

Department of Chemistry  
Indian Institute of Engineering Science and Technology, Shibpur  
Howrah-711 103

Ref.: Tender Advt. No. CH 1187, published in “The Times of India, Kolkata”,  
“Sanmarg” and “Ei-Samay”, dated 26.02.2016

Project Code: DRC/DST-NM/CHEM/JD/019/15-16

**Notice Inviting Quotations**

Sealed quotations are invited for the supply of *Solar Simulator, DSSC Characterization Unit, Screen Printer, Cell Construction Unit, High Temperature Round Vacuum Oven and other Laboratory equipment* as per the following technical specifications. The relevant bidding document can be downloaded from the Institute Website. The document can also be obtained from the Department of Chemistry (contact: Dr. Jayati Datta) between 10.30 a.m. and 2.00 p.m. on all working days **on or before 17.03.2016.**

**Dean (R&D)**

(A. Code DRC-T107/15-16)

*This is downloadable*

**INDIAN INSTITUTE OF ENGINEERING SCIENCE AND  
TECHNOLOGY, SHIBPUR**



**BIDDING DOCUMENT**

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*For Supply of*

***Solar Simulator, DSSC Characterization Unit, Screen Printer, Cell  
Construction Unit, High Temperature Round Vacuum Oven and  
other Laboratory Equipment***

**Under**

DST-Nano Mission Project Scheme  
Govt. of India (New Delhi)  
**Department of Chemistry**

**SECTION I: TERMS & CONDITIONS AND IMPORTANT INSTRUCTIONS  
FOR BIDDERS**

1. Bidders are invited to submit quotations for technical specifications as per requirement and also for their commercial values separately in sealed covers to the Department of Chemistry in the following address:

**Dr. Jayati Datta**  
**Professor**  
**Department of Chemistry**  
**Indian Institute of Engineering Science and Technology, Shibpur**  
**Howrah-711103, India**  
**Contact No: 9830029798**

2. Enquiry Number must be mentioned on the cover.
3. Tender Application Fees @ Rs 500/- (Rupees Five Hundred only) is to be deposited with the Quotations by Demand Draft in Favor of Registrar, IEST, Shibpur payable at Kolkata.
4. Quotations are to be submitted **on or before last date of submission, ie., 17<sup>th</sup> March, 2016** between **10.30 a.m. to 2.00 p.m.** except Saturday, Sunday and other public holidays.
5. After the deadline of submission quotations will not be entertained under any circumstances.
6. Each of the Bidders has to quote minimum **two (02) items** under the category of **Instruments I, II & III.**
7. Bidders have to deposit Earnest Money for each quoted item by Demand Draft in Favor of Registrar, IEST, Shibpur payable at Kolkata. The EMD amount is 1% of the quoted value or Rs 20,000/- whichever is higher.
8. The Tender Application fees and EMD should be enclosed with the Technical Bid.
9. Technical Bid will be considered first. Items qualifying in the Technical Bid will be considered for the Price Bid.
10. Date and time of The Bid will be opened on **22<sup>nd</sup> March, 2016** at **12.00 Noon.** in the Office of the Department of Chemistry, Indian Institute of Engineering Science and Technology, Shibpur, Howrah-711103.
11. Technical Bid should include the technical details and specifications as per requirement, International Standards (BIS/INTERNATIONAL), Catalogues, List of users & / Operating Parameters, Pre-Installation Requirements and the Warranty period.
12. The Price Bid should be inclusive of all taxes, duties and levies. Inclusion of Tax/Levy at a later stage will not be accepted. Freight and Insurance charges and Payment terms should be clearly mentioned. Price has to be mentioned in Indian Rupees also. Essential Accessories & Spares are to be indicated.
13. The materials are to be supplied in the Department of Chemistry, IESTS between 11.00 a.m. and 4.00 p.m. The Bidders/Suppliers will be responsible for any breakage, damage or

defect in the equipment detected subsequently. The supply and installation of the equipment should be completed within a period not exceeding 03 months from the placement of the formal work order or opening of the LC, failing which appropriate action will be taken as per Institute Rules.

14. If the supply is not completed within the stipulated period as indicated in the Work Order, a Liquidated Damage @ 0.5% per week will be imposed, subject to maximum of 5% of the value of the work order.
15. For Indian 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 Receipts. The Order Number is to be noted on both the Challan and Bills.

**16. Documents to be submitted with the tender:**

Tender Documents/Terms & Conditions in Original duly signed by the Proprietor / Partner/ Director of the Company as a token of acceptance of Terms & Conditions of Tender. .

**17. Customs Duty & Excise Duty**

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

**18. Indian Institute of Engineering Science and Technology, Shibpur (Formerly, Bengal Engineering and Science University, Shibpur), Howrah reserves the right to accept / reject all or any of the tenders without assigning any reason whatsoever.**

We accept the above terms and conditions.

Dated:

Signature of Bidders/Suppliers

With date & Seal

## **SECTION II: TECHNICAL SPECIFICATIONS**

### **I# Solar Simulator combined with LED Light Soaker, (Peccell Technologies, Japan; Dyesol, Australia; Bunkou-Keikii, Japan or Higher)**

To be provided with:

#### **Class AAA Xe lamp Solar Simulator**

Mirror Unit is 45° for 360° rotation of illumination light beam; AM 1.5 G Air Mass Filter, Irradiance : 0.8 to 1.5 Sun (1 SUN = 1000 W/m<sup>2</sup>); Illumination Area: 70 mm x 70 mm (Effective Area 40 mm x 40 mm) with Class AAA; Automatic Shutter; Freely rotatable in 360 degree Illumination Head; Lamp life: 2000 hour (approx); Filter Holder : Two filter to be inserted and touched controlled panel; Reference Si Cell should be quoted for calibration of Solar Simulator and Spare lamp – 1 unit

**&**

#### **LED Light Soaker**

10 cm X 10 cm Illumination Areas; Spectral Range: 380 nm - 1100 nm; Spectral Property: Class AAA; Customizable Head Orientation Range; Lamp should be Multi high quality LED matrix; Lamp Lifetime should be > 12,000 Hour and USB Controller. Incident power at working plane: Variable 0 to max value; Self-customization of light source Emission spectrum; Program Illumination cycles; Cut specific bandwidth

### **II#DSSC Characterization system including IPCE and IV measurements (Peccell Technologies, Japan; Bunkou-Keikii, Japan or Higher) and Spectral measurement units**

#### **➤ IPCE measurement:**

Minimum specification required

Wavelength range 300 nm - 1000 nm with purity; Intensity of monochromatic light @ 500 nm 35mA/cm<sup>2</sup>; Light source: 150 W Xe lamp (ozone less). Each component to be specified with the following:

**(a) Monochromator:**Focal length 100 mm; Diffraction grating 600 lines/mm; USB Interface; Motorised Filter Wheel with order sorting filters

**(b) Optical fiber: The unit should be equipped with** Optical fiber to irradiate high intense monochromatic light suitable for DSSC; Optical fiber: Bundled fiber (SUS); Fiber length : 1 m; Exit diameter : ID 3 mm, ED 5 mm; Folder : detachable folder

**(c) Sample chamber: Must be small, separate and independent from main unit in order to put the unit in Glove box;** Dimension to be specified(possible to keep through big antechamber in single workstation Glove Box of 300 mm dia.) IV amp: selectable (x1, x10, x100, x1k); Output voltage 10 V.

**(d) Calibrated reference Si photodiode** 10 mm action area and calibrated spectral sensitivity data

**Software for operation and analysis;** Software PEC-PRO; Wavelength control: step scanning Filter control: auto; Data analyzing: conversion to spectral sensitivity, quantum efficiency and Jsc, spectral calculation

➤ **I-V measurement**

IV Curve Analyzer System should be compatible with IV Curve Analyser Software (I-V Curve Analyser Ver. 2.1 (PEC-IV2)). Measurement Parameters like Open circuit voltage; Short circuit current; Conversion efficiency; Fill factor; Maximum power; Voltage at Maximum Power; Current at Maximum Power; Series Resistance. HP Probook Laptop with necessary cables.

Both-way scanning Measurement: Software supports; Real-time display of IV data storage in MS-Excel Format

➤ **Spectral measurement**

(a) IR Unit: Wavenumber Range : 7800~375  $\text{cm}^{-1}$ ; Resolution : 1  $\text{cm}^{-1}$ ; Signal Noise Ratio : 30000:1 (resolution@ 4 $\text{cm}^{-1}$ , sample and background scan for 1 min@2100  $\text{cm}^{-1}$ ); High performance DLATGS Detector; Coated KBr Beam splitter; Light Source : Long life, steady state infrared emitter; Universal ATR (ZnSe crystal plate), Bolt Press for 13 mm pellets; Agate Mortar and Pestle and KBr Powder, Magnetic Film/Pellet Holder (for 13 mm samples).

(b) Portable Laser Raman Spectrometer: Wavelength 532 nm, Laser Power 30-50 mW Spectrometer (software control); Spectral Range 90  $\text{cm}^{-1}$  – 6000  $\text{cm}^{-1}$ ; Spectral Resolution 5-8  $\text{cm}^{-1}$ ; Detector Type Linear CCD Array; Read out Noise 30 e rms; 90% Maximum quantum efficiency, Integration Time 10 ms – 8minutes; 75 mm Focal Length; Entrance Aperture 20  $\mu\text{m}$  wide slit; Grating 1800 g/mm holographic grating; One Additional diode laser of 532 (power 30-50mW); Electronics; Microsoft operating (minimum Windows XP) system with details specification. The unit should Data Analysis software & own library creation programme. Various sample holders for liquid, powder, pellets, films should be included, Manufacturers calibration standards should be supplied, Glass sample vials for liquid sample.

**III # Screen Printer combined with Cell Construction Unit (Dyesol, Australia or Higher)**

**Screen Printer**

Screen Printer with screen for coating TiO<sub>2</sub> and Pt paste, screen printing jig with Teflon blade Air consumption 0.45 IGI/cycle; Air source 5-7 kg/cm<sup>2</sup> PSI; Substrate thickness (mm): 0-50 mm; Capacity (P/H, full speed full stroke) 990; Max. Print area: 200 x 250 (DxW, mm)

**Cell Construction Unit**

Cell Construction Machine should include

1. Manual Hole Drilling Machine

Grit Media: Grit sizes from ultra fine 10 micron to larger 300micron media

Control Grit Dosage :Manual control of grit dosage; Safety glass window; Dust Absorber to collect harmful dust particles produced during the blasting process; Blasting Unit length should be 320 mm, Width 220 mm, Height 350 mm and Blasting Chamber should be Length 460mm, Width 300mm Height 200mm; Substrate Sizes accommodation : Length 430mm x Width 270mm

2. Programmable Hotplate

230 mm x 160 mm Substrate Size; Temperature range up to 650°C; Due to the large thermal capacity of the Programmable Hotplate the temperature uniformity once

stabilized is +/- 2°C except; Programmable timing facility and maximum temperature steps; Temperature steps incorporate a ramp time and constant temperature time; Time range should be mentioned.

### 3. Test Cell Assembly Machine (TCAM)

To assemble test cells in a repeatable manner by melting a thermoplastic gasket, between the working and counter electrode, through timed resistive heating of the Counter electrode and application of a set pressure.

Variable voltage range: 0V DC to 40V DC, maximum current 3Amps and variable timing of pressure application set by a user controlled timing unit: from 0.01 to 9999 seconds; Dimension to be specified.

## **IV# Accessories, Peripheral / associated units for matrix fabrication**

### **(i) Multi parameter system**

pH Module: range -2.0 to 20.00, Resolution should be mentioned, Relative Accuracy  $\pm 0.002$ , Calibration Editing.

ISE: range 0 to 19999, Relative Accuracy  $\pm 0.2$  mV, 4 digit Resolution, Calibration Editing.  
Temperature: range -5 to 105 °C, Relative Accuracy  $\pm 0.1$

Dissolved Oxygen: Concentration – Polarographic, range 0 to 90 mg/L, Resolution should be mentioned, Relative Accuracy  $\pm 0.2$ ; % Saturation – Polarographic: Range 0 to 600, Relative Accuracy  $\pm 2$  %; Concentration – RDO: Range 0 to 50 mg/L, Relative Accuracy  $\pm 0.1$  mg/L; % Saturation – RDO: Range 0 to 500, Relative accuracy  $\pm 2$  %, Automatic Barometric Pressure Correction 450.0 to 850.0 mm Hg, Automatic Salinity Factor Correction, Polarographic or RDO probe

Conductivity: Range 0.001  $\mu$ S to 3000 mS, Resolution 0.001  $\mu$ S minimum; Reference temperature 5, 10, 15, 20, 25 °C, Calibration should be edited.

Resistivity: range 2 ohm to 100 meg-ohm, Resolution 2 ohms-cm, Relative accuracy 0.5%

Salinity: Range 0.01 to 80.0 ppt NaCl equivalent; 0.01 to 42 ppt, Resolution 0.01, Relative Accuracy  $\pm 0.1$

TDS: Range 0 to 200 ppt, Resolution should be mentioned, Relative Accuracy  $\pm 0.5$  %, Linear 0.01 to 10.00 TDS Factor Range.

### **(ii) Programmable Spin Coating System**

Micro-controller Controlled, Brushless DC Motor, 100-10,000 R.P.M. Speed Range, 40-5,000 R.P.M./sec programmable Acceleration speed, Duration: 1-9,999 sec/step, Preset Editable Programs, Real-time LCD Display of R.P.M., Timing & Program Status. Input & Controlling should be through Key-pad, 8" Diameter Teflon coated Working Chamber, Integrated Power On/Off Switch with Indicator, Integrated Vacuum release Switch with On/Off Indicator, Spill-

drainage Facility, Lid over the Working Chamber should be Transparent Photo-resist. 0.5", 1", 1.5" and 2" Substrate Holders, Gas purging facility.

### **(iii) Oil-free Vacuum Pump**

Mentioned Maximum Power and Maximum Current, Maximum Vacuum should be mentioned in mm Hg, Maximum Flow Rate: 25 l/min Noise Level: 52dB, Horse Power: 0.5 and 1 HP, Mention Motor rotation.

### **(iv) Freeze Dryer**

Microprocessor controlled and LED display of temperature, Condenser temperature should be  $-110^{\circ}\text{C}$  (at an ambient of  $20^{\circ}\text{C}$ ) for faster drying process of aqueous and organic solvent, other volatiles which have very low freezing point, Provision for connecting vacuum concentrator for future up gradation, Seamless surface condenser with external cooling coil with large surface area without gasket or seals to avoid leakage, The condenser trap which is normally prone to corrosion should be made of highest quality rust free stainless steel **AISI316 grade** to prevent corrosion at any case, System should be completed with : Cold trap -  $110^{\circ}\text{C}$  or lower Round acrylic top cover of condenser trap; 'Manifold Basic with 4 Rubber Valves 3/4" for freeze drying in flasks

High vacuum pump (specification should be mentioned) with anti suck back device and oil mist separator; Ultimate vacuum : 0.001 mbar or lower, Condenser (trap): 2.5 Kg /24 hours, Total Condenser capacity should be 3Kg, 4liter Condenser volume, Adaptor for freeze drying various size of flasks (24/29, 29/32, 34/36), Built in front drain trap.

### **V# High Temperature Round Vacuum Oven with inlet and outlet air flow control facility**

Outer body wall- Mild Steel powder coated, inner Body wall- Thick stainless steel S.S.304, high grade glass wool insulation between two walls to prevent heat loss, silicon door gasket and positive door clamping arrangement, temperature range:  $50^{\circ}\text{C}$  to  $250^{\circ}\text{C}$ , accuracy:  $\pm 2^{\circ}\text{C}$ , Minimum Vacuum control:  $\leq 30$  mm Hg, chamber dimension: at least 15"x15", number of rack: at least two, digital Vacuum indicator with LED/LCD Display, resolution: at least 1 mm Hg, accuracy:  $\pm 1$  mm Hg, digital temperature controller/ indicator with resolution:  $1^{\circ}\text{C}$ , temperature resistant toughened glass observation window on the door, vacuum gauge with vacuum release valve and nozzle. Humidity measurement facility using humidity indicator (Dry Bulb – Wet Bulb method) having RTD probe, graphical LCD Display for a user-friendly display interface and four capacitive touch sensitive keys for programming. Inlet and outlet gas flow control facility using two mass flow controllers with flow range of 0-100 sccm and 0-200 sccm, accuracy:  $\leq \pm (1\% \text{ of reading} + 0.4\% \text{ of Full Scale})$ , operating Range: 1% to 100% of full scale measure and control, controllable flow rate  $\geq 100\%$  of full Scale, inbuilt display and control panel (separate display and controller is not acceptable), input /output Signal: digital mass flow, volumetric flow, pressure & temperature RS-232 serial (interfacing option with pc is desirable), calibrated for air, process connection: 1/4 inch, target gases: air,  $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{C}_2\text{H}_2$ , Ar,  $\text{CO}_2$ , CO,  $\text{D}_2$ ,  $\text{C}_2\text{H}_6$ ,  $\text{C}_2\text{H}_4$ , He, Kr,  $\text{CH}_4$ , Ne,  $\text{N}_2\text{O}$ ,  $\text{C}_3\text{H}_8$ ,  $\text{SF}_6$ , Xe, i-Butane, and n-Butane.