with the Technical Quotation, failing which, unless otherwise exempted by any rule, shall not be entertained.

b) Tender has to be kept valid for acceptance for a period of 3 months without any modifications in its terms and conditions. Failure to comply with the same, the authority may forfeit the Earnest Money Deposit.

c) Earnest Money Deposit of the successful bidders will be converted to Security Deposit.

d) Earnest Money Deposit / Security Deposit will be refunded after successful completion of supply or after expiry of Guarantee period. No interest is payable on Earnest Money Deposit/ Security Deposit.

e) Bidders shall submit self-addressed envelope affixing postal stamp of Rs.25/- for release of Earnest Money Deposit.

14. Documents to be submitted with the tender:

- Tender Documents, General Conditions and Important Instruction in original duly signed by the Proprietor/ Partner/ Director of the company as a token of acceptance of Terms and Conditions of Tender.

- Latest Income Tax, Sales Tax, Professional Tax clearance certificates and copy of valid Trade License.
- Technical Bid, Price Bid (Priced) separately in two sealed envelope according to specifications.
- Demand Draft/ Pay Order for Earnest Money Deposit.

15. For all items the warranty/ guarantee period should be at least 24 months from the date of commissioning. Warranty/ Guarantee for all the items supplied will be on 'all comprehensive' basis, i.e., including repairs, replacements, maintenance etc.

Calibration / Test Certificate must accompany along with the equipment.

Supply of equipment shall include installation, erection, commissioning and demonstration.

Bengal Engineering and Science University, Shibpur, Howrah reserves the right to accept/ reject all or any of the bidders without assigning any reason whatsoever.

#### 16. Evaluation and comparison of bids

16.1.1 The Purchaser shall evaluate each bid that has been determined, up to this stage of the evaluation, to be substantially responsive.

16.1.2 To evaluate a Bid, the Purchaser shall only use all the factors, methodologies and criteria defined below.

No other criteria or methodology shall be permitted.

16.1.3 The bids shall be evaluated on the basis of final landing cost which shall be arrived as under:

##### For goods manufactured in India.

- (i) The price of the goods quoted ex-works including all taxes already paid.
- (iii) VAT and other taxes like excise duty etc. which will be payable on the goods if the contract is awarded.
- (iv) Charges for inland transportation, insurance and other local services required for delivering the goods the desired destination.
- (v) The installation, commissioning and training charges including incidental services, if any.

##### For goods manufactured abroad

The price of the goods, quoted on FCA (named place of delivery abroad) or FOB (named port of shipment), as specified in the bidding document.

- (i) The charges for insurance and transportation of the goods to the port/place of destination.
- (ii) The agency commission etc., if any.
- (iii) The installation, commissioning and training charges including incidental services, if any.

16.1.4 The comparison between the indigenous and the foreign offers shall be made on FOR destination basis and CIF/CIP basis respectively. However, the CIF/CIP prices quoted by any foreign bidder shall be loaded further as under:

- a) Towards customs duty and other statutory levies—as per applicable rates.
- b) Towards custom clearance, inland transportation etc. - 2% of the CIF/CIP value.

Note: Where there is no mention of packing, forwarding, freight, insurance charges, taxes etc. such offers shall be rejected as incomplete.

In the case of Purchase of many items against one tender, which are not inter- dependent or, where compatibility is not a problem, normally the comparison would be made on ex works, ( in case of indigenous items) and on FOB / FCA (in the case of imports) prices quoted by the firms for identifying the lowest quoting firm for each item.

Orders for imported stores need not necessarily be on FOB/FCA basis rather it can be on the basis of any of the incoterm specified in ICC Incoterms 2000 as may be amended from time to time by the ICC or any other designated authority and favorable to CSIR Labs/Institutes or Headquarters.

Wherever the price quoted on FOB/FCA and CIF/CIP basis are the same, the Contract would be made on CIF / CIP basis only.

The GCC and the SCC shall specify the mode of transport i.e whether by air/road/rail.

16.2.1 The Purchaser shall compare all substantially responsive bids to determine the lowest-evaluated bid, in accordance with ITB Clause 15.

I/We accept the above terms and conditions.

Signature of the Bidders with date and seal

## Section II: Technical Specifications

### Item 01: Plasma Enhanced Chemical Vapor Deposition System (PECVD)

EARNEST MONEY: Rs. 200,000/-

Period of delivery: Preferably 16 to 20 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

## TECHNICAL DATA

### SPECIFICATIONS FOR PECVD SYSTEM

Type: Cluster Tool type

PROCESS CHAMBERS – 4 Nos.

For each process chamber we need

- One view port.
- Heating tapes for chamber baking upto 100 deg.C.
- Transfer magnetic arm (4 Nos.) to move the substrate carrier from/to each process chamber and central load lock chamber and 1 no from Entry/Exit load lock to transfer chamber .

O-ring: 1 process chamber should be with KALREZ or equivalent o-ring

CENTRAL TRANSFER CHAMBER - 1 No.

ENTRY/EXIT LOADLOCK CHAMBER - 1 No.

- To load 10cm x 10cm substrate.

### PUMPING SYSTEM

- 600 l/s Turbo molecular pump mounted to the central transfer chamber – 1 No. Base pressure  $10^{-7}$
- Dry scroll pump for backing the turbo as well as to rough the central transfer chamber and entry/exit – 1 No.
- Dry pump for each process chamber – 4 Nos.

- Gate valves to connect between the process chamber, load lock chamber to the transfer chamber – 5 Nos.
- Gate valve for Turbo pump – 1 No.
- Necessary Electro pneumatically operated Roughing and backing valves.
- Vacuum pumplines.
- Necessary vacuum gauges.

#### RF ELECTRODE WITH POWER SUPPLIES & PROCESS GAS DISTRIBUTION

- Shower type RF Electrode of 6" diameter – 4 Nos. one per process chamber
- RF Electrode mounted from the bottom of the chamber
- Mass flow controllers for Process gases as given below: (MFC manufacturer should have servicing and recalibration centre in India)
  - o Hydrogen (200 sccm)– 4 Nos.
  - o Silane (50 sccm)– 4 Nos.
  - o Silane + 1 % Phosphine (50 sccm)– 1 No.
  - o Carbon Di oxide (20 sccm) – 1 No.
  - o 1% diborane in Helium (20sccm) – 1 No.
  - o Methane (20 sccm)– 1 No.
  - o Germane (50 sccm) – 1 no.
  - o Helium (200 sccm) – 1 Nos.
- RF Power supply with matching network – 300W, 13.56 MHz – 2 Nos. Selector switches (2 Nos.) to select between the power supplies and the RF electrodes, 27.12MHz – 1.0 kW one number.
- Capacitance manometer – 4 Nos. to monitor the chamber pressure during process with controller.

#### SUBSTRATE HOLDER

- Rotary substrate holder with cradle to accommodate the 10cm x 10cm substrate.
- Capacity to heat the substrate to about 250 deg.C
- Vertical 'Z' – shift for varying source to substrate distance from 10 to 50 mm from substrate.

#### ELECTRICAL CONTROL

- Standalone Electrical rack to house PLC, power supplies and control gadgetries.
- Standalone PC with necessary Software for Supervisory control and data acquisition.

Spare Parts: 1 Turbo Molecular Pump, 1 Dry scroll Pump, 1 power supply 13.56 MHz, 4 MFCS (0-10sccm, 0-20 sccm, 0-50 sccm and 0-200 sccm)



Supplier should have proven track record and supplied to reputed institute and also they should have knowledge in process establishment.

## Item 02: Magnetron Sputtering

EARNEST MONEY: Rs. 30,000/-

Period of delivery: Preferably 8 to 10 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

### TECHNICAL DATA

#### Features

The System is comprised of one process Chamber with one Entry/Exit Load Lock.

#### Application

- Metal & Oxide Coating for solar cell
- Multi layer coating

#### Specifications

- Sample Size : 10cm x 10cm
- Process Chamber : One
- Entry/Exit load lock: 1, with substrate transfer mechanism
- Vacuum pumping system : (Dry Rotary + TurboMolecularPump at process chamber)  
Also the same rotary pump will be used for the entry/exit load lock with a bypass line
- Base vacuum: <10<sup>-6</sup>
- Magnetron sputter source : 6 inch Sputter Gun x 2 with shutter to eliminate cross contamination, sputter up configuration.
- Sample Rotation : Rotation only
- Sample Heating Source (Substrate temperature upto 300 °C)
- Thermo-couple (2sets) with temperature controller with indicator
- Sample holder : 2 Set
- Gas Supply System : Ar, O<sub>2</sub>
- Power supply : DC, 1 KW
- Film Uniformity : <±5%
- Full Automation Control System using PC Interface
- Power requirement: AC220V/415 V, single phase or 3 phase , 50 Hz

## Item 03: Reactive Ion Etching (RIE)

EARNEST MONEY: Rs. 50,000/-

Period of delivery: Preferably 12 to 16 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

### TECHNICAL DATA

#### Features

- Reactive Ion etching (RIE) is a dry etching technology used which is used to selectively etch thin films in various device structures.
- It uses chemically reactive plasma to remove material deposited on wafers (MESA etching).
- High energy ions from the plasma attack the wafer surface and react with it.

#### Application

- Silicon etching
- Dielectrics etching (SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, etc)
- Polyamide etching

#### Specifications

1. Substrate Size : 6 inch diameter
2. Max. Temperature : 300°C (On substrate)
3. Process Gases Nozzle & RF Plasma Source Effective Area : 6 inch diameter
4. RF Power Supply : 13.56MHz, 600W
5. Gas Flow System
6. Flow Control Range : 0~100 scum
7. Gas : Ar, O<sub>2</sub>, SF<sub>6</sub>, CHF<sub>3</sub>(4 Channel + Option)

8. All System Control using PLC Based Touch Panel

9. Ultimate Pressure :  $<1 \times 10^{-6}$  Torre within 10 min.

10. Power requirement:  $<6 \times 220V$ , 3 phase or single phase, 50 Hz

Options:

(a) Additional gas lines

Item 04: Thickness Profilometer

## EARNEST MONEY: Rs. 40,000/-

Period of delivery: Preferably 8 to 10 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

## TECHNICAL DATA

Features :

Technique of measurement : Stylus profilometry

Measurement capability : surface profile measurement

Data acquisition and display : Computerized

### Profilometer Specifications

- Vertical range: 10 nm to 50  $\mu\text{m}$
- Vertical resolution: 1 nm
  
- Scan Length range: 50 $\mu$  to at least 30mm
- Scan Time range: 3s to 50s
- Stylus (standard): Diamond, Approximate 10  $\mu\text{m}$  radius and 2  $\mu\text{m}$  radius as option . Should have quick change stylus replacement fixture for easy replacement of stylus
- Stylus Tracking Force: Adjustable, Approximate range : 10 mg to 40mg
- Maximum Sample Thickness: 20mm or more
- Sample Stage diameter: 125 mm – 150 mm
- Sample stage movement: Translation on X axis: at least  $\pm 10\text{mm}$  and on Y axis:  
 $\pm 10\text{mm}$  ( from the centre )
- Sample Stage rotation: 360°continuous
- Maximum Sample Weight: ~ 0.5 Kg
- Zoom Magnification: upto ~ 200x
  
- Vibration Isolation Table

- Data acquisition, display and analysis: Operation under Windows, Software with stress measurement software for thin films (optional) and Cantilever deformation studies software (optional)

## Item 05: Modular Photoluminescence System

EARNEST MONEY: Rs. 100,000/-

Period of delivery: Preferably 12 to 16 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

### TECHNICAL DATA

(1) White light source:

Wavelength range: 200-1500nm

Power: 200 watt (Max)

Light stability:  $\pm 0.5\%$

Housing: Air cooled housing with suitable focusing lens assembly.

Power supply: With current stability of less than 0.1%

(2) Tunable wavelength Argon-ion Laser System:

Wavelength range: 454nm to 676nm

Power: 100mW or higher @ 488nm & 514nm

Beam Diameter: ~1mm

Beam Divergence: 1.0mrad

Polarization: Linear

Extinction ratio: =250:1

Cooling: built in

(3) Pulsed Laser Diode:

(A) Wavelength:  $375\pm 5$  nm

Pulse width: =70ps

Repetition Rate: 50MHz

Peak Power: >100mW

Power supply: Built in

(B) Wavelength:  $400\pm 5$  nm

Pulse width: =70ps

Repetition Rate: 50MHz  
Peak Power: >100mW  
Power supply: Built in

(C) Wavelength:  $475 \pm 5$  nm  
Pulse width:  $\approx 70$ ps  
Repetition Rate: 50MHz  
Peak Power: >1mW  
Power supply: Built in

(4) Monochromator-I :

Optical Port: One entrance and two exits slits with beam diverter  
Operating Range: 185 to 1100nm with selectable gratings  
Resolution: 0.5nm or better  
Dispersion: 5nm/mm or less  
Accuracy:  $\pm 0.25$ nm or better  
Repeatability:  $\pm 0.1$ nm or less  
Drive Step Size: 0.005nm with stepper motor  
Standard Slit Width: 0-5mm, with 10 $\mu$ m increment or decrement via motorized control  
Height: 5-15mm selectable  
Grating Mount: Dual grating turret  
Grating: Size- 67x68mm, ruled grating, 1200 groves/mm with 250nm and 750nm blaze wavelength  
PC Interface: USB

(5) Monochromator-II :

Focal Length : 500mm  
Aperture Ratio : f/6.5  
Optical Port : One entrance and two exit slits with beam diverter  
Operating Range : 185 to 1800nm with selective gratings  
Resolution: 0.05nm or better  
Dispersion : 2.0 nm/mm or less  
Accuracy:  $\pm 0.2$ nm  
Repeatability:  $\pm 1.0$  nm  
Drive Step Size : 0.005nm with stepper motor  
Focal Plane Size : 25mm wide x (10 to 15)mm high  
Standard Slit: Width: 0-5mm with motorized control  
Height: 5-15mm selectable



Grating Mount: Triple turret

Grating: Size- 68x68mm, holographic grating 1200groves/mm with 250nm blaze wavelength,

-68x68mm, ruled grating 1200 groves/mm with 500nm blaze wavelength

-68x68mm, ruled grating 600 groves/mm with 1.0um blaze wavelength

PC Interface: USB.

(6) PL Sample Chamber:

Capable of holding solid and liquid samples (quartz cuvette)

Including lens, Beam splitter (2 nos.), Variable Neutral Density filters, Band pass filter, mirrors (5 nos.), polarizer, analyzer , all with suitable mounts.

XYZ sample stage: screw pitch~0.01cm

(7) Thermoelectrically Cooled Optical Cryostat

Sample: Sample should be in Vacuum and Cooled by Mechanical contact with heat exchanger,

Electrical access to sample: should be via external Fischer connector

Sample chamber Dimension: Capable of holding sample of dimension 2cmX2cm

Five optical access ports (4 radial and 1 axial).

Temperature range: 4 – 325 K measured on heat exchanger.

Cooling power: @ 50Hz mains power: 0.25W @4.2 K

Temperature stability:  $\pm 0.15$  K

Vibration Characteristics: Typical RMS displacement of 10 microns of the sample mount.

Single channel (upgradable upto 3 channel) Temperature controller complete with at least 3m Long Cryostat cable with 10 pin connectors , IEEE 488 and RS232 Interfaces, Digital display, Suitable software for data Logging and range handling:

Suitable Oil free Pumping system: With Vacuum gauge

(8) Detectors

(A) PMT Detector Assembly including housing for PM Tube, LCD display and High Voltage Power supply.

Wavelength range: 185-900nm

(B) InGaAs Detector: 2mm dia. active area, including, mount adaptor to monochromator, power supply and cooling system.

Wavelength range: 900-1700nm

(C) Optical Power meter:

Wavelength range: 200-1100nm

PC interface: USB

- (9) Dual Phase Lock-in Amplifier Frequency: 10Hz to 100kHz or higher
- (10) Chopper with controller  
Including chopper control unit with digital Display of actual chopping frequency  
Resolution: 0.1Hz or better.
- (11) Data acquisition & processing software  
For system control and general spectroscopy applications including system control PC  
and LCD monitor.
- (12) Optical Bread board  
Metric version  
Size: 4 x 6ft.  
Thickness: 4inch  
M6 thread on 25mm hole centre,  
Including mounting systems  
Laser safety Goggles

## Item 06: Chemical Balance (2 types)

EARNEST MONEY: Rs. 20,000/-

Period of delivery: Preferably 6 to 8 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

### TECHNICAL DATA

#### Chemical Balance (Type I)

- Weighing Range : upto 250gm
- Readability : 0.1mg
- Repeatability : 0.1 mg
- Linearity : +/- 0.2 mg
- Floating Display : Adjustable
- Operating Temperature : 0°C to 40°C
- Indicator : LCD / LED
- Calibration : Internal, Automatic
- Operating temperature: : 10 degC to 50degC
- Line Voltage : 200 - 230 V AC
- Interface : RS – 232C and USB supported

Note: All values are indicative of the required ranges. Please quote model having the closest characteristics.

### Chemical Balance (Type II)

- Weighing Range : upto 100gm
- Readability : 0.01mg
- Repeatability : 0.02 – 0.03 mg
- Taring range : Entire range
- Linearity : +/- 0.06 mg
- Floating Display : Adjustable
- Operating Temperature : 0°C to 40°C
- Indicator : LCD / LED
- Calibration : Internal, Automatic
- Operating temperature: : 10 degC to 50degC
- Line Voltage : 200 - 230 V AC
- Interface : RS – 232C and USB supported

Note: All values are indicative of the required ranges. Please quote model having the closest characteristics.

## Item 07: High Resolution Field Emission Scanning Electron Microscope

EARNEST MONEY: Rs. 100,000/-

Period of delivery: Preferably 20 to 24 weeks from the date of issue of Purchase Order. If the supply is not completed within the stipulated period as indicated in the Purchase Order a Liquidated Damage @ ½ % per week will be imposed on the value of purchase order.

### TECHNICAL DATA

This technical specification describes the minimum technical requirements and the minimum acceptable performance standards for the Scanning Electron Microscope (SEM) attached with Energy Dispersive X-ray Analyser (EDS) to be installed and commissioned by the supplier at Bengal Engineering and Science University, Shibpur, Howrah, WB, India. After commissioning, the supplier has to demonstrate the performance of the microscope with attached EDS spectrometer at site.

#### Specifications:

1.	Resolution	1 nm or better @30 kV or 1.5nm or better at@ 15 kV and 3nm or better@1kV.
2.	Magnification	Lowest X15 or less Highest x800,000 or more
3.	Vacuum System	Suitable vacuum system having ion pump, Turbo Pump & Oil free rotary pump.
4.	EHT	500V to 30KV
5.	Electron Gun*	Schottky field emitter or Thermionic emitter
6.	Chamber	Large chamber with at least 7 accessory port.

7.	Stage	5 axis motorized stage with motorized stage movements equivalent to or better  X=100mm or more  Y=100 mm or more  Z=40mm or more  Tilt=0-70°or more  R=360°endless
8.	Electron Optics	Beam Deceleration/Gentle beam/Beam Booster/ technology or equivalent for high resolution imaging at low KV, Magnetic/Electrostatic objective lens assembly etc. for high resolution imaging of magnetic materials
9.	Probe Current	At least 20nA or higher
10.	Detectors	a) Chamber mounted SEI detector.  b) In-Lens SEI detector for high resolution imaging in High Vacuum.  c) 4QBSD detector.
11.	User Interface	Keyboard, Mouse, Control Panel with multifunction for the control and adjustment of frequently used SEM parameters, Manual Joystick control for stage axis.
12.	Display	1No. 19" TFT Monitors for FESEM
13.	Accessories	a) High resolution printer.  b) Chiller.  c) Compressor.  d) Infrared chamber scope(IRCCD)  e)Control panel for adjustment of various SEM functions like focus, mag etc

		f) Gold /platinum coater. g) Interface between SEM and EDS h) Joystick for stage motor control i) 2 emitters. j) Spares (Detail list to be attached with the quote.) k) EDS liquid nitrogen free detector, resolution 135eV or better l) EDS analysis software m) Standard sample set for EDS
14.	Elemental (optional)	E beam Lithography system should be compatible with the quoted system.

\* Two separate Quotations should be submitted for two types of electron guns

Calibration standards: Standard samples to check system calibration i.e. magnification etc should be supplied along with the system.

Pre-installation requirements: Pre-installation requirements such as room size, acceptable limits of EM field and mechanical vibration and required power rating are to be stated.

Environmental requirements: Necessary environmental requirements, i.e. temperature, humidity etc during the operation of SEM/EDS system should be specified.

#### Warranty & Training

(a) At least Two years of extended warranty should be offered after successful commissioning of the equipment.

(b) Installation, commissioning and training should be carried at BESU site

(c) Delivery time and Service response time of the equipment should be clearly specified.

### Compliance Statement

- (a) The supplier must submit technical brochures and proper application notes adequately explaining and confirming the availability of the features of the equipment quoted.
- (b) The supplier must submit the data in tabular form indicating the compliance of the features of the model of the equipment being quoted with those given in the tender.
- (c) Features not matching – must be clearly indicated.

### User List & After Sales Service

- (a) The supplier must submit a comprehensive list of users of the equipment being quoted or similar equipments – in India.
- (b) The supplier must have sold about a good number of similar equipments in India.