Sr No. 48 / Reference No.51

Detailed Description of item : TEM based Local Orientation and Strain Mapping plus Reconstruction of the Reciprocal Space Based on 3D Electron Diffraction

Detailed Description: Product Details & Specifications Including both Hardware and Software:
1. Universal device for controlling the TEM beam resulting in the acquisition of Precession Electron Diffraction (PED) patterns.
2. Precession angle can be continuously varied from 0° - 3°.
3. Precession frequency is adjustable from 0.2 to 1KHz, 100 Hz working frequency.
4. Hardware: Precession control unit, interface to TEM (GIS), PC tower professional grade and software for beam precession with store/recall values.
5. Transmission electron microscope (TEM) diffraction pattern acquisition software and computer system workstation controls signal over different channels connected to the TEM coils and supplied scan generator. CCD mounted onto the TEM viewing chamber is used for fast data acquisition of precession electron diffraction (PED) patterns while scanning the sample area. Advanced features include: User-friendly graphical interface for PED pattern and pole figures, PED pattern generated for all crystal systems, virtual dark field (VDF) and virtual bright field (VBF) images are displayed together in real time, on-line distortion correction, etc.
6. PED pattern generator makes diffraction patterns for every degree (or less) through the Ewald sphere for every phase/crystal symmetry. Advanced features include: PED patterns are generated for all crystal systems, displays selected reflection intensities and indices.
7. Every calculated-simulated pattern is compared to the experimental diffraction pattern through template matching. Advanced features include: Optimising routines for orientation resolution- automatic camera length calibration, correlation index map calculation and display (for reliability checking), pseudo-bright field or pseudo-dark field image reconstruction mask.
8. Crystal orientations extracted for every pattern related to the scanned area and stored in the results file. Advanced features include: orientation map: pixel colour is related to the sample X, Y or Z crystallographic direction, phase map: pixel colour is related to different existing crystal phases, grain boundaries may be apparent on orientation maps, grain size and pole figure analysis, export facilities compatible with most available image/EBSD-SEM analysis software, grain size distribution analysis, 180 degrees ambiguity correction, etc.
9. Hardware Inclusion: CCD camera and mechanical interface to TEM.
10. Advanced software features include: Virtual STEM/ BF / DF via CCD, Suite of scan modes (spot, line, area, …), Suite of image processing features. Precession Electron Diffraction Pattern Acquisition, Beam Precession Control and automatic alignment, PED patterns from multiple discrete points, lines and areas, Assisted calibrations (camera length, distortion correction), On-line distortion corrected diffraction pattern acquisition, Drift correction, Improved workflow Phase and Orientation Mapping.
11. Novel Automated Strain Mapping solution for TEM/STEM, Nanobeam (NBD) spot patterns “enhanced” with precession, acquire STEM image of region of interest via CCD. Automated scanning synchronized with acquisition of spot precession ED patterns, acquisition from individual positions, line profiles, areas, fast acquisition of diffraction patterns via high frame-rate external CCD camera. Automated Strain Analysis, no need for user to identify spots or principal strain directions, no bias introduced due to the involvement of user judgement in identifying spots. Software to allow for offline data processing/Viewing.
12. Program covering reconstruction of the reciprocal space based on 3D electron diffraction (ED) data and the subsequent determination of cell parameters. Data consist of precession ED patterns when the holder is tilted (manually) within the tilt limits of the TEM (usually -40º to +40º at 1º angular step with single tilt or of specific tomography holder). The reconstructed reciprocal space can be visualized to determine possible crystal cell parameters (within 2 - 3 % accuracy, automatically). The software also allows the user to spot special crystallographic effects like twinning and disorder. Software module allows the user to index every reflection and to extract intensities useable for structure analysis procedure. Listing of HKL and intensities allow to be used to various free aca-

demic software for structure solution in order for the user to solve precisely the atomic 3D crystal structure.
Additional Requirements :
i) Qualified microscope engineer visit to pre-qualify the microscope, install new hardware for precession interface and microscope software followed with final microscope calibration and performance testing.
ii) Spatial resolution & lt; 5 nm, Grain size resolved at 00 PED: 3nm and at 0.7PED: 5nm. Strain Sensitivity & lt; 0.1% and Accuracy of in-plain strain: & lt; 0.05%

Sr No. 49 / Reference No. 52. (Revised)
Name of the equipment: Carbonaceous Aerosol Speciation System (CASS)

Detailed Description of Item : Carbonaceous Aerosol Speciation System 'CASS' -Specifications.

1.	Measuring Parameters	Light absorbing carbonaceous aerosols like Black and Brown carbon (BC, BrC), Total and Organic carbon (TC & OC)
2.	Technique	1. Appropriate and established optical, thermo-optical techniques to be utilized 2. Deployed technique should be free from sampling artefacts such as interference in optical measurements due to aerosol loading
3.	Time resolution	Real-time, online measurements of different parameters; from tens of seconds to a few tens of minutes, one measurement of all the parameters are taken at every 30 min or less
4.	Offline measurement capability	Offline mode to analyse previously – collected samples for determination of one or more parameters
5.	Source apportionment	A quick, preliminary source identification of absorbing carbonaceous aerosols
6.	Detection limit	Detection limit for BC (1 hour) <0.006 µgC/m^3. Detection limit for TC (1 hour) < 0.12 µgC/m^3.
7.	Sensitivity	Sensitivity for Black carbon < 0.035 µgC/m^3. @ 1 min and 5 SLPM Sensitivity for Total carbon < 0.55 µgC/m^3 @ 16.7 SLPM.
8.	Detection range	For Total carbon <0.035 µgC/m^3 to > 300 µgC/m^3 For Black carbon < 0.012 µgC/m^3 to > 100 µgC/m^3 Black Carbon

9.	Sample flow rate	For Total carbon > 15 LPM For Black carbon > 4 LPM.
10.	Measurement time base	Should be user selectable from a few tens of seconds or less to a few tens of minutes or more
11.	Construction	Rugged construction with sturdy and durable materials. Minimum use of fragile/glass materials. Suitable for field deployment.
12.	Carrier gas	Ambient air, complete avoidance of costly commercial grade carrier gases
13.	Operation interface	Digital, touch screen, measurement values should be displayed
14.	Data output & storage	Digital via RS-232 COMport and Ethernet Network ready remote management.
15.	Carrier gas	Ambient air, complete avoidance of costly commercial grade carrier gases
16.	Operation interface	Digital, touch screen, measurement values should be displayed
17.	Data output & storage	Digital via RS-232 COMport and Ethernet Network ready remote management.
18.	After sales support	Supplier/vendor should have trained engineers/technician to provide comprehensive after sales support
19.	AMC	Atleast 3 years AMC
20.	Warranty	Atleast 3 years Warranty
21.	Installation and Training	The supplier/vendor should arrange a comprehensive training during the installation

Sr No. 50 / Reference No: 53

Detailed Description of Item

Micro CT and optical imaging for animal imaging facility

A combination of a 3D optical tomography in vivo small animal imaging system along with a stand-alone Floor micro-CT system for small animal imaging with following specifications is required:

S.No. Tender Specifications

3D Optical TomographyIn vivo Small Animal Imaging System

1 Should be fully automatic system to image live small animals like mice, rats, hamsters& rabbits should be suitable for biphotonic, fluorescence, bioluminescence and chemiluminescence and radio isotopic Cerenkov studies for in-vivo and in-vitro use.

2 Complete system should be provided with light tight cabinet (allowing dark room conditions to disallow any leakage of light), CCD camera, excitation and emission filterssample stage, gas anesthesia system and computer workstation.

3 Camera :

Grade one back thinned, back illuminated CCD

Thermoelectrically cooled to at least -90 ˚C

16-bit digitizer for broad dynamic range
Minimum Imaging Pixels: 2048 x 2048
Pixel Size: 13.5 microns
Min. Image Pixel Resolution: 20 microns
4 Filters which should accommodate fluorescent dyes in the Green to Far red Spectrum (430 nm - 850 nm) or better.
Excitation filters: minimum 10 (equivalent to bandpass filters in the above range with an interval of 35 nm or better)
Emission filters: minimum 15 (equivalent to bandpass filters in the above range with an interval of 20 nm or better)
5 The analysis software:
Should perform background subtraction with the image algorithms based on compute pure spectra.
Spectral unmixing of multiple reporters (at least 5) within same animal.
6 Stage movement software control for multiple Optical Field of View (FOV):
4 X 4 cm or less and 20 x 20 cm or more.
7 Stage movement should be software controlled for different levels of magnifications or equivalent approach to provide precision and flexibility for imaging. Various levels of magnificationsto be provided are f/1 - f/8; 1.5x, 2.5x, 5x, 8.7x or better. The choice of magnification should be software controlled for individual imaging applications.
8 The system should be sensitive enough to detect single cell in vivo & in vitro with proven data. Publication support should be provided.
9 3D surface topography:
The system should provide 3D surface topography and be able to create 3D images using optical light for accurate reconstruction of light sources in deep tissues.
10 3D tomography:
The system should quantify the depth, geometry, and brightness of a fluorescent or bioluminescent source in 3-dimensional space using 3D tomography and should be able to co-register organs from the Mouse Atlas on a 3D image for exact positioning of point source.
11 Fluorescence Illumination modes:
Both Epi-Illumination and Trans-illumination for localization and quantification of deep tissue sources must be provided
12 The system should be software compatible to make 3D opticaltomographic images to use with X-Ray micro-CT system.
13 The system should be supplied with high configuration computer withI5 processor, 4 GB RAM, nVidia Quadro 600, 250 GB and 1 TB HD, 24" widescreen LED Monitor work station with preinstalled complete software package for control, scanning, visualization & analysis.

Floor Micro-CT system for small animal imaging
14 High resolution and high speed Floor CT system capable of seamlessly co-registering with 3D optical tomographic integrated markers should be provided with the following specifications:
- Resolution of minimum 2.3 µm voxel
- Voltage controllable microfocus X-ray source (90kV, 88µA, 8W)
- sCMOS flat panel detector array of 2944 x 2353 pixels
- Minimum scan time 4 sec or less (scanning cycle < 4 sec).

15 Micro CT in vivo and ex vivo imaging of all organs including lung, bone, kidney, heart, brain with Multi-species imaging capability for small animals such as mice, rat, hamster & rabbit and with bore size of 160 mm or more for larger animals with weight upto 5kg for whole body imaging.
16 Must permit animal of more than 200mm scannable range be stitched together and displayed as a single image.
17 System should have user-defined image resolution and field of view (FOV) size & should be able to adjust the animal position with respect to the X-ray source and detector for different physical magnifications.The choice of magnification should be software controlled for individual imaging applications.
18 System should be capable to do high speed imaging with less than 4 sec. scan time and be capable for high resolution (2.3 um resolution or better) imaging. System should also perform multiple scans with minimal radiation impact and adverse physiological outcomes.
19 System should be capable to do imaging of the sample in 360 degree around the sample to acquire 3D data with a choice of viewing field and magnification. Circular or helical scanning should be available.

20 System should have a continuous gantry rotation system during scanning.
21 X Ray focal spot of 5um or equivalent for better resolution with minimum 5filters (Al 0.5 mm for low contrast samples, Al 1.0 for soft tissue/fat analysis, Al 0.5 mm + Cu 0.06 mm for standard CT scanning for bone etc., Cu 0.1 mm for dense samples at high voltages, Cu 0.2 mm for metal containing samples) allowing the user to select different filtering settings for their scans.
22 The system should be enabled with intrinsic image-based cardio-respiratory gating for multiphase reconstructions of respiratory and cardiac function without requiring cardiac and respiratory monitoring equipments like an electrocardiogram (ECG), pneumatic sensor or video camera.
23 The system should have GPU-based highspeed 3D image reconstruction. The reconstruction must be performed automatically on the same computer within 1 minute after image acquisition.
24 The temporal resolution of the detector must be 117 frames per second and less.
25 The instrument must have a high-quality glass-transparent window with protective shielding against X-ray radiation and a lighting system which allows direct observation of the animal during the scan.
26 The operational instrument noise should not be higher than 55 dB.
27 BONE, FAT and TUMOR MORPHOMETRIC IMAGING AND ANALYSIS:
System should be able to perform morphometric analysis of bone like BMD and BMC parameters, trabecular thickness and cortical bone morphology, adipose fat analysis, structure thickness, separation and porosity, bone-implant studiesand bone tumor & other tumor studies. System must have automated 3D bone segmentation and BMD and ASBMR parameter measurements. System should also be able to perform metabolic studies such as Quantitative fat segmentation: brown fat, subcutaneous fat, visceral fat.
28 CARDIO-RESPIRATORY ANALYSIS:
Cardio-respiratory gated images must be acquired within 4 minutes or less. System should be able to do Cardiac analysis- Intrinsic, retrospective, phase gating: systole, diastole. The data acquired should allow the user to reconstruct different phases of cardiac and respiratory cycle. The allowed measurements should include Ventricular End-Diastolic Volume (LVDV & RVDV), Ventricular End-Systolic Volume (LVSV & RVSV), Ventricular Ejection Volume (LVEV & RVEV), Ventricular Ejection Fraction (LVEF & RVEF) and functional and metabolic imaging of myocardial infarction models. Should be provided with Publication support.
29 The reconstruction software should be able to perform sub-volume or slice reconstructions, allow portion of the image to be zoomed in and reconstructed at the highest resolution without the need of additional scan.
30 Must have on-screen CT dose display based on dosimetry.
31 Optical and CT mode shuttles and adapters for small animals should be available for co-registration of CT & optical 3D tomography for easily fused 3D visualization and analysis.
32 The radiation safety must be <1µSv / h at any point on the instrument surface.
33 The system should be supplied with high configuration computer of processor 3.60 GHz, 3.90 GHz turbo, 4 cores, 8,25 MB cache, Ram 32GB (4x8GB) 2666MHz with graphic card Quadro P2000 5GB, 4DP work station with preinstalled complete software package for control, scanning, visualization & analysis.

Offline computer, Software and Other requirements
34 In line Gas anesthesia:
Ports and multiple position manifolds, nose cones (5 for mice, 3 for rats and 2 for hamster/rabbit) with gas flow controller should be supplied. Complete working configuration inclusive of hardware/software, tubing, valves, should be supplied.
35 Must provide additional Laptop/PC with specifications -i5 processor, 8 GB RAM, 1TB hard drive, 24 inches HD monitor, graphics card with 24/32 bit capability with Windows 10 (or latest model) for analysis with image acquisition and analysis software(s) installed.
36 The software for image acquisition and analysis should be provided with minimum 3 copies.
37 The Complete System should include the basic unit and allied supporting components like tables to accommodate all the supplied equipment, online UPS (3 KVA with battery back-up of minimum 1 hour), Dehumidifier (2.5 liters or better), Laser Inkjet Color Printer, Air Conditioner to be supplied by the supplier along with the basic unit.

GENERAL TERMS AND CONDITIONS
38 The company should provide a comprehensive plan for on-site training, conducting workshops and software upgrade every six months during warranty period.
39 Company should provide free of cost training in first 3 months after installation to multiple users PLUS one onsite training session to multiple users every six months for the entire period of Warranty and AMC.
40 Trained engineer & application support within India should be available for onsite training & support.

41 The company should provide performance proof of similar scope of work (3D optical tomography co-registered with stand-alone micro-CT) in India. Provide list of current installation.
42 The equipment and all accessories must be provided with a comprehensive onsite warranty for 5 years (60 months) including spare parts and labor.
43 Warranty will start from date of successful installation.
44 During the Warranty period, the supplier is required to visit at consignee's site at 2 times in the year commencing from the date of the installation for preventive maintenance of the Equipment/Stores.
45 The Supplier along with its Indian Agent and the CMC provider shall ensure continued supply of the spare parts for the machines and Equipment supplied by them to the purchaser for 10 years from the date of installation and handing over. Company should ensure that spare parts will be available till 10 years from the installation
46 Performance security 10% of the cost of the supply value shall be deposited till the Warranty period of the Instrument.
47 Should attend all breakdown calls within 24 hours of the receipt of information from the institute through fax/e-mail/mobile/sms.
48 The equipment will be diagnosed with a problem within 72 hours of receiving the complaint and repaired within 4 weeks, failing which the warranty period will be extended by the number of days the instrument is non-functional post 4 weeks.
49 Technically qualified operator should be provided for 3 years. The technical operator should be present on all working days of the institute as per the norms. He/She should be able to train students on a periodic basis.This should be quoted with a monthly salary of the operator to be comparable to that of a JRF i.e. 50000 INR/month or better. The overall cost should also include a general 10% hike of salary every year.

Optional Items/accessories to be quoted:
50 1. Different size of phantoms (Bioluminescence & Fluorescence) that can be used for mice & rat.
2. Animal isolation box
3. Additionally quote 5 year AMC and CMC prices after the completion of 5 year Comprehensive Warranty period.

Sr No. 51 / Reference No: 54

Multiphoton imaging equipment for live animal imaging

A High-resolution microscope workstation for in vivo small animal imaging with laser scanning and multiphoton attachment is required for live animal imaging

A. Fully Motorized & Computer Controlled Fixed Stage Upright Microscope for small animal imaging:
Application Multiphoton Confocal system for small animal imaging facilitated with high sensitive detection for deep tissue imaging, in vivo imaging, intravital imaging including second harmonic generation (SHG), FRAP, FRET, photo activation/conversion and ablation. System should be upgradable in future to FLIM attachment.
Optics Optics for Bright field, Dodt contrast or IR DIC, Fluorescence observations with accessories for Confocal imaging.
Z Focus Built in Motorized Z-focus drive with minimum z-step resolution of 25 nm or better.
Nosepiece & Turret. Motorized 5 position or better motorized FL filter wheel, 2/4 position objective turret.
Stage Motorized XY Scanning stage with universal sample holder for slides, 35/60mm petri-dishes and well plates for in vivo small animal as well as tile and multi-position imaging.
Illuminations 12V/100W halogen transmitted light illumination for BF/DIC and high power 120 W metal Halide illumination for fluorescence with PC control.
Objectives High resolution confocal grade water immersion objectives with long working distance Water Dipping 10X/0.50 (or 10X/0.3) WD of 3.5 mm or better, Water Dipping Plan Apo 20X/1.0 WD 1.80 mm (or 2.2. mm) or better (or Water Dipping Plan or Semi Apo 25X/0.95 WD 2.4 mm or better), Plan Apo 40X/1.30 oil immersion, Water Dipping Plan Apo 60/63X (1.0 or 0.9) WD 2.1 (or 2.2) mm or better and Plan Apo 63X/1.40 oil immersion objective. Dodt / IR-DIC accessories for all objectives to be included. Quoted objectives should be corrected for UV-VIS-IR.
Fluorescent Filters Band Pass Fluorescent filters for DAPI, FITC/GFP & TRITC/Rhodamine for visualization.

Detectors
(Reflected and Transmitted) • 2 channels high sensitivity GaAsP or equivalent detectors for reflection mode imaging using IR laser. Also 2 channel GaAsP Non Descanned Detectors (NDD's) for high sensitivity SHG imaging in transmitted and reflected mode. NDD's to be located close to the objective back focal plane for high photon collection efficiency. The detectors should have user selectable and changeable filter combination for optimizing to various fluorochromes under observation.
• The reflected mode detectors should have filter combinations for blue/green, green/red, CFP/YFP pairs.
• Transmitted mode NDD should have filter combination for violet/green, green/red pair.
• High NA (1.2) water immersion condenser with transmission down to 380 nm for Second Harmonic Generation (SHG).
Cooled CCD Camera Monochrome cooled sCMOS camera, 2/3''Chip with min 10 to 12 million or better net effective pixel resolution, 1" chip size, wide sensitivity spectrum 350nm – 1000nm, (USB III) controlled by confocal software with multichannel, z stack, time series imaging should be offered.
Table A suitable breadboard anti-vibration table for the complete microscope and laser scanning system with size of approx 1.8m X 1.5 m (or 1.2 m x 1.5 m) including air compressor for placement of the complete system.
B. Spectral Confocal Laser Scan Head with built in or Separate Detectors for small animal imaging:
Scanning Laser point scanning and confocal detection unit with PMT and/or HyD/GaAsP detectors. All detectors should have freely selectable emission band width for optimal detection of fluorochromes.
Scan Head Should be capable of simultaneous detection and separation of minimum 5 fluorophores (DAPI, GFP, CFP, YFP, Cy3, Cy5) out of which 2 can be PMT/HyD and 3 should be high sensitivity GaAsP/HyD or equivalent detectors with QE 45% or more. Combination of detectors should be channel based or capable for spectral imaging with selection of emission range without any limitations.
Spectral Dispersion The spectral dispersion of the emission light should be either with reflection grating or with Prism dispersion.

Excitation Range Laser scan optics covers the entire wavelength range from 400 nm to 1040 nm (or more) and should have simultaneous laser coupling ports for UV, VIS and IR lasers.
Pinhole Computer controlled confocal pinhole with software control for multi-tracking including short wavelengths.
Scanner High speed XY galvo scanner with 200 deg scan rotation or better with total scan flexibilities of Line, free hand curved line, XY, XYZ, XYZ t and XYZ,t,λ.
Scanning Options. The laser scanner should have dual scan capability of high speed ROI/Image scan for "bleaching/photo-activation/imaging"&"normal scan for Imaging/stimulation", Real ROI scan capability to conduct experiments like FRAP, FRET, photo activation/photo conversion and ablation.
Scan Resolution Maximum scan resolution should be 4Kx4K (or better) for all channels and can be selected freely down to 16x16 pixels (or better).
Frame Rate Scanner should be capable of acquiring 10-15 fps (or 28 fps) @ 512x512 (or better) and increase to 400 fps (or 280 fps) or better @ 512 X 16 for fast time lapse imaging applications.
Field of View The scan field diagonal should be 18 mm or better.
Data Acquisition Data acquisition and Digitization capability with 8/12/16 bit should be available.
T-PMT An additional Transmitted light detector for bright field and DIC imaging to be provided.
C. Laser Module with AOTF control:
Visible Lasers Visible laser module with laser lines of 405nm, 445/448 nm, 488 nm, 514nm, 561nm, 640 nm laser lines.
All the lasers should be optically coupled and connected to the scan head through a fiber optic cable. All the visible laser lines controlled through an AOTF for fast laser switching and attenuation in synchronization with scanner position.
Multi photon IR Laser IR Laser: Totally integrated and software controlled Femto pulsed Ti-Sapphire laser system for Multiphoton imaging with the following specs should be offered.
Tuning range: 690 to 1040 nm.
Pulse width: < 100 femto seconds.
Average power: > 2.5 watt @ 800nm.
Repetitive rate: 80 MHz.
All direct coupling optics of the laser to the scan head as well as both microscopes should be provided. Laser attenuation device should be through AOM.
D. Hardware Based High Speed Super Resolution (SR) Imaging System for small animal imaging:

High Resolution Imaging Attachment • Fully automated and motorized SR attachment with suitable high sensitivity Detectors (GaAsP or equivalent with quantum efficiency 45% or better) for complete UV-Vis-IR Spectrum.
• Lateral resolution of 120 to 130 nm or better and Axial resolution of at least 350 nm or better should be expected out of the system.
• Detection should be based on GaAsP or high sensitivity detectors.
• At least 2 fluorophores imaging in simultaneous mode should be possible with the SR system. Any dye used for Confocal system should be possible for imaging without changing sample preparation techniques/ protocol.
• Should be able to perform live cell SR Imaging. Frame rate in SR mode should be at least 25 fps @ 512X512 & maximum 400 fps (or 280 fps) @ 512x16 or better. SR mode should be able to perform 2D / 3D images, time series, tiling / mosaic, ROI imaging, multiple location imaging, photomanipulation experiments (FRAP, FRET).
• All laser lines for Confocal Imaging (Vis and IR) should be used for imaging in SR mode. Depth of penetration for SR imaging should be same as NDD based imaging with better sensitivity (approx. 4 – 8 times better than Confocal). The claim should be supported by white paper and brochure.

E. Optional Accessories:

FLIM • The system should be capable of carrying out at least two channel lifetime-based imaging and analysis of biological and chemical samples. Analysis should consist of identifying different life-time based components in the sample, separation of these different life-time components and gated detection capability to separate photons from signal and/or background.
CO2 incubation • The system should come with a suitable environment-controlled incubation unit with water dipping objectives having full enclosure box for entire microscope. The incubation system should have independent control of CO2 (accuracy 0.1%), Temperature (3°C to 40°C or better), Temperature accuracy of 0.1°C on sample, Humidity. Parameters should be controlled through the same imaging software. Entire system should be provided with CO2 cylinder & regulator.

F. Control Computers with Monitors.
Latest 64 bit control computer with Intel Xeon 6 Core Processor, DDR RAM 96 GB HDD: 4 TB SATA upgradable to 8 TB or better, DVD, SuperMulti SATA +R/RW, Graphics : AT Fire GL V5200 256MB DH DVI, Gigabit Ethernet, Win 10 64 bit , USB 2.0 / 3.0, Fire wire. Large 32" LCD TFT monitor to be provided.

G. System control and imaging software.
System software capable of controlling Motorized functions of microscope, digital camera, scan head control, laser control including AOTF and Image acquisition & processing.
• Saving of all system parameters with the image for repeatable/reproducible imaging.
• Line, curved line, frame, Z-stack, Time series imaging capabilities.
• Real ROI bleach for FRAP, FRET, Photo-activation/conversion experiments.
• Standard geometry Measurements like length, areas, angles etc including intensity measurements.
• 3D/4D image reconstruction from a Z-stack image series.
• Co-localization and histogram analysis with individual parameters.
• Spectral un-mixing and emission fingerprinting with separation of overlapping emission spectra of fluorochromes.
• Image acquisition and processing tolls for SR with various modes of visualization tools should be available.
H. Hardware and software for offline analysis
• Additional high-end dedicated PC and HD monitor (with specifications same as main PC mentioned above) with image acquisition and analysis software(s) installed along with a printer.
• Additional offline software with complete features for image analysis should be provided with minimum 3 copies.
I. Additional requirements
• The Complete System should include the basic unit and allied supporting components like tables to accommodate all supplied equipment, suitable online UPS (10KVA or better with battery backup of minimum 30

minutes), Dehumidifier (2.5 liters or better), Color Laser jet Printer, Air Conditioner to be supplied by the supplier along with the basic unit.
J. Installation and service supports:
• Supplier should clearly specify the after sales/service/application support capabilities.
• Warranty of the system should be 5 years from the date of installation and should cover cost of spares and labor.
• Should provide a comprehensive plan for on-site training, conducting workshops, software upgrade during warranty period.
• Trained engineer & application support within India should be available for onsite training & support.
• Supplier should provide free of cost training in first 3 months after installation to multiple users PLUS one onsite training session to multiple users every six months for the entire period of Warranty and AMC.
• During the Warranty period, the supplier is required to visit at consignee's site at 2 times in the year commencing from the date of the installation for preventive maintenance of the Equipment/Stores.
• The Supplier along with its Indian Agent and the CMC provider shall ensure continued supply of the spare parts for the machines and Equipment supplied by them to the purchaser for 10 years from the date of installation and handing over. Company should ensure that spare parts will be available till 10 years from the installation.
• During the Warranty period, the supplier is required to visit at consignee's site at 2 times in the year commencing from the date of the installation for preventive maintenance of the Equipment/Stores.
• Should attend all breakdown calls within 24 hours of the receipt of information from the institute through fax/e-mail/mobile/sms, etc.
• The equipment will be diagnosed with a problem within 72 hours of receiving the complaint and repaired within 4 weeks, failing which the warranty period will be extended by the number of days the instrument is non-functional post 4 weeks.
• Technically qualified man-power/operator should be provided for 3 years. The technical person should be available on all working days of the institute as per the norms. This should be quoted with a monthly salary of the operator to be comparable to that of a JRF i.e. 50000 INR/month or better. The overall cost should also include a general 10% hike of salary every year.
• Provide all pre-installation requirements for system installation.
• Provide a detailed list of users and current installations of the system with similar set-up in India with contact details.

Sr No. 52 / Reference No: 55
Detailed Description of Item : **Cryofree 9 tesla superconducting magnet**

Cryofree, sweepable 9 Tesla superconducting magnet with 10 ppm homogeneity with a variable temperature insert of range 1.6-300 K

Specifications for a cryofree, sweepable 9 Tesla superconducting magnet and a cryofree variable temperature insert. The magnet + VTI combination detailed below will be used together with an NMR spectrometer (tendered separately) to perform NMR experiments on solid samples at variable temperature and magnetic field.

1. The superconducting magnet should have a vertical bore of ID greater than 50 mm so that the VTI (detailed below after item 8) can be integrated with the magnet. The magnet should be rated to produce a maximum magnetic field of 9 Tesla or more.

2. The homogeneity of the magnetic field should be better than 10 parts per million (0.001%) over a 1 cm dia sphere. The above should be validated and documented using an NMR probe during factory testing/validation. The stray field map of the magnet should be provided.

3. You should provide an engineering drawing of the magnet assembly.

4. It should be possible to put the magnet in persistent mode (with the provision of a persistent switch) at any field upto the highest rated field. When in persistent mode, the drift should be lower than 0.1 ppm per hour.

5. Adequate quench protection should be provided for any accidental quench.

6. With the magnet power supply (having serial/USB interfaces), routine programmable sweeping (ramping) of the field in the full range (0 to 9 Tesla) should be possible. A minimum sweep rate 60 Oe per min should be possible. On the higher side a sweep rate of 1500 Oe per minute (or more) should be possible. Ramping the magnetic field at any of the above rates should not affect the temperature stability in the sample space of the VTI at any temperature. Device drivers for automation and control of the magnet power supply should be provided for standard software suites such as ActiveX, OLE, Windows scripts, VB Basic, Labview, Matlab, etc.

7. The magnet should be of a dry, cryofree type and no liquid cryogens should be required to cool the magnet.

8. The cooling of the magnet should be achieved by a two-stage pulse tube cryocooler of minimum 1 Watt power at 4.2 K and 40 W at 45 K. Specify the make and model of the pulse tube refrigerator system. The necessary compressor (fully charged with high purity helium gas) with at least 10 m long flexible SS lines, water chiller, and other items needed to make the system fully functional should be included and quoted. Specify the tonnage and power requirement of the water chiller. In case some of these items are sourced in India, they should be quoted in INR.

9. A top loading variable temperature insert (VTI) with a temperature range of 1.6 K-300 K (or more) is to be provided which is integrated with the above magnet. The VTI should also be cryofree.

10. The VTI should have a KF50 or equivalent flange at the top and the inner diameter (ID) of the VTI should be 49 mm or more. You should provide a precise value for the ID accompanied by an engineering drawing. The VTI must be made of non-magnetic materials.

11. The VTI should be equipped with suitable heaters, needle valve, and magnetic field independent temperature sensors to control the temperature.

12. A compatible temperature controller also to be provided. Temperature controller should have standard serial/USB ports for interfacing with a computer. At least two extra channels should be available on the temperature controller; one for connecting to the NMR sample probehead to monitor the sample temperature and another spare one for redundancy. Device drivers for automation and control of the temperature controller should be provided for standard software suites such as ActiveX, OLE, Windows scripts, VB Basic, Labview, Matlab, etc.

13. You will provide necessary cables to connect the various instruments to a computer.

14. It should be possible to hold and stabilize the sample space at any temperature between 1.6 and 300 K (with a stability of 0.1 K) for more than 12 hours.

15. You should provide vacuum pumps (dry/oil-free) needed for regular operation of the magnet and the VTI.

16. The vibrations at the sample position inside the VTI should be less than 10 micrometer amplitude especially at low frequencies (0-1 kHz).

17. A floor to ceiling height of about 2.75 m (9 feet) is available in the room where the magnet + VTI will be installed. The top of the magnet+ VTI assembly should be less than 60 inches from the floor. It should be possible to assemble, install, and perform routine measurements with the above equipment given the above dimensions. It should be possible to remove the VTI from the magnet, if needed, in the available height. You should justify the above with relevant drawings.

18. A proposed schematic layout of the magnet + VTI and the pulse tube cryocooler with compressor should be provided for an approximately 10 ft x 30 ft space together with power supply requirements for the above equipment together with a water chiller. The height is about 9 ft.

19. You will be required to work together with the NMR spectrometer supplier (separate tender) to enable interfacing of the magnet power supply and temperature controller with the NMR software. Availability of device drivers for commonly used software will facilitate this interfacing. A similar clause is included in the tender for the NMR spectrometer. 20. Where single phase power supply is needed, equipment should be compatible with a 220 V, 50 Hz ac power supply. Likewise, where 3-phase power supply is needed, the equivalent of the above will be needed.

Optional items 1. Pumping station with turbo pump and backing pump for evacuation of cryostat and sample space. 2. An electronics rack (made of non-magnetic materials) to house various units above. 3. An online UPS of suitable rating (25 kW or more) and batteries with 2 hours backup to support magnet power supply, cryocooler, compressor, water chiller, various temperature controllers, pumps, etc.

Terms and conditions 1. The vendor should have a proven track record in terms of prior installations and technical support in India. (Please furnish the contact details of the customers). 2. The vendor should have qualified technical service personnel for the equipment based in India. 3. The clauses of on-site installation and training need to be specified, and ideally provided free of cost. 4. The instrument must carry a comprehensive warranty of 3 years from the date of installation. Please quote for this separately.

Sr No. 53 / Reference No: 56

Detailed Description of Item : Single resonance nuclear magnetic resonance (NMR) spectrometer without a magnet

Specifications for the single resonance nuclear magnetic resonance (NMR) spectrometer without a magnet. The NMR spectrometer detailed below will be used together with cryofree, sweepable 9 Tesla superconducting magnet + variable temperature insert VTI (separate tender) to perform NMR experiments on solid samples at variable temperature and magnetic field. The NMR spectrometer is to be used for measurements on solid samples and should include the following:

1. A (frequency synthesizer) transmitter with a frequency range of at least 5 MHz - 300 MHz with 1 Hz (or better) frequency resolution. Less than 50 ns rise time for the rf pulses. With a nominal output of 1 V, the pulse amplitude should be controllable in a range greater than or equal to 0-90 dB. The phase should be adjustable with a resolution of 1 degree or less. High stability oven oscillator with greater than 1 x 10-9/day stability.

2. A 500 W (or greater) linear rf power amplifier with a minimum frequency range of 5 MHz-300 MHz and a blanking delay of 1 sec or less and a maximum pulse width of at least 20 msec.

3. Preamplifier with a minimum frequency range 5 MHz-400 MHz, low-noise (1.1- 2.3 dB noise figure) and fast recovery (less than 1 sec recovery time). The preamplifier gain should be more than 25 dB.

4. Wideband digital rf receiver with digital quadrature detection. The receiver bandwidth should be greater than 12 MHz. The dead-time of the receiver should be less than 1 sec. The receiver should have a gain of more than 80 dB (without preamplifier). A digitization rate of better than one point every 100 ns should be possible in the complex data.

5. Digital pulse programmer with which user-defined pulse sequences can be generated. Minimum pulse width of 10 ns and timing resolution of 10 ns. Minimum duration of an event 100 ns. The phase and amplitude of the pulses and the various delays should be programmable.

6. Transcouplers for the 5-200 MHz frequency range with > 2 kW power handling capabilities, low insertion loss, broad band-T.

7. A series of ¼ wavelength cables or plug-ins to cover the 5 to 200 MHz range should be provided. Also, provide swept frequency probe tuning.

8. One Signal Averager with at least 1GB of memory (e.g. 512 x 512 x 512).

9. Fast (greater than 480 Mbits/s) USB 2.0 interface to pulse programmer and signal average

10. Software for NMR data acquisition and analysis. All time domain data must be stored on the hard disc and should be retrievable later for analysis. Standard sequences for T1 and T2 measurements should be available. In the sequences, phase and amplitude of the individual pulses should be adjustable. The position of the trigger signal for the signal averager to record data should be adjustable. The number of signal averages that the software and hardware allows should be more than 100000. In a pulse sequence, the minimum pulse width possible should be less than 1 sec. It should be possible to repeat a pulse sequence from a rate of once every 1 msec to once every 10 minutes.

11. The NMR spectrometer will need to be integrated with a cryofree field sweep 9 Tesla superconducting magnet with a variable temperature insert (VTI) and a standard PID temperature controller (0.1 K accuracy) enabling one to do automated measurements as a function of magnetic field and temperature. The magnet + VTI is part of a separate tender. The company supplying the spectrometer will be required to interact with the magnet supplier and build in the necessary protocols in the NMR system software to do the above. A similar clause is included in the tender for the cryofree 9 Tesla magnet + VTI.

12. Single resonance, variable temperature (1.5 K to 300 K) probe-heads to cover the range 5 MHz to 200 MHz. A goniometer with a resolution of 1 degree should be built-in and mechanically adjustable from the top. A cernox temperature sensor should be located near the sample coil. It should be possible to hold the sample temperature at any value between 1.6 K and 300 K (with a 0.1 K stability) for more than 12 hours. The probehead assembly should be compatible with the NMR spectrometer and the VTI which is a part of the cryofree magnet tender specifications. In particular, the ID of the VTI cryostat will be a nominal 49 mm (magnet supplier will provide a precise value) with a KF50 flange at the top. The probe will have to be designed such that the sample coil is at the center of the superconducting solenoid magnet as per the design of the magnet and VTI which are in a second tender. Cable for connecting the cernox sensor (from the top flange of the probehead) to the temperature controller is to be provided by you. We will inform you about the type of connector/socket and pin identification on the temperature controller side once this is known from the magnet supplier.

13. All equipment should be compatible with single phase 220 V, 50 Hz ac power supply.

Optional items 1. RF Line Section with RF Extractor directional coupler for high power tuning. Give the model/make and specifications. 2. Digital storage oscilloscope to monitor forward and reflected power taken from the line extractor. Give the model/make and the specifications. 3. An electronics rack (made of non-magnetic materials) to house various units such as pulse amplifier, temperature controller, NMR pulse programmer, etc.

Terms and conditions 1. The vendor should have a proven track record in terms of prior installations and technical support in India. (Please furnish the contact details of the customers). 2. Please quote for a comprehensive warranty of 3 years from the date of installation.

Sr No. 54 / Reference No: 57 (Revised)

High-throughput Cell Imaging System

MICROSCOPE

- System should have Inverted microscope with bright field, fluorescence and DIC Imaging capability.
- 10X eyepieces with diopter adjustment
- Motorized Peizo/Galvo Z-axis focus stage with minimum step size of 5 nm or less in Z axis.
- 6 position or higher motorized FL filter wheel for excitation and emission path and 6 position motorized objective turret.
- Should have motorized universal condenser turret with NA 0.5 or better.
- The microscope system should ensure minimum time lost in changing filters and ensure precision overlap of images.
- The excitation and emission filters should be installed in separate filter wheels. Rotations of dichroics, emission and excitation filters should be independent. Switching time between adjacent emission filter positions should be at least 300 ms or less.
- The microscope system should be capable of conducting long time live cell imaging in the time range of minutes to days with image acquisition occurring at intervals of msecs to secs. The microscope should be equipped with hardware to correct for focus drift.
- System should be able to achieve high speed – 400 fps or higher (512 X 512 pix). Should have very low phototoxicity and photobleaching to allow long duration live cell imaging.
- The system should have hardware based autofocusing for long time imaging.

OBJECTIVES

- System should be supplied with high resolution plan apochromatic class objectives 10x/0.4 NA or better, 40x/0.6 NA or better, 60x/63x Oil (N.A 1.40 or better), 60x/63x Water (N.A 1.20 or better), and 100x oil (N.A 1.40 or better).
- DIC condenser and nomarski prism for 40x, 60x and 100x objectives.
- A 4 or 5 position DIC attachment for 10x to 100x objectives with analyzer and polarizer attachment, sliders and modules for the respective objectives.

STAGE

The stage position should be encoded with respect to the fixed Z position objective lens. The stage should be calibrated and qualified using its internal absolute position encoders.

- Stage repositioning feature for keeping moving cells in the field for live imaging.
- Microscope step resolution: 250 nm or better in X and Y.
- Focussing range 7 mm or higher, automated: X-Y Stage travel 100 mm x 70 mm or better.
- Stage speed: 25 mm/sec in X/Y or faster; 2.5 mm/sec in Z or faster

- Should have a high precision motorized X, Y stage and Z axis with capability to image 35 mm and 40 mm culture plates, conventional slides and multi-well (6, 24, 96 and 384) SBS format plates and chambered cover glass.
- System should be controllable by software as well as by joystick.

- Stage should allow panel collection for stitching multiple high magnification images into a single image without individual image manipulation.
- Each motor (X, Y and Z) should move independently of each other to ensure linear motion in each axis.

ILLUMINATION

a. Bright field LED illumination with lifetime more than 20000 h and with instant on-off computer controlled operation.
b. Fluorescence LED light source of wattage >40 W and lifetime more than 20,000 hr and with seven wavelengths in the range - 381-399, 426-450, 461-489, 505-515, 529-556, 563-588, 621-643 nm to cover the entire imaging spectrum.
c. Wavelength switching should be in the speed of 1 ms or better.

The illumination source should be factory integrated with company's own software without any third-party software.

WORKSTATION

- Octa core processor, 32 GB RAM; 1 TB HDD, 0.5 TB SSD; 64-bit OS; 4GB GPU must be compatible with SRRF for faster GPU based processing.
- High resolution 24" LCD TFT wide aspect true colour monitor (2 nos) for connection to workstation to enable 2560 x 1600 pixel resolution
- Another identical workstation with 32 TB storage capacity for complete offline analysis of all the imaging data should be available
- Two copies of software license, one online and one offline.

SOFTWARE

1. The software should be owned by the company and should control all the computer controlled/ motorized components of the system.
2. The software should possess the following features:
   a. Multi-point imaging, controlling bright field and fluorescence shutter, changing the fluorescence filter, snapping image, stage control.
   b. Interactive System control with sophisticated multidimensional data acquisition, visualization, analysis, image restoration, image correction and image viewing management.
   c. Camera Control.
   d. Data acquisition must have features like Time lapse, 3D stack, Multi-channel, multi-point acquisition, 2D and 3D image deconvolution.
   e. Software must have a quantitatively validated deconvolution solution generating accurate measure of sample fluorescence through image restoration algorithm.
   f. The deonvolution algorithm should be Non-subtractive restorative 3D deconvolution
   g. True OTF (Optical Transfer Function) calculated on the system.
   h. Colocalization analysis.
   i. 3-D volume rendering of the images and 3D measurement
   j. FRET analysis.
   k. Multi point imaging.
   l. Contrast based Auto Focus.
   m. Saving of all instrument parameters along with the image for repeatable/reproducible imaging.
3. The software should have the capability to show two live windows for two cameras while performing simultaneous dual color imaging.
4. Latest software upgrades should be provided free of cost for 5 years.

CAMERA

- Back illuminated sCMOS camera.
- Maximum field of view - 2304 x 2304 imaging array.
- 6.5 µm x 6.5 µm pixels.
- 16-bit dynamic range.
- 90% or more quantum efficiency at 550 nm.
- 272.3 MHz readout speed.
- Readout noise should be 0.9 e- or better with full well capacity should be 30,000 electron or better. Optimal FOV of 80 µm X 80µm or better using 63X/1.40 oil objective should be available.

LASER FREE CONFOCAL ATTACHMENT

- Confocality: Atleast 0.6 micrometer (full width at half maximum) with 1.4 NA oil objective.
- Optics should be based on combination of spinning disk with grid like patterns for structured illumination microscopy
- Spinning disk speed: 3,000 rpm or better
- Should include broad spectrum LED illumination with spectral coverage from UV to red region (16 LED based Light Engine) with remote operational control, wattage of >40 W and long lifetime >10000 hours (coverage: 370-700 nm) and individual LED should be controlled for the imaging of very specific dyes in future.
- Should include a digital sCMOS camera with quantum efficiency of >80%, minimum effective number of pixels:2048 x 2048, cell size 6.5-micron X 6.5-micron, effective area of 13.3 mm X 13.3 mm, readout speed of at least 100 fps (full resolution, standard scan, camera link).
- Compatible camera detector and light source port should be available within the Scanner.
- Band pass filter cubes for detection of fluorophores: DAPI, FITC/GFP, RFP/DsRed, Cy5 imaging should be supplied.
- Imaging software that can control camera, confocal unit, and XYZ stage as well as is customizable for additional configurations.
- Compatible deconvolution at high speed, minimal bricking artefact and high FWHM resolution and correct PSF estimation (Microvolution or Similar) should be provided.

AMC

- 2 years of CMC from the date of installation followed by 1 year of AMC should be provided for the machine.

OTHERS

- **CO_2 incubator:** System should have live cell chamber for controlled CO_2 (0-10% with accuracy of 0.1%), O_2 (1-20% with accuracy of 0.1%) temperature (3^0 C above ambient to 60^0 C with 0.1°C accuracy) and humidity.

- High-performance active vibration isolation lab table should be provided with the system.
- The spare parts support should be provided for a period of ten (10) years from the date of installation. The principal agent should be responsible for the complete installation, testing, integration of the system and training.

A. All operating, technical and service manuals with circuit diagrams should be provided along with the system. Tools necessary for calibration of system like calibration objectives & test samples to check the system performance etc., for fluorescence & co-localization checking should be supplied along with the system.

B. Original literature with complete specifications should be given.

C. Detail list of Publications, users and references should be provided.

Sr No. 55 / Reference No: 58

Detailed Description of Item: ULTRAMICROTOME

• Cutting transmission should be done by vibration decoupled gravity stroke • Specimen feed at steps of 1 nm or better
• Cutting speed should be controllable in a range of 0.05 to 100 mm/sec
• Complete system should be controlled by a touch screen controller of size 10” or more
• Knife stage should be fully motorized and controllable by the touch screen controller
• Movement range of knife stage in E-W (X) and N-S (Y) directions should be at least 25 mm <(>&<)> 10 mm respectively
• Countdown, section counters, speed, feed, stage movement parameters should be visible on controller screen • Details of user, sectioning, knife parameters and grid box parameters should be downloadable via USB (logbook)
• It should be possible to make segments of knife and it should be approached automatically
• Ultramicrotome should have automatic trimming function, programmable by the touch controller
• Stereomicroscope with magnification range of 10x to 50x or more should be provided • It should have eu-centric movement with defined click stop positions for glass knife and diamond knife
• There should be 4 LED illuminations with top light, spotlight, back light and specimen trans Illumination
• All illuminations should have independent control via touch screen controller
• Accessories like forceps with straight and curved tip and a perfect loop (05 numbers for each) should be provided with the equipment.
• Offered ultramicrotome should have provision for future upgradation with cryo attachments for cryo-sectioning with controls built in the existing touch controller
• A 3.0 mm diamond knife of 35° should be provided
• Two sample holders for holding embedded sample up to 8mm thickness should be provided Glass Knife maker <(>&<)> accessories
• 100% balanced break method
• Breaks glass from 6.4 to 10mm
• Variable scoring lengths with Accurate glass strip positioning
• Drawer system with convenient and safe knife removal •
Auto reset of breaking and scoring mechanism
• Push action score for even scoring and Adjustable scoring pressure 1.0
• Breaking wheel with scale for defined and reproducible glass break
• Glass strips 6.4 mm <(>&<)> 8 mm - 20 pcs. each.
• Trufs 6.4 mm <(>&<)> 8 mm, - 500 pcs. Each •
Easymold, embedding mould for 5.6 mm <(>&<)> 8 mm dia.
• Knife box 1 each for 6.4mm and 8mm glass knives
• Grid box for 100 grids, 10 pcs.
• Copper grids of mesh 100, 200, 300 <(>&<)> 400 each 100 pcs.
• Dental wax
Others

• A vibration free table and ergonomic chair should be provided with the system • 3 years warranty should be provided from the date of installation

Sr No. 56 / Reference No. : 59.

Detailed Description of the item : Lattice Light Sheet Microscope

Comprehensive light sheet microscope utilizing Bessel beam lattice sheet illumination via cylindrical lenses and high-speed SLM for multicolor imaging, annular mask array for various lightsheets, galvo mirrors to control lattice movement in X and Z, cameras in image and Fourier space to inspect the lattice and annular mask, 25x/1.1NA water immersion detection objective, 28x/0.71NA water immersion illumination objective, piezo X, Y translation stages and piezo imaging objective control. Includes Software System for Lattice LightSheet for high-speed synchronization of laser firing, SLM pattern display, galvo movements and imaging camera readout along with the ability to de-skew and view data; with offline license for analysis. Includes motorized sample chamber and annular mask wheel, LED transmitted light, LED epi path, solid state heating, beam shielding, laser safety enclosure, sample chamber and specimen holders.

1) LIGHT SHEET THICKNESS: 0.4µm at 50µm length RESOLUTION: 230 x 230 x 370 nm (Dither) @ 1.1NA; 150 x 230 x 280nm (SIM) @ 1.1NA SAMPLE CHAMBER: Medical grade stainless steel with environmental control system with digital control of temperature, CO2, and humidityalong with gas cylinder and regulator. Temperature Accuracy: ± 0.1°C in sample feedback mode, ± 0.3°C in chamber feedback mode. SPECIMEN MOUNTING: Standard, horizontally-oriented 5mm round coverslip

2) ILLUMINATION <(>&<)> DETECTION OPTICS: DETECTION OPTICS: 1.1NA water objective, 2.0mm WD, 62.5x total magnification ILLUMINATION OPTICS: 0.71NA water objective, 3.7mm WD

3) LASER LINES: Solid State Diode Laser lines of 488nm (300 mW or better), 560nm (500mW or better) and 642nm (500mW or better) with lifetime of 10,000 h or better should be offered with the system. All lasers should be connected to the system through fibre optic cable and should have fast laser switching and attenuation mechanism in pixel precise synchronization with the laser scanner for Imaging.

4) DETECTOR • Back illuminatedsCMOS Camerawith Quantum efficiency: @550 nm: 95 %, Imaging device: sCMOS, Effective no. of pixels: 2304 (H) × 2304 (V), Cell size: 6.5 µm (H) × 6.5 µm (V), Readout speed: Fast scan: 89.1 frames/s (@2304 x 2304 pixels, 16 bit), Readout noise: Ultra-quiet scan: 0.7 electrons rms (Typ.), Dynamic range: 21 400:1 (Typ.), A/D converter: 16 bit, 12 bit, 8 bit, Water Cooling option includes water chiller and hose set

• A second camera with same specification as mentioned above should be supplied for fast sequential two color imaging and spectral separation. All necessary Adapters, Filters should also be supplied for smooth function of the second camera.

5) IMAGE ACQUISITION OPTIONS <(>&<)> SOFTWARE: Software should be capable of controlling the following:

• Motorised components of microscope, digital camera, light path settings, laser control including AOTF and Image acquisition and pr ocessing.

• Multiple sample imaging using multi-point imaging should be acquired during a single multi-view experiment for higher sample imaging throughput. •

Rapid piezo z-drive acquisitions for fastin acquisition speed.

• Alignment, Imaging, SIM, and other spatial light modulator (SLM) presets for ease of use.

• Multidimensional image acquisition with combinations of z-stack, time series, multiple viewing points.

• Data file naming and saving request option at the start of image acquisition for data storage safety.

• Files should be separated according to time, view, illumination, channel, or z-stack.

• Ability to set a Home Position for quick sample repositioning as well as a Load Position for quick sample exchange.

• Light sheet tracking for maintaining ideal sample focus over time.

Offline software licenses (02 in numbers) should be provided. The offlinesoftware should have all these features excluding Control <(>&<)> Data acquisition.

6) Workstation:The workstation should be fully integrated and optimized for the system, all the custom electronics, drivers, hardware configuration files and software with licenses should be pre-installed. It should have following minimum configuration to allow seamless operation.

• Dual Intel Xeon Gold 6226 2.7GHz, 3.7GHz Turbo, 12C, 10.4GT/s 3UPI, 19.25MB Cache,HT(125W) DDR4-2933, 1TB OS SSD, 8TB Fast Acquisition Drive (RAID-0), 20TB additional storage (RAID-10), 1300W power supply, backlit wired keyboard, Windows 10 Pro.

• 34" WQHD Curved Monitorincludes professional, high brilliance 34" curved monitor with 2x HDMI inputs, one DisplayPort (DP) input, one USB-C input, and 4 USB 3.0 ports. 3440 x 1440 (WQHD) resolution.
•

Another identical workstation along with the monitor (same specifications as stated above) for complete offline analysis of all the imaging data should also be supplied. • A 60TB NAS Storage Device for external storage of microscope data configured in RAID-10 10TB 3.5-inch hard drives (twelve in numbers)

7) ACTIVE ANTI-VIBRATION TABLE:Active anti-vibration Table with Compressor should be provided. Dimension: 900x1500mm 2" thick smooth laminated top with 1/4-20 tapped holes 1" on center, alphanumeric grid, sub shelf, casters, and On Trak unloading system 8) ENVIRONMENTAL CHAMBER: ACO2 Incubator for Live Cell Imaging having temperature controller, heater and digital CO2 gas mixer should be provided. CO2 range: 0-18% with accuracy: ± 0.1%.Should include active humidity controller (50-95% RH, sensor resolution of 1%) and heated chamber (Temp. range: 3°C above ambient temperature – 45°C) for objective assembly. Temperature Accuracy: ± 0.1°C in sample feedback mode, ± 0.3°C in chamber feedback mode. The environmental chamber should be integrated onto the stage so that all parts of stage come in thermal equilibrium with the experimental temperature and reduces any drift.

IMPORTANT TERMS AND CONDITIONS: • System and accessories should work with 220v @50 HZ. • The Warranty of the equipment should be for Three (03) Years from the date of installation.

• One trained manpower(Qualification: B.E./B.Tech/M.Sc in Engineering Physics, Physics or Electronics) with salary for a period of three (03) years should be provided. Selection of the candidate should done by a committee comprised of IITB faculty members and technical representative of the vendor. He/Sheshould be present on-site and will be solely responsible for daily operation and maintenance of the system.

• The response time for attending a call should be within 24 hours by factory trained service engineer. A letter of commitment should be given in this regard from principal head office.

• The principal agent should be responsible for the complete installation, testing, integration of the system and training.

• The Principal Supplier should arrange for in-persontraining for 1st, 2nd<(>&<)> 3rd year for minimum of 5 days/yr.

• Latest software upgrades should be provided free of cost for 5 years.

• All operating, technical and service manuals with circuit diagrams should be provided along with the system. Tools necessary for c alibration of system like calibration objectives <(>&<)> test samples to check the system performance etc., for fluorescence <(>&<)> co-localization checking should be supplied along with the system.

• The spare parts should be available for purchase/replacement for a period of ten (10) years from the date of installation of the equipment.

• Original literature with complete specifications should be given.

• Detail list of Publications, users and references should be provided.

• System should be upgradable to photomanipulation scanning unit with laser lines from 405-640 nm

Sr No. 57 / Reference No. 60.

Detailed Specifications : Multi-Angle Light scattering instrument

Multi Angle Light Scattering (MALS) for *absolute* molar mass measurements along with protein separation accessories, Batch Dynamic Light Scattering Detector with capability to connect to MALS system for carrying out online DLS studies, and attached to Protein separation system (HPLC System) with UV-VIS Detector Accessories

Detailed Specifications :

Static Light Scattering Detector:

Multi-angle, digital signal processing (DSP) light scattering detector with Programmable laser (10 - 100%)

Laser Wavelength: ~ 600-700 nm

Minimum8 angle research grade light scattering photometer for ***absolute*** molar mass determination

- Temp Control: Ambient
- **Molar Mass Range: 200 Da to 150 MDa (typical)**
- **Molecular Size Range: ~5to 300 nm**
- It should eliminates column calibration
- It should have option for *in- situ* flow cell cleaning
- Detector Resolution: 24 bit or similar
- It must determines absolute molar masses, sizes and conformations
- Compatible with all solvents (aqueous and organic)

- SEC-MALS System Readiness Monitor, Real-time Instrument Health Indicators
- It should be compatible with all HPLC
- It must be eliminating stray light
- Power input 80-260V AC, Full colour display for data at a glance.
- **Microcuvette assemblies must be included**

1. **Inline - Filter Kit(Aqueous)**

- The Filter Kit should contains all necessary parts to install an in-line filter after HPLC pump, including the filter holder.
- Helpful SEC columns in terms of reducing cleaning frequencyand should improve light scattering baselines.
- 50 Nos. of 0.1 µm Durapore membranes, for aqueous separations.

2. **Syringe Pump**

   Syringe Pump for microbatch measurements;

   Should accommodate fluids up to 50 cc or similar syringe

3. **Automated Software**
   Chromatography based software for data collection,

   a. data analysis of Static Light Scattering Data including Differential Refractive Index Measurements.

   b. Should determine absolute molar mass, size, relative fractions of copolymers and conjugates.

   c. Should also take UV signals for processing.

   d. Determines dn/dc and also Hydrodynamic radii with Online DLS module installed.

   e. Enables conformational studies through RMS studies Vs. Molar masses.

   f. Facilitates customized reporting and includes standard deviation of the measurements.

   g. Multiple floating licences provided in the same site.

4. **Differential Refractometer** with extended range for absolute refractive index determination

- RI detector with 256 times the detection power
- Should have High dynamic range
- Range : -0.005 to + 0.005 RIU; Noise: ± 7.5 x 10-10 RIU or similar
- Dynamic Range : 12,000,000 : 1 or comparable
- Band Broadening : < 20 µL
- Sample Temperature : 4 C to 65 C
- Measures the absolute refractive index of a solution (1.2 – 1.8 RIU)
- Should measure *dn/dc at the same wavelength*, as the LS detector.
- Should also make *absolute* refractive index determinations.
- Should have 512 or equivalent light measuring elements in one photodiode array System Readiness Monitor, Real-time Instrument Health Indicators

5. **Dynamic Tight Scattering capable of online and offline (cuvette based) mode**

- Laser Wavelength : ~600-700 nm; it should be programmable
- Scattering Angle : 90 degree
- Size Range Rh by DLS: 0.2 to 2500 nm
- Molar Mass by SLS : 200 Da to 1.5 MDa or similar
- Temperature Range: - 10C or belowto + 100 C and above
- Sample Cells : Capable of supporting Micro Quartz Cuvette and DisposableMicroCuvette(~100 ml to 500ml); one smaller and one higher volume.
- Sensitivity : 0.1 mg/mL or equivalent
- Data Acquisition time : 1 to 3600 sec
- Correlator : 512 Channel, 100 nsec sampling in multi-tau Layout
- Correlator : 512 Channel, 100 nsec sampling in multi-tau Layout
- *Very well connected to MLS system for Seamless Online DLS Studies through a Compatibility Kit*
- *Appropriate Software for DLS Data Acquisition, Analysis and Reporting*
- *Minimum TWO Quartz Cuvette Included*
- *Additional, separate Static Light Scattering Channel for absolute molar mass determination*
- *Auto-Attenuation up to 105 to measure small and large particles*
- *Front panel display for status and raw data visualization*
- *Fast Ramping and Equilibration during Melting Studies*

7. **Cell Cleaning Kit** *should be included and compatible with above mentioned system*

8 ***.Microbatch Filter Kit*** *for calibration of above mentioned system.*

9. ***LC-20AD BLK Solvent Delivery Unit should have***

- ***Solvent Delivery Unit***
  Solvent delivery method : Parallel-type double plunger
  Flow rate : 0.0001 mL to 10.000 mL/min

  10 Constant-pressure & Constant Flow Rate solvent delivery
  Flow rate accuracy ±1% ; Flow rate precision: 0.06% RSD or equivalent
  Operating Pressure : 40 Mpa or 5800 psi (400 bar)or equivalent
  Safety measures: Liquid-leakage sensor, high-pressure/low-pressure limits must be included

  Should include Reservoir Tray, Washing Kit,20AD, Mixer SUS 20A

HPLC system UV-VIS Detector

UV-VIS Detector with Dual-Wavelength Mode for HPLC/SEC applications.

Wavelength range : 190 - 700nm
Wavelength accuracy :1 nm ; Noise : 0.5 X 10-5 AU

Wavelength reproducibility : + 0.1 nm ; Drift 1 X 10-4 AU/h
Simultaneous Dual Wavelength Detection; Long life D2 Lamp : 2000 hours
Light source: Deuterium (D2) lamp, Mercury lamp for Wavelength, Include an additional lamp as spare

- Solvent Bottles with caps and Accessories 5/pack
- Appropriate software compatible with HPLC and MALS
- Rheodyne Injector with 20ul loop & Mounting Plate
- Suitable power cord
- Various loops such as 10, 50,75,100,250µl,
- Columns suitable for separation of different molecular weight systems (2 KDa to 200 Kda) and reverse phase columns

Price : All Prices must be quoted in INR/USD/EURO/JYN/GBP, Mention Ex-works price and CIP prices

Data processing

- Automated and manual; remote connection capabilities
- Including comprehensive data analysis package with scripts. Additional licence for data analysis software

PC monitor: High resolution with capability for extension

Training:

1. Two users should be trained properly and extensively at the company site.
2. Must include an intense training by a company expert for all mode of data recording and analysis after installation
3. Periodic training by local engineers for usage of the instrument

UPS: 10 KVA or appropriate for the instrument

Optional Quote: Temperature controller in the range of 10-80 degree C.

Warranty: 5 Years of CMC (all parts, all electronic boards should be covered)

Sr No. 58 / Reference No. 61.

Detailed Specifications : Thermal Conductivity Measurement

Flash Diffusivity Testing Apparatus for solids according to ASTM E 1461

The purpose is to study thermal transport coefficients for solid materials which cannot be fulfilled by any other instruments.

- The instrument shall be Gas tight and designed as table top instrument for flexible application. Sample handling should be performed within this footprint. Beside thermostat and optional LN2 vessel all parts should be integrated in the device.
- The instrument should have vertical set up with a light flash arranged on the bottom, the sample in the centre and the detector on top. No wave guide should be required guiding the flash from the reflector to the sample.

5. The distance between sample, detector and flash lamp should be minimized to get an optimum signal-to-noise ratio. No specific sample preparation (e.g., silver paint) should be required if the sample material is not electrically conductive.
6. The instrument should allow measurements from -100°C … 500°C within one instrument and without any change of detector, furnace or other components

- The thermal mass and total volume of furnace must be minimized to get a fast temperature stabilizing and short measurement times.
- Heating rates up to 50 K/min should be possible.
- The temperature equilibrium should be determined not only from the sample temperature signal but also from the stability of the detector signal.
- The furnace should be capable of holding the temperature stable to at least ⌖0.1K at a given pre-set temperature after achieving each isothermal temperature segment (during measurement).
- The temperature accuracy of the furnace should be ⌖ 0.1 K.
- The isothermal stability should not exceed 0.02 K/min
- The sample temperature will be measured using a type E.
- For furnace cooling, a cooling system (LN_2) should be available. The LN_2 controller is optimized for fast temperature stabilization with a reduced LN_2 consumption.
- The furnace shall be capable of running samples under oxidizing, reducing and inert atmospheres.

Detector, Thermal Diffusivity Range, Accuracy

- The system shall have the capability of being equipped with liquid nitrogen cooled MCT detectors with a nominal 24h-Dewar. IR detectors are capable to measure samples which are highly conductive, inhomogeneous or enclosed in a container allowing non-contact measurements.
- The exchange of the detector should be simple and executed by the operator within a couple of minutes.
- No iris or any additional orifices shall be used, for reducing the energy towards the detector.
- No mirrors shall be used on the detector side.
- The instrument should have the capability to measure thermal diffusivities over the range of 0.01 mm^2/s to 2000 mm^2/s between -100°C to 500°C. For most materials it should be possible to achieve accuracy better than 3% for samples with optimum thickness and diameter.
- The instrument should have the capability to measure the specific heat of solids with an accuracy of better than 5% (for standard materials).
- The detectors of the system shall be user-exchangeable to accommodate any future application.
- An automatic LN_2 refill system for the detector must be available as an option. The nominal operation time of such a refill device should last for more than one (1) week.

- No compressed air shall be required for actuator control (no pneumatic control) for filters and apertures.

- A lens should always be used between detector and sample for proper definition of the temperature sensing area and to increase the signal height.
- The detector signal should only be originated from the surface of the sample and not from any surrounding parts. Therefore, for an automatic adjustment of the temperature sensing area a vertical lens shift device, a so-called *ZoomOptics*, should be optionally available. The *ZoomOptics* should be software-controlled.

Light Flash

- The light flash source should be positioned beneath the sample and the distance between flash lamp and sample should be minimized and the mirror system should be optimized so that no additional wave guard is necessary.
- The flash source must have a variable energy of up to 10 J/pulse.

1. Additional flash source energy reduction by an optional filter (for e.g., thin films; 25%, 50%, 75% and 100% of pulse energy) should be implemented. The filter wheel should be software controlled.

- The flash energy should be software controlled.
- The pulse width should be minimum 20 µs
- The flash pulse width must be adjustable from 10 ❍s to 1500 ❍s.
- The system must be equipped with a pulse mapping device to measure the actual pulse shape for each individual pulse (necessary for calculation of thermal diffusivity and specific heat,

Sample Position, Thermocouple, Automatic Sample Changer (ASC), Sample Holders

- The system shall be equipped with an automatic sample changer (ASC). It should be possible to measure of up to sixteen (16) samples with a diameter of 12.7 mm in the temperature range from -100°C to 500°C.
- The sample position within the furnace should not be changed during a measurement and thermocouple should be integrated in the furnace and should be as close as possible to the sample that is being tested.
- The system must allow measurements on round & square samples, with diameters/square sizes between 10 mm and 12.7 mm (with a tolerance of 0.0/-0.3 mm) & sample thicknesses between 0.01 mm and 6 mm, depending on the samples' thermal diffusivity. For highly conductive and thin materials no limitations of the sample thickness should be given.
- Sample holders made should not be made of alumina. The sample holders should be made of optically dense materials, e.g. stainless steel. Special sample holders for molten polymers, low viscosity liquids (e.g., water, possible viscosity shall be 0.2 to 10^{10} mPa*s)), pastes, powders, laminates and fibers as well as for measurements in-plate direction (in-plane) and for tests under mechanical pressure should be available. Special sample holder with low cost consumables (for e.g. resins during curing) should be available.
- The sample holders should have identification marks/numbers for each sample position for safe distinction between the 16 possible samples.
- For calibration and especially for c_p determination Pyroceram should be available among further reference materials.

Sr No. 59 / Reference No. :62

Detailed Description of the item :

Aberration corrected TEM system for soft materials with Cryo capability.

Soft materials aberration corrected Cryo-TEM system consisting of A. 200KV aberration corrected Cold-FEG TEM, with items for sample preparation: B. Cryo-ultramicrotome with knife maker and block trimmer, C. Automatic Plunge Freezer, and D. Freeze fracture with vacuum cryo transfer unit; suitable for a variety of cryo-TEM work with biological, nanomedicine, soft-solid and complex-liquid related samples.

Sr. No	Parameters	Desired Specifications
1	Accelerating Voltage	200kV - user changeable from 30 kV – 200kV without intervention of a service engineer. Condenser lens should be aligned at least for three of the voltages such as 200, 120, 80 kV, or 60kV at no extra cost. Minimum Step size ≤ 50 V.
2	Electron Source	W COLD FEG. The emitter brightness should be 8×10^8 A/cm^2 · sr or higher at 200 kV. The vacuum level in gun area up to the bottom of the acceleration tube should be 10^{-8} Pa or less. The probe current should be 1.0 nA or more for probe diameter of 0.19 nm.
3	Resolution and Spot size	Point image resolution ≤0.27 nm Information Limit ≤ 0.14 nm Lattice image resolution ≤ 0.14 nm; STEM HAADF, BF, DF lattice imageresolution should be ≤0.082 nm with STEM corrector. The configuration should enable STEM Tomography with above resolution in place.
4	Magnification	i) TEM Magnification: Range 50x to 1.5Mx or higher
		ii) STEM Magnification : Range 200x to 150Mx or higher
5	Operation Modes	The TEM should be fully digital microprocessor controlled with following modes as standard _ HRTEM, STEM, EDS, BF, DF, HAADF, Diffraction, CBED, SAED, NBD
6	STEM Permissible Aberrations Coefficients	i) Spherical aberration:-0.1 mm to 1.0 mm
		ii) Chromatic aberration ≤ 2.0mm
7	Cooling system	Close circuit, automatic temperature and flow rate controlled water cooled chiller

8	Lens System	System consisting of condenser lens, objective lens, diffraction, intermediate and projection lenses

9	Vacuum System	Microscope should have suitable vacuum system consisting of Non evaporable getter (**NEG**), Sputter ion pumps (SIP) FEG gun vacuum should be ≤ 10^{-8} Pa TEM specimen chamber vacuum should be ≤ 2 X 10^{-5}Pa
10	Specimen chamber	Goniometer maximum tilt should be +/-70° or higher X movement range:±1 mm or more Y movement range:±1 mm or more Z movement range:±0.4 mm or more STEM tomography should be automated with dynamic focusing capability.
		Microscope should have a fully Eucentric goniometer with all 5 axis motorized for standard 3.0 mm TEM grid
		Facility for recording specific specimen translation position as reference point in memory
		Minimum step of ≤0.05 nm for sample should be provided
11	Detectors	STEM detector should be consisting of BF, HAADF and ABF detectors. STEM detector should be able to acquire BF, DF, HAADF, ABF, e-BF, LAADF images. Above goniometer, the dedicated multi-channel plate BSE/SE detector must be provided.
		The system should have an ability to acquire four images simultaneously.
12	Probe corrector	Probe corrector to be provided with STEM resolution of <0.082 nm.
13	Recording System	Bottom Mounted, retractable, EELS compatible high resolution CMOS camera of minimum resolution 4k X 4k pixel @ 25 fps with full resolution of 4k x 4k
14	3D-Tomography	TEM and STEM 3D-tomography holder with appropriate software should be provided and on-field upgradable to EELS in future. The system should be compatible for tomography with Cryo holder.
15	Window less EDS Detector	Window less Silicon Drift Detector EDS of total area ≥158 mm2 using at least one EDS or more, solid angle should be ≥ 1.1 srad, take-off angle should be ≥30.5° Energy Resolution at Mn-Kα should be at least 133 eV at 100,000 spectra/s or better Capability to detect elements with atomic number >5 (i.e. from B onwards) Capability of autoprotection in case of vacuum loss or high electron flux

16	Anti Contamination Device	Liquid nitrogen based anti-contamination device to suppress specimen contamination that may adversely affect high resolution imaging and analysis
18	Sample holders	1. Analytical Doubletilt Holder- 1 No.

		2. Single-tilt Holder - 1 No. 3. Analytical high tilt Tomography holder – 1 No, 4. CRYO Holder -2 Nos 5. CRYO Transfer station and controller for CRYO holder – 1 No 6. CRYO Tomography holder– 1 No 7. CRYO Transfer station and controller for CRYO Tomography holder – 1 No 8. Cryo holder dry pumping station – 1 No.
19	User Interface	1. Fully computer controlled system with windows based software for operating the Microscope along with keyboard, mouse.
		2. Manual control panel using knobs, sample movement by track ball or joystick
		Control Panel and Joystick-Control panel including multifunction keys/knobs for control and adjustment of TEM parameters (focus, magnification etc) and manual joystick control for stage in X,Y,Z tilt and rotation directions.
	Work Station and Software	1. Latest desktop system with sufficient USB ports and windows compatible operating system to operate FF-TEM and all attachments and 24 inch or higher HD LED monitor
		2. Complete software for image analysis, topography, morphology, dynamic picture recording, and image manipulation for separation of different images, super posing and subtraction
		3. Suitable for screening samples for subsequent single particle reconstruction (SPR) studies.
		4. Tomography Software for automatic control and reconstruction
		5. Image file in JPEG, TIFF & BMP formats. Backup software must be provided on optical media. Any further version of the software and updates must be provided free of cost
21	Manual	One set of instruction manual and service manual (both hard and soft copy in English) should be supplied with the equipment.
22	Pre-Installationrequirements	Complete technical details of pre-installation requirements should be furnished along with the technical bid to ensure quoted resolution.
23	Installation	Installation, complete interfacing of the system with its subsystems, and commissioning is to be carried out by the vendor’s factory-trained engineers, followed by a demonstration of the system’s performance to the user’s complete satisfaction
24	Training	The manufacturer/supplier of HRTEM should provide seven days onsite training initially during installation followed by regular follow up training during the warranty

		period on mutually convenient dates.
25	Accessories	Chiller/compressor /UPS/other necessary accessories for installation as required should be included in the offer and should be manufactured by the vendor or internationally reputed manufacturer
26	Sample Preparation	Following Accessories should be included in the offer: B. Cryo Ultramicrotome with knife maker and block trimmer C. Automatic Plunge Freezer D. Freeze fracture with vacuum Cryo transfer unit as per specifications below.
27	Site-preparation requirements	Offer should include complete site preparation for optimum installation of all units procured under this order. 4. Including Precision Air conditioner, confirming to temperature variation requirements as specified by TEM manufacturer. 5. Electromagnetic interreference tools/equipments to control Electromagneticinterreference as per requirements of equipment manufacturer. 6. Anti vibrationtools tools/equipments to control Electromagnetic interreference as per requirements of equipment manufacturer. Please note that demonstration of resolution confirming to parameter no. 3 above should be demonstrated at site by the equipment supplier and hence specifications of point 27 a, b, c should be planned and quoted by the TEM manufacturer accordingly after conducting thorough site survey at our proposed installation location.
28	Warranty	Comprehensive for three years with AMC for five years to be quoted optionally.FEG Emitter and Gun are an integral and crucial part of the system and should not be considered as a consumable, hence should be covered under warranty.
29	Supply	Offer should cover delivery to IITB Powai Mumbai campus installation site. Customs concessional certificate will be issued by IITB and customs clearance done with customs duties paid by IITB.

B. Technical specification for Cryo-Ultramicrotome with knife maker and block trimmer

Cryo Ultramicrotome

- Cutting transmission should be done by vibration decoupled gravity stroke
- Specimen feed at steps of 1 nm or better
- Cutting speed should be controllable in a range of 0.05 to 100 mm/sec
- Complete system should be controlled by a touch screen controller of size 10” or more
- Knife stage should be fully motorized and controllable by the touch screen controller
- Movement range of knife stage in E-W (X) and N-S (Y) directions should be at least 25 mm & 10 mm respectively
- Countdown, section counters, speed, feed, stage movement parameters should be visible on controller screen

- Details of user, sectioning, knife parameters and grid box parameters should be downloadable via USB (logbook)
- It should be possible to make segments of knife and it should be approached automatically
- Ultramicrotome should have automatic trimming function, programmable by the touch controller
- Stereomicroscope with magnification range of 10x to 75x or more should be provided
- Ergonomic wedge with adjustable angle of 5°- 25° should be included with stereomicroscope
- It should have eucentric movement with defined click stop positions for glass knife and diamond knife
- There should be 4 LED illuminations with top light, spotlight, back light and specimen trans Illumination
- All Illuminations should have independent control via touch screen controller
- Cryo chamber should have adjustable temperature form+110°C to -185°C with automatic rapid cooling
- The controls for Cryo chamber should be integrated within the main machine's controller
- Individual temperatures setting for specimen, knifeand gas temperature
- Chamber wall should be heated and have high gas GN2 flow < -140°C
- It should have 5 level LN2 indicator with reserve warning
- Knife holder should be rotatable with position for 2 Cryo knives
- Ionizershould be provided withelectrostaticcharge and discharge functions
- Chamber should have warm arm rests and gaps for GN2 flow
- Dual micromanipulators for Tokuyasu and CEMOVIS cryo-sectioning

Glass Knife maker

- 100% balanced break method
- Breaks glass from 6.4 to 10mm
- Variable scoring lengths with Accurate glass strip positioning
- Drawer system with convenient and safe knife removal
- Auto reset of breaking and scoring mechanism
- Push action score for even scoring and Adjustable scoring pressure
- Breaking wheel with scale for defined and reproducible glass break

Block trimming unit

- High speed diamond miller with variable speed of 300 to 20000 rpm or more
- Integrated stereo microscope with LED ring light for easy adjustment of the block positions
- Miller movement should be adjustable in steps of 0.5, 1, 10, 100 um
- Auto feed function for minimizing human intervention
- LCD display for showing the feed of miller
- Safety cover for working area and auto stop mechanism on removal of safety cover

Consumables

- Diamond knife 3 mm for Cryo as well as room temp. sectioning
- Cryo trimming blade for auto trimming of cryo sample
- Glass strips 6.4 x 400 x 25 mm, 30 pcs.
- Trufs 6.4 mm, 500 pcs.
- Easymold, embedding mould for 5.6 mm diameter
- Knife box for 6.4mm and 8mm glass knives
- Grid box for 100 grids, 10 pcs
- Dental wax

C. Technical Specification of Automatic Plunge freezer

1. Movable climate control chamber with automatic adjustment oftemperature up to 60º C or more as well as humidity up to 99% or more
2. Climatic chamber should be we lit inside with LED and a defogger/window heater should be available to maintain a clear view of chamber
3. Windows for inserting pipette should be available on both left as well on right side of the chamber
4. Touch screen control panel to program and run the system with easy to use graphic user interface with library of 15 or more editable operating programmes
5. Possible to set & adjust pre-blotting, blotting/hold time.
6. It should be capable of doing single or multiple side automaticsensor-controlledblotting.
7. Positioning of grid should be adjustable in terms of distance and height with respect to the blotting paper
8. There should be two separate containers for secondary cryogen& cryotransfer of sample with lid
9. One liter LN2 dewar and secondary cryogen should be stationary
10. Secondary cryogen temperature should be adjustable with a range up to -190º C or more
11. Container should have adjustable GN2 flow for avoiding contamination due to ice
12. Secondary cryogen preparation with Ethane or propane, using a transparent and attachable lid on container should be available
13. Required accessories like cryo-tool dryer, grid box, insulating forceps, blotting papers etc should be provided along with the equipment

D. Technical Specification of Freeze fracture with vacuum cryo transfer unit

16. Movable climate control chamber with automatic adjustment of temperature up to 60º C or more as well as humidity up to 99% or more
17. Climatic chamber should be we lit inside with LED and a defogger/window heater should be available to maintain a clear view of chamber
18. Windows for inserting pipette should be available on both left as well on right side of the chamber
19. Touch screen control panel to program and run the system with easy to use graphic user interface with library of 15 or more editable operating programs
20. Possible to set & adjust pre-blotting, blotting/hold time.
21. It should be capable of doing single or multiple side automatic sensor-controlled-blotting.
22. Positioning of grid should be adjustable in terms of distance and height with respect to the blotting paper
23. There should be two separate containers for secondary cryogen& cryotransfer of sample with lid
24. One liter LN2 dewar and secondary cryogen should be stationary
25. Secondary cryogen temperature should be adjustable with a range up to -190º C or more
26. Container should have adjustable GN2 flow for avoiding contamination due to ice
27. Secondary cryogen preparation with Ethane or propane, using a transparent and attachable lid on container should be available
28. Required accessories like cryo-tool dryer, grid box, insulating forceps, blotting papers etc should be provided along with the equipment

Sr No. 60 / Reference No. :63.

Detailed Description of the item : Bench top Lab-scale Twin Screw Extruder with mini Injection Moulding Machine and accessories.

Parallel Twin-Screw Extruder :

A. Parallel Twin-Screw Extruder 1 no.

1.Compact parallel co-rotating 11 mm twin screw extruder designed with unique monocoque housing. Suitable for compounding of thermoplastic polymers. Throughput up to 2.5 kg/h. Minimal required sample size of approximately 20 g. Extruder control is via an integral colored touch screen HMI.

2.Barrel construction: Nitriding steel 1.7365 (EN40B) or similar material

3.Horizontally split extruder barrel with removable top half barrel. Barrel length must be 40 L/D. The processing length of the extruder can be reduced by the optional length reduction kit. The barrel must have at least 3 multipurpose ports.

4.Water cooled primary feed port (Chiller required). Three additional closable multi function barrel ports, suitable for additional feeding or venting.

5.The barrel is split into 8 zones (5 L/D), after the initial cooled feed zone there are 7 separate (5 L/D) heating zones to facilitate temperature profiles along the barrel.

6.Die: Rod die, 1 x D: 2 mm, Strand diameter can be easily altered using optional die nozzles.

Extruder must be complete with:
7.Set of configured screw shafts
8.Atmospheric venting adapter
9.Pressure transducer
10.Melt Temperature transducer
11.Operation manual

Technical data:
1.Extruder Screw speed: 10…1000 rpm or more
2.Max. pressure: 100 bar or more
3.Max. torque: 6 Nm / Shaft
4.Power rating: 1.25 kW (Drive)
5.Temperature: RT…. 450 °C
6.Power connection: 230 V, 16 A, 50-60 Hz

B. Small compact bench top Chiller Unit 230 V, 50 Hz 1 no.

Suitable to cool the main feeding port (mandatory) and the optional barrel cooling unit. Including tubing and connections. Ready to connect to extruder.

Technical data:
1.Temperature range: 10 ... 80 °C
2.Cooling capacity: 500 W
3.Heating capacity: 2 kW
4.Power requirement: 230 V, 50 Hz (single phase)

C. Volumetric Single Screw Feeder for polymer pellets 1no.

1.Single screw feeder to feed powder or pellets (max. size 2.5 mm) into the main feeding or a secondary feeding port.
2.The feeder is designed to locate on the extruder housing and connected electrically to the extruder base.
3.Multiple feeders (maximum 3) can be daisy-chained and are all recognized and operated from the extruder HMI touch screen.
4.Different feeder screws are available to allow various feed ranges for different materials.
Technical data:
5.Hopper volume: 1.3 l or more
6.Outlet height: 210 mm (Height 1)
7.Power supply: 230V, 50/60 Hz

D. Feeder Screw 1no.

1.Twin Lead Feeder screw with core for minimal output. Suitable for powder materials.
2.Diameter: 11 mm
3.Helix pitch: 8 mm
4.Core: 9 mm

E. Screw element flexibility kit 1 no.

1. Set of common screw elements to modify the screw configuration.
Content:
2. 4 x Feed Screw, 1 L/D
3.2 x Feed Screw, 0.5 L/D
4.2 x Reverse Feed Screw, 0.5 L/D
5.8 x Mixing Element 0°, 0.25 L/D
6.8 x Mixing Element 90°, 0.25 L/D
7.Anti-Seize paste

F. High Volume Feed Screw Kit 1 no.

1.A set of asymmetrical shaped geometry feed screws (increased free volume and special intake pockets) allows feeding commercial pellet sizes (=4 mm) into the extruder.
Content:
2. 4 x Long Pitch Push Screw Element, 2 L/D

G. Set of die inserts (0.5, 1.0, 1.5, 2.5, 3.0 mm) 1 no.

To allow quick change of the die diameter. Contains a set of threaded die nozzle inserts with diameters: 0.5 1.0 1.5 2.5 and 3.0 mm

H. Secondary feeding of powders and Liquids

1.Secondary Cooled Feed Funnel for twin screw extruder
Allows the feeding of solids into a downstream feed port. To avoid material melting in the funnel the feed funnel is equipped with a cooling jacket.
Secondary Feeder required. 1 no.

a. Volumetric Feeder for twin screw extruder for powders

1.Volumetric Feeder with agitator. Electrical connected to and operated by the extruder. Suitable for powders and micro pellets (max. size 1 mm). Set of screws suitable for the application have to be ordered separately.
Complete with:
2.Twin screw feeder with agitator
3.Cylindrical hopper (0.6 l volume) closed by lid
4.Horizontal outlet tube
5.Feed funnel extension with lid
Technical data:
6.Power: 230 V, 50/60 Hz 1 no.
b. Adder Secondary Feeder Usage

1.This option indicates the above ordered feeder is used as secondary feeder. Only required if the feeder should be retro fitted to an extruder and used as secondary feeder (Feeder 2). 1 no.

c. Set of concave screws

1.Set of screws for very low throughputs.
2.Outer diameter: 12 mm
3.Helix pitch: 4 mm
4.Core diameter: 8 mm 1 no.

d.Set of spiral screws

1.Geometry: Spiral Screw
2.Outer diameter: 11 mm
3.Pitch: 11 mm

4.Inner diameter: 7 mm 1 no.

e. Liquid System complete for extruder

1.Complete solution to feed liquids into the twin screw extruder barrel.
2.The feeding pump is digitally controlled at the pumps user interface and interlocked into the twin screw extruder start/stop signals.

Content:
3.Peristaltic feeding pump
4.Liquid Feeding Plug
5.2 m feeding tube 1 no.

I. Bench top Water Bath 1 no.

1. Suitable to cool the polymer strand before it is feed into the pelletizer. Includes two rolls to guide the strand within the bath. An included air ring blows off remaining water from the strand.

Technical data:
2.Connection: Quick coupling (self closing) for 8 mm tube
3.Capacity: 5 l
Pelletizer for extruder 1 no.

1. Strand Cutting Variable Length Pelletizer; with variable speed drive and adjustable pellet length. With opening panel for easy-cleaning access, fully safety-interlocked and complete with electrical controls.
Technical data:
2.Line speed: 3 … 25 m/min
3.Pellet length: 0.5 … 2.0 mm (step: 0.5 mm)
4.Power connection: 230 V 50/60 Hz

K. Micro injection molding machine with vertical piston design and compatible with
the twin screw extruder to make it work in tandem with Extruder. 1 no.

1. Micro Injection molding machine to produce test specimen with a minimum amount of sample material (3.5 g and maximum volume 12.5 cc). The manufacturing process is completely numerically controlled. Ten different sets of parameters
can be stored in the machine.
2. Advanced machine with vertical piston design and compatible with the twin screw extruder to make it work in tandem with the Extruder, suitable to produce specimen with maximum 150 mm length (ISO 527 Tensile bar).
Technical data:
3.Max. melt temperature: 450°C
4 Max. mold temperature: 250°C
5 Max. Injection pressure: 1100 bar
6 Weight: 60 kg
7.Electrical power: 230/110 V, ±10%, 3.15 A, 50/60 Hz
8.The requirement for compressed air supply should not be more than 10 bars
9.Mold for Tensile bar ISO527-2-1BA 1 no.
10.Mold for Tensile bar type 3 1 no.
11.Mold for disc diameter 20 mm, height 1.5 mm 1 no.
12.Mold for disc diameter 25 mm, height 1.5 mm 1 no.
13.Mold for disc diameter 35 mm, height 1.5 mm 1 no.
14.Mold for Tensile bar ISO527-2-5A 1 no.
15.Mold for bar 80x10x4 mm Izod ISO180, Charpy ISO179-1 1 no.

L. Sheet Die for Twin Screw Extruder 1 no.

1. Horizontal 30 mm wide sheet die with adjustable slit height 0.1 ... 1.1 mm.
2.Max. temperature: 350 °C. Temperature is controlled via separate controller. Complete with:
3. -Flexible lip with adjustment screws
4. -Fishtail flow channel
5. -1/2" UNF Measurement port
6. -Die heater
7. -Temperature controller

M. Modification of slit height for flexible sheet die 1 no.
1.Adjusting range: 1 mm.
2.Maximum possible slit height: 3 mm

N. Sheet Take Off for Twin Screw Extruder 1 no.
1.To smooth and take off extruded sheet and ribbon samples in a defined manner. Easy handling due to cantilever mounted rolls.
2.Two driven chill rolls (water cooled) take the sheet from the die.
3.Two rubber stretching rolls. Speed of the rubber rolls can be controlled separately within 0-10 %.
4.Wind Off roll with interchangeable rolls with self-adjusting speed to compensate increasing roll diameter.

Sr No. 61 / Reference No. 64.

Specifications for "Raman spectrometer" to be established as a central facility at IITB

Note 1: All components are necessary. Some suggestions for the suitable option are provided based on previous experience.
Note 2: In the technical bid, point by point list should be furnished to demonstrate requirements have been met.

Other important terms:

1. The Raman spectrometer system should come with a five-year warranty except for lasers, which should be for two years. The heating stageand UPS should come with a warranty of three years. Vibrational isolation table and dehumidifying dry storage should come with a warranty of one year. During warranty, all spare parts should be included free of cost, and at least three maintenance/ breakdown service per year should be provided.
2. AMC cost after fiveyears of system warranty should be mentioned in the quotation.
3. The authorization letter should be furnished along with the quotation.
4. **Door to door duty delivery paid for all components. IIT Bombay would provide the exemption certificates as applicable. This will be used for L1.**
5. The compliance statement should be enclosed with the quotation.
6. The vendor should furnish a letter of authorization from the manufacturer along with the quotation. Also, the manufacturer should have ISO9001or similar certifications.
7. The vendor should have trained service personnel to provide efficient after-sales service support. Names of three personnel, along with their training certificates, should be furnished along with the quotation.
8. The vendor must have done installation of at least five similar (with four lasers including UV) Raman spectrometersduring the last 10 years in thegovernment academic institutions and R&D labs in India to be supported withinstallation reports obtained from the Institutions. The names and contact details ofthe Institutions where the instruments are supplied and installed should be given sothat the technical Committee can ascertain the veracity of the information provided.
9. The installation should be done free of cost for all equipment. Training to operate the instrument must be given to our research scholars free of charge.

10. Trained Service engineers in India or directly from OEM must be available to resolve technical problems within a week.
11. The vendor should take total responsibility to install the Raman spectrometer with the heating stage and cryostat and demonstrate the performance.
12. All power supplies should be Indian type 230+/-10% Volts, 50 Hz, with Indian standard plugs. If Indian plugs are not available, suitable converters must be provided.
13. In the technical bid, technical specifications described below should be substantiated with data measurement of 5 user-supplied samples. The inability to do so will lead to disqualification from the tender process.

Confocal Laser Raman and PL spectrometer

Fully integrated and computer-controlled confocal Raman spectrometer with a research-grade microscope and all necessary optics and accessories.The specifications are below.

1. Spectrograph equipped with a research-grade microscope capable of producing Raman (wavenumber transfer 50 to 4000 cm^{-1}) and PL (330 nm to 1.7 microns).
2. Spectral Range of spectrometer: 200 nm – 2200 nm
3. Autofocusing of a laser beam on non-planar samples for 2D mapping.
4. High throughput: 1x1 mm^2 area with 10 micro meter resolution in less than 60 minutes.
5. Scanning step size for 2D mapping to be better than 50 nm.
6. See the table forthe minimum specification requirementfor each laser wavelength. Laser switching must be computer-controlled without any need for realignment.

Laser wavelength	HeCd325 nm	Diode 532 nm	HeNe633 nm	Diode 830 nm
Power	> 25 mW	> 50 mW	> 17 mW	> 200 mW
Spectral resolution (FWHM)	2 cm^{-1} with 2400 gr/mm	0.5 cm^{-1} with 2400 gr/mm	1 cm^{-1} with 1800 gr/mm	0.75 cm^{-1} with 1200 gr/mm
Gratings (on a computer-controlled stage, easy switching without realignment)	600/1200/1800/2400 gr/mm	600/1200/1800/2400 gr/mm	600/1200/1800/2400 gr/mm	600/1200/1800/2400 gr/mm
PL	330 nm to 1100 nm	--	--	830 nm to 1600 nm
Minimum Raman wavenumber required	200 cm^{-1} for routine measurements	50 cm^{-1} for routine measurements, 10 cm^{-1} for low wavenumber measurements	50 cm^{-1} for routine measurements	100 $cm^{-1}$for routine measurements
Remote probe	--	Fiber optic, motorized switching option fully controlled by software, hands-free alignment, 100 to 4000 cm^{-1}, 2 optical fibers of 5 m length each, white light illumination system and video viewer, motorized visualization system to view both sample and laser spot, optics for injecting the laser beam in a	--	--

		fiber, achromatic focusing and collecting lens of 40 to 50 mm focal length, and any other necessary interface kit.		
Objectives	15x (minimum of 8 mm WD), 40X	5x, 20 X, 50 X (LWD, minimum of 8 mm), 100 X	5x, 20 X, 50 X (LWD, minimum of 8 mm), 100 X	5x, 20 X, 50 X (LWD, minimum of 8 mm), 100 X
Polarization kit	--	Continuous laser polarization rotator (>180 degrees rotation) for outgoing beam (analyzer), and quarter and half waveplate forincoming laser beam before the sample	--	--
Detector (spectrometer should support two detectors to be mounted simultaneously)	A fully automated multichannel high efficiency thermo-electrically (-60 deg C Peltier cooled) cooled back-illuminated CCD, pixel size: 1024x256, Quantum efficiency > 80% between Spectral Range 400 and 850 nm, overall spectral range 200 to 1060 nm	A fully automated multichannel high efficiency thermo-electrically (-60 deg C Peltier cooled) cooled back-illuminated CCD, pixel size: 1024x256, Quantum efficiency > 80% between Spectral Range 400 and 850 nm, overall spectral range 200 to 1060 nm	A fully automated multichannel high efficiency thermo-electrically (-60 deg C Peltier cooled) cooled back-illuminated CCD, pixel size: 1024x256, Quantum efficiency > 80% between Spectral Range 400 and 850 nm, overall spectral range 200 to 1060 nm	A fully automated multichannel high efficiency thermo-electrically (-60 deg C Peltier cooled) cooled back-illuminated CCD, pixel size: 1024x256, Quantum efficiency > 80% between Spectral Range 400 and 850 nm, overall spectral range 200 to 1060 nm, and InGaAs array detector, 512x1 pixels, spectral Range: 800 to 1700 nm (-90 deg C Peltier cooled), Quantum efficiency > 80% between Spectral Range 1000 and 1500 nm
Fast imaging				High resolution (250 nm) fast imaging, imaging speed >1000 spectra/second

7. Grating efficiency (efficiency curve should be provided with the technical specifications):
   a. 600gr/mm should have >50% efficiency between 250 and 430 nm for the unpolarized light. It can be less and more for S and P polarization.
   b. 1200gr/mm should have >50% efficiency between 650 and 1000 nm for the unpolarized light. It can be less and more for S and P polarization.
   c. 1800gr/mm should have >50% efficiency between 530 and 730 nm for the unpolarized light. It can be less and more for S and P polarization.
   d. 2400gr/mm should have >40% efficiency between 400 and 700 nm, and >30% efficiency between 200 and 400 nm for the unpolarized light. It can be less and more for S and P polarization.

8. Spatial resolution: better than 2 microns for both axial and lateral directions
9. Spectrograph should allow continuous acquisition for the entire spectral Range to avoid any discontinuities at any given wavenumber. Measurement resolution, as specified in the above table, should be maintained during the acquisition.
10. Minimum of 12 power levels in neutral density filters going from 0.0001 to 100%
11. High stability research-grademicroscope with color camera and directly coupled to the spectrometer. Reflected light illumination must be available. A video camera must be attached to the microscope for viewing the specimen.
12. XYZ motorized and computer-controlled mapping stage with a minimum travel distance of 110x75x25 mm with a resolution of 50x50x10 nm. It should come with a joystick.
13. Sampling arm or open space microscope: For bigger samples or samples in an external cryostat/heating stage, which cannot be fitted under the microscope. It should be coupled to the XYZ motorized stage, so we do not need to move the samples.
14. Calibration: Automatic calibration on single crystal silicon sample and neon light. Motorized switching between laser and white light sample.
15. Power meter: should measure 100 micro Watt to 2 Watt with 10 micro Watt resolution, capable of measuring from 190 to 1060 nm.
16. Computer: Minimum of the dual-core 10 Gen processor, 16 GB RAM, Graphics card for 3D viewing, DVD-RW, 2 TB HDD, 2 USB 3 ports, Windows 10 (64 bit), 24-inch LED color monitor.
17. Software: Should be available on a minimum of 6 computers for remote analysis of data. Capable of collecting and performing full Raman and PL data analysis, including background removal, peak fitting, averaging, etc., fully integrated with all motorized stages of the spectrometer and XYZ mapping stage.
18. Libraries: Inorganic and minerals, polymeric materials, biochemicals. Minimum of 5000 entries in the libraries. Libraries should be permanent. Mention the company name where an additional library can be acquired.

To ensure the above requirements have been met, we will:

I. Evaluate data on fiveuser-supplied samples.
II. Demonstration of 2D mapping in pharmaceutical tablet of typical dimension 12.5x12.5 mm^2 with 100-micron resolution in less than 60 minutes.
III. Checkthe spectral resolution of the neon line. It should meet the requirement listed in the table.
IV. Check the reproducibility of the spectra.It should be better than 0.02 cm^{-1} when repeated over a minimum of 25 acquisitions.
V. Check higher harmonics of silicon at 1440 and 1940 cm^{-1}. The minimum expected signal to noise ratio must be 25:1 and 4:1 for 1440 and 1940 cm^{-1}, respectively.
VI. Check for long exposures of more than 10 minutes.The Raman shift must not shift by more than 0.02 cm^{-1}, thus ensuring phonon linewidths do not broaden.
VII. Check the L-cysteine sample to make sure the 14.9 cm^{-1} peak is visible including full shoulder. The vendor should supply the L-cysteine sample.
VIII. Check for any discontinuity in the measured Raman spectrum for extended scanning range (Raman shift of 50 to 4000 cm^{-1} measured with 532 nm laser).
IX. Testing of bigger samples which cannot be accommodated under the microscope.

UPS

1. Uninterrupted power supply battery back-up of the entire Raman system (including all motorized stages) must be more than 2 hours.

Vibration isolation table

A. Specifications for Table Top

- Size: 2400mm(L) x 1200mm(B) x 200mm(T)
- Construction: Honeycomb core
- Core Design: Honeycomb core made of 0.3 mm aluminum sheet
- Top Skin: 5.0mm thickness 410 series magnetic stainless-steel plate, smooth sanded finish
- Core cell size: 6 sq.cm
- Sidewalls: Compressed woodenparticle boards with lack mat finish
- Bottom skin: 5mm thickness epoxy coated MS
- Surface flatness: ±0.1mm over 300mmx300mmarea
- Mounting holes: Metric: M6-1.0 holes on 25mm grid, 37.5mm borders, nylon cups under each tapped hole for the protection of the core.
- Damping: Broadband standard damping
- Bonding: Preferably semi-solid epoxy

B. Specifications of Isolator

- Isolate the optical table from vertical and horizontal vibrations in 3 to 50 Hz frequency range

C. Performance Specifications

- >90% at5 Hz (both horizontal and vertical)
- >97% at 10 Hz (both horizontal and vertical)
- Maximum load capacity > 1000 kg
- Vertical resonant frequency <= 1.25 Hz, transmissibility at resonance should be less than 10dB
- Horizontal resonant frequency <= 1.0 Hz, transmissibility at resonance should be less than 10dB
- Self-leveling repeatability < +-0.5 mm
- Height > 600 mm and less than < 800 mm
- Height adjustment range: -10 mm to +5 mm

D. Air Compressor

- Appropriate air compressor should come with the table for filling the air up to 80 psi

Heating Stage for Raman spectrometer

Full kit for Micro thermometric cell working from ambient temperature up to 1500 °C controlled by soft-ware, with the following specifications:

1. Sample crucible/cup size: >=7mm diameter and minimum of 3mm deep
2. Suitable for transmitted and reflected light
3. Gas-tight chamber for atmospheric control
4. Water cooling connections for stage lid and body
5. Should come with water circulation unit and touch screen temperature controller
6. Should be integrated with the Raman system computer
7. Heating rate should be between 0.1 degC/min to 200 degC/min.
8. Temperature stability < 1 degC
9. Objective lens working distance < 8 mm

Dehumidifying dry storage cabinet

1. Capacity: 80 liters or more
2. Toughened Glass Windows
3. LED Display for Temperature and Humidity
4. Humidity Controller maintains stable RH Level within accuracy: ±5%RH or better
5. Humidity Range: 25 - 60 %RH (should reach 25%RH in less than 2 hours initially, and recovery time should be better than 30 minutes)
6. Humidity Technique: As suitable, preferably -- Semi-permanent dry Desiccant
7. Minimum Doors/Shelves: 2 Doors/3 Shelves
8. Input Supply: 220V ~ 240V, 50Hz

Closed cycle cryostat for Raman spectrometer (not to be quoted)

The cryostat with the below specifications must be compatible with the Raman spectrometer.The vendor must take responsibility for their integration. A separate tender is being floated for the cryostat.

1. Thetemperature at the sample mount (not the second stage) should be controllable at least from 10 to 325 K.
2. Temperature stability should be better than 50 mK.
3. If required for operation, the unit shouldcome with a chiller unitwith minimum of 10m piping length and water reservoir tank.
4. Temperature controller unit (preferably Lakeshore 335)

    - Two independent diode / resistor input channels;
    - Two independent heater output loops (1st loop 25 W max banana plug output, 2nd loop 2 W max detachable terminal block)
    - Autotuning PID, audible and visual alarms, and relays;
    - GPIB (IEEE-488) parallel computer interfaces;
    - Cable to connect to cryostat.
5. Dry turbopumping station with dry diaphragm backing pump from reputed suppliers only

    a. Suitable vacuum gauge, vent valve, SS bellows, all necessary connections to be supplied.
    b. Turbo Pumping speed for N2 with NW40 should be at least 40 liter/sec.
6. Maintenance interval: minimum of 30,000 hours for compressor and 12,000 hours of the cold head.

7. Exchange-gas low vibration design with flexible rubber bellows.
8. Cryostat should have 10-pin feedthrough with 10 PhBr wires running to sample holder for user experimentation (exclude all other standard cryostat wires)
9. The system should come with a microscopy extension to be used under a microscope.
    a. The length of microscopy extension from center of vacuum shroud should be >= 200 mm, and length of microscopy extension rod should be >=80 mm.
    b. Microscopy extension top & bottom flange diameter should less than 120 mm.
    c. Microscopy extension height should be less than 40 mm.
    d. Microscopy extension top flange height should be less than 75mm when measured from base of cryostat.
10. Window material should be made from UV-grade fused silica windows. Windows should be epoxy sealed. Windows should be both on the top and bottom flanges and at least 1-inch diameter. Optical windows must have more than 90% transmission for 300nm to 1700nm.
11. Working distance: the sample position to outer quartz window distance must be less than 7 mm.
12. Vibrations at the sample position in the laboratory working condition must be less than 120 nm when measured from 0 to 100 Hz. Vibration data to be provided in the same range with the technical bid measured using the same parts that are going to be supplied.Vibration test reports to be submitted prior to shipment.
13. Cooling power of bare cryocooler should be more than 7.5 W @ 20 K (second stage), 1.5 Watts @ 10 K (second stage), and 15 W @ 40 K (first stage).Initial cooldown time should be less than 2.5 hrs @ 50 Hz to reach 10 K from ambient.
14. The water-cooled compressor with a full charge of high-purity helium gas

15. Cryostat vacuum shroud base should not occupy more than 130mm diameter space on optical table.
16. Cryostat drawing & product brochure with detail specifications to be submitted along with technical bid
17. The system should come with all necessary flex lines (minimum 10 feet long) and cold head control cable (minimum 10 feet long),exchange gas valve manifold with pressure relief valve, hose adaptor, flanges, evacuation valve, safety pressure relief valve, calibrated temperature sensor.

18. The system should come with a gold plated OFHC copper optical sample holder.Sample holder should have space to accommodate samples of 10mm diameter or more.
19. Appropriate mounting stand arrangement with castors & lock for mounting cold head to be included.

Sr No. 62 / Reference No. 65.

Specifications for "Closed cycle cryostat" to be established as a central facility at IITB

Note 1: All components are necessary. Some suggestions for the suitable option are provided based on previous experience.
Note 2: In the technical bid, point by point list should be furnished to demonstrate requirements have been met.

Other important terms:

14. The closed-cycle cryostat should come with a three-year warranty. During warranty, all spare parts should be included free of cost, and at least three maintenance/breakdown service per year should be provided.
15. AMC cost after threeyears of system warranty should be mentioned in the quotation.
16. The authorization letter should be furnished along with the quotation.
17. **Door to door duty delivery paid for all components. IIT Bombay would provide the exemption certificates as applicable. This will be used for L1.**
18. The compliance statement should be enclosed with the quotation.
19. The vendor should furnish a letter of authorization from the manufacturer along with the quotation. Also, the manufacturer should have ISO9001or similar certifications.
20. The vendor should have trained service personnel to provide efficient after-sales service support. Names of three personnel, along with their training certificates, should be furnished along with the quotation.
21. The vendor must have done installation of at least five closed-cycle cryostatduring the 5 years in the-government academic institutions and R&D labs in India to be supported withinstallation reports obtained from the Institutions. The names and contact details ofthe Institutions where the instruments are supplied and installed should be given sothat the technical committee can ascertain the veracity of the information provided.
22. The installation should be done free of cost for all equipment. Training to operate the instrument must be given to our research scholars free of charge.
23. Trained Service engineers in India or directly from OEM must be available to resolve technical problems within a week.
24. The vendor should take total responsibility to install the closed-cycle cryostat with the Raman spectrometer and demonstrate the performance.
25. All power supplies should be Indian type 230+/-10% Volts, 50 Hz, with Indian standard plugs. If Indian plugs are not available, suitable converters must be provided.
26. In the technical bid, technical specifications described below should be substantiated with data measurement, in particular for sample temperature and vibration level. The inability to do so will lead to disqualification from the tender process.

Closed cycle cryostat for Raman spectrometer

The cryostat with the below specifications must be compatible with the Raman spectrometer.The vendor must take responsibility for their integration. A separate tender is being floated for the Raman spectrometer.

20. Thetemperature at the sample mount (not the second stage) should be controllable at least from 10 to 325 K.
21. Temperature stability should be better than 50 mK.
22. If required for operation, the unit shouldcome with a chiller unitwith minimum of 10m piping length and water reservoir tank.
23. Temperature controller unit (preferably Lakeshore 335)

    - Two independent diode / resistor input channels;
    - Two independent heater output loops (1st loop 25 W max banana plug output, 2nd loop 2 W max detachable terminal block)
    - Autotuning PID, audible and visual alarms, and relays;
    - GPIB (IEEE-488) parallel computer interfaces;
    - Cable to connect to cryostat.
24. Dry turbopumping station with dry diaphragm backing pump from reputed suppliers only

    a. Suitable vacuum gauge, vent valve, SS bellows, all necessary connections to be supplied.
    b. Turbo Pumping speed for N2 with NW40 should be at least 40 liter/sec.
25. Maintenance interval: minimum of 30,000 hours for compressor and 12,000 hours of the cold head.

26. Exchange-gas low vibration design with flexible rubber bellows.
27. Cryostat should have 10-pin feedthrough with 10 PhBr wires running to sample holder for user experimentation (exclude all other standard cryostat wires)
28. The system should come with a microscopy extension to be used under a microscope.
    a. The length of microscopy extension from center of vacuum shroud should be >= 200 mm, and length of microscopy extension rod should be >=80 mm.
    b. Microscopy extension top & bottom flange diameter should less than 120 mm.
    c. Microscopy extension height should be less than 40 mm.
    d. Microscopy extension top flange height should be less than 75mm when measured from base of cryostat.
29. Window material should be made from UV-grade fused silica windows. Windows should be epoxy sealed. Windows should be both on the top and bottom flanges and at least 1-inch diameter. Optical windows must have more than 90% transmission for 300nm to 1700nm.
30. Working distance: the sample position to outer quartz window distance must be less than 7 mm.
31. Vibrations at the sample position in the laboratory working condition must be less than 120 nm when measured from 0 to 100 Hz. Vibration data to be provided in the same range with the technical bid measured using the same parts that are going to be supplied.Vibration test reports to be submitted as part of technical specifications.
32. Cooling power of bare cryocooler should be more than 7.5 W @ 20 K (second stage), 1.5 Watts @ 10 K (second stage), and 15 W @ 40 K (first stage).Initial cooldown time should be less than 2.5 hrs @ 50 Hz to reach 10 K from ambient.
33. The water-cooled compressor with a full charge of high-purity helium gas

34. Cryostat vacuum shroud base should not occupy more than 130mm diameter space on optical table.
35. Cryostat drawing & product brochure with detail specifications to be submitted along with technical bid
36. The system should come with all necessary flex lines (minimum 10 feet long) and cold head control cable (minimum 10 feet long),exchange gas valve manifold with pressure relief valve, hose adaptor, flanges, evacuation valve, safety pressure relief valve, calibrated temperature sensor.

37. The system should come with a gold plated OFHC copper optical sample holder.Sample holder should have space to accommodate samples of 10mm diameter or more.

38. Appropriate mounting stand arrangement with castors & lock for mounting cold head to be included.

The following line items for the above specification in their respective currencies (INR or foreign) must be quoted separately:

1. Closed-cycle cryostat
2. Temperature controller
3. Water chiller
4. Mounting stand for cryostat
5. Vacuum gauge
6. Turbo pump

Sr No. 63 / Reference No. 66

Technical Specifications:

Field Emission Scanning Electron Microscope compatible with external patern-generation systems.

1	Resolution	1.0 nm or better @ 15KV and higher, & 2.5 nm or better @1KV. The resolution should be achieved without sample or stage biasing.
	Electron Gun	Schottky (Thermal-FE) Emitter.
2	Magnification	15X to 10,00,000X or more continuously variable
3	Acceleration Voltage	Lower limit :200V or less, Higher limit: 30KV or higher all the KV settings must be software controlled. Imaging at all energies should be possible without sample or stage biasing.
4	Chamber	Large chamber with at least 6 additional ports.
5	Stage	5-axes motorized stage should have facility to load single and multiple stub. Stage must allow eccentric tilt throughout working distance and controlled through computer as well as manually with joystick (equivalent). X=100 mm or more Y=100 mm or more Z=50 mm or more Tilt= (-10) – (+90)° R=360°
6	Electron Optics	1.Possibility of imaging at low acceleration voltage (~ 1 kV) with high SNR (Gentle beam technology or equivalent). Possibility of stage biasing. 2.Suitable technology for high resolution imaging of magnetic materials with short (< 5 mm) working distance should be provided. 3.The lenses must be water cooled, and apertures must be motorized. 4.The system should have a focus wobb with variable amplitude and adjustable stigmator with octopole configuration 5.High Speed electrostatic beam blanker

		with complete electronics for e-beam lithography, compatible with third party pattern generation systems (like Nabity/ ELPHY etc.)
8	Probe Current and external measurement	• 5pA - 100nA or better with a current stability 0.2%/h or better. • It should be possible to measure the beam current either with the built-in specimen current monitor (Faraday cup) and an external pico-ammeter. • The system should have a “touch alarm” feature.
9	Detectors	• Detection of SE-1: The system should have an "In-lens"/"Through the Lens"/In column detector or equivalent detector for high resolution imaging of surface topography in High Vacuum, • using SE-1 electrons • Detection of SE-2: The system should have an in-chamber detector for Secondary Electron Imaging (SEI) with SE-2 electrons

FESEM compatible with external pattern

10.	User Interface	A. Keyboard, Mouse, Control Panel with multifunction for the control and adjustment of frequently used SEM parameters, like Focus, magnification, astigmatism correction, scan rotation etc. B. Manual Joystick control for stage axis.
11.	Scanning & Display	1 No. 24” Monitors with suitable computer workstation for FESEM. Image frame store 32K x 24K or higher.
12.	Vacuum System	A. Suitable vacuum system having ion pump, Turbo Pump & Rotary/Diaphragm Pump B. Ventilation interlock to protect window-less detectors C. System should have a penning gauge for accurate vacuum measurement. D. Suitable heater and heat jackets for the baking of the column needs to be supplied by the manufacturer.
13.	Essential Accessories (to be included in quoted cost)	• Suitable chiller • A scroll-type (not reciprocating) compressor • Chamber scope (IR-CCD & color) • Interface between SEM and EDS. • 5 carbon tapes. • 2 ultra-high resolution gold-nanoparticles-on-carbon resolution-test specimen • 2-inch Wafer Sample Holder • Suitable UPS with 30 min backup.
14	Warranty	3 years warranty + AMC/preventive maintenance for the complete system,

		including for accessories such as EXTIF and electrostatic beam blanker with its electronics
15.	AMC and CMC charges	Manufacturer should offer AMC and CMC, after the expiry of warranty.
16	Consumable	Supplier should quote for three spare FEG emitters, as an option.
17	Environment	The FESEM should have an integrated Mu-metal shielding to protect from stray magnetic fields.
18	Compatibility & Upgrada-tion	The system should be upgradable to cryo, in-situ heating, tensile testing, EDS, electrical measurement and micromanipulation system at any point in future.
19	Service support & Instal-lation	A. User list for similar FESEM systems supplied in India, together with refer-ence letters from at least 2 such customers should be provided. B. A list of at least 5 users using such FESEM system for electron beam lithography internationally, and/or within India, should also be provided. C. The vendor should have service engineers stationed permanently in India, and be able to visit IITB (if required) in 48/72 hours. D. Pre-installation site-inspection (at least 3 weeks prior to installation) by service engineers, to ensure smooth installation is required. B. Installation and on-site demonstration of the FESEM capability meeting advertised specifications, as claimed (with images) in the technical bid.

•	•	• A list of at least 5 users using such FESEM system for electron beam lithogra-phy internationally, and/or within India, should also be provided. • • The vendor should have service engineers stationed permanently in India, and be able to visit IITB (if required) in 48/72 hours. • • Pre-installation site-inspection (at least 3 weeks prior to installation) by ser-vice engineers, to ensure smooth installation is required. • • Installation and on-site demonstration of the FESEM capability meeting ad-vertised specifications, as claimed (with images) in the technical bid.

Sr No. 64 / Reference No. 67

Technical Specifications: Differential Interference Contrast (DIC) reflected light optical microscope.

Reflected light differential interference contrast (DIC) microscope

1	General	The microscope would be primarily used for viewing very thin layers of photo-sensitive resist, PMMA, very thin (monolayer) flakes of materials like Graphene, MoS2 etc scattered on various semiconductor (e.g. Silicon, Gallium Arsenide) and other substrates like sapphire, diamond etc.
2	Basic features	A. The microscope should have **brightfield**, **darkfield** and

		DIC capability with epi-illumination. B. It should be an upright type microscope.
3	Nosepiece/Turret	A. The nosepiece for the objectives should have FIVE or more positions. B. It should be an aperture stop slider
4	Objectives	Parfocal set semi-apochromatic infinity corrected objectives should have numerical apertures (NA) and working distances (WD) at least as follows: A. 5x (NA > 0.1) WD > 15mm B. 10x (NA > 0.2) WD ≥ 10mm C. 20x (NA > 0.4) WD ≥ 4mm D. 50x (NA > 0.8) WD ≥ 1mm E. 100x (NA > 0.9) WD ≥ 1mm
4	Transmittance of the objectives	The objectives should have 90% transmittance starting from 350 -700 nm and should not fall below 60% at 1100 nm.
5	DIC	A. Slide in DIC attachment suitable for DIC and polarized light microscopy for the objectives. B. A manually rotatable polarizer-analyzer combination should be provided
6	Illumination	Illumination should be from a Tungsten Halogen lamp (12 V, 100 W type or better, brightness control) with slots for colour/UV filters, neutral density filters.
7	Eyepiece	A. Trinocular eyepiece with Siedentopf design. B. The eyepieces should be 10X widefield with diopter correction and eyecup provided. C. Interpupilary distance should be adjustable (approx 50- 75mm) D. The eyepiece should have a cross-hair and scale.

		E. Adjustable light path Selector lever 100:0 / 0:100.
	Sample stage, z- height and focusing knobs	A. Sample stage should be have a XY motion of 50 mm or better. The stage size should be at least 150mm x 150mm B. The Z-height adjustment should have at least 50 mm stroke with (manual) coarse and fine adjustments.
	USB microscopy camera	A. 5 megapixel (or better) colour sensor with The pixel size of the sensor should be in the range 3-5 microns. B. Compatible Image acquisition software (Windows 10 compatible) with distance and angle measurement capability. C. Realtime features are NOT required. D. The camera should be from the same manufacturer as that of the microscope.
	Warranty	3 yr manufacturer warranty should be included in cost.

Sr No. 65 / Reference No. 68

Detailed Technical Specifications: Benchtop Stylus Profilometer

1	General	A. The tabletop profilometer should be of a stylus (not optical) type. The equipment will be used for step height & etch depth measurements. B. The system should be configured to run off Indian mains supply ~230V ac/ 50 Hz.
2	Measurement Range and scan parameters	A. It should have a vertical step height measurement range of upto 1000 micron (1 millimeter or better) B. Step height repeatability should be better than 0.5% on standard samples like calibration step-heights C. The length of the scan should be at least 20 mm (or better) D. The vertical resolution should be at least 1 nm (or better) in the lowest z-range.

		E. The lateral resolution should be 100 nm or better. F. The scan speed should be variable, (i.e. have at least slow/medium/fast settings) enabling one to compare the results obtained by varying the speed of the stylus. The minimum speed should be at most 10 micron/sec and the maximum speed at least 100 micron/sec. G. The system should be able to accommodate sample thicknesses upto 1 centimeter or more.
3	Stylus	A. The stylus force should be variable with a range of 0.5 - 15mg or better. B. The stylus shape, radius etc should be discussed with the user before submitting the quote. Acceptable range is 5-15 microns tip radius C. The stylus should be replaceable by the user D. The cost of one spare stylus should be included in the cost.
4	Camera	A. A camera should have focus and zoom control enabling one to view the stylus and the active area of the sample during positioning and scanning. B. The camera should be able to give a field of view of 2mm x 2mm or better. C. The software should have keystone correction.
5	Software	A. The software running the instrument should work on Windows 10 and preferably interface with the hardware through USB port. B. The software should have a "levelling" capability, allowing the rotation of the entire trace such that any two points to be brought to the zero level. C. The software should have some averaging capability over user defined "bands" such that quantities like the average step height can be measured in presence of some fluctuations. D. It should be possible to save the height-vs-scan-distance data in simple text (ascii) format such that it can be read by other programs. E. The computer/laptop supplied by the manufacturer should have sufficient USB ports such that memory sticks/external drives may be connected whenever necessary.
6	Accessories (optional items)	A. Two standard steps/etched heights should be provided for calibration purposes. One should be around 1 micron and another approximately 50 microns. Calibration certificates provided by the manufacturer is acceptable. B. A vibration isolation slab (not table) with elastomer type pads (eg Sorbothene) should be quoted as an accessory.

7	Servicing and Maintenance	In case of a breakdown, service engineers stationed in India, should be able to attend to the equipment within 72 hours. Address and contact of a service center (NOT sales) should be submitted along with the response.
8	User base	A list of users in India should be provided along with the offer. There should be at least 5 users of the model (or very similar one) in India. The buyer will contact the previous users to gauge the performance of the brand/model before making a decision on the purchase.
9	Warranty	Warranty for 3yr should be included in cost.

Sr No. 66 / Reference No. 69

Detailed Technical Specifications :External pattern generating system for electron beam lithography, using a field-emission scanning electron microscope (FESEM)

Hardware : 1) Should be capable of controlling the X-Y motion of the sample stage of the FE-SEM system. The precision of the X-Y motion control should allow patterning of features, with size and separation of 10 nm or smaller, and alignment accuracy of 20 nm or better. 2) Should be able to read the beam current from an external pico-ammeter (and the Faraday cup (optional)). 3) Should be able to control the beam blanker of the FE-SEM system. 4) Should include all the required cables to connect to the FESEM system. 5) Should have the required PCIe card for all controls 6) Should include a workstation PC with 8 GB RAM, 500 Gb Hard Disk, DVDRW Drive, wheel mouse, LAN, USB, Serial Port, and a 20" LCD Monitor as an optional item. 7) Should be compatible with all the leading FE-SEM systems available in India.

Software : 1) Should include the required softwares for design and electron-beam writing of all patterns, with features of size and separation 10 nm or smaller. 2) Detailed instructions for use of the software and tutorials for running the process should be included in the user manual of the software. 3) The patterning software should allow exposure at different doses and at different write field sizes in one step, without manual intervention. 4) Should allow trial-run option to verify time-estimate for lithography and verification of the pattern to be written. 5) At least 5 licences for the software should be included in the bid.

Track record: Should provide a list of 25 or more national and/or international users, using the system for electron beam lithography.

Warranty : Should provide comprehensive warranty for a period of 3 years or more.

Technical specifications : Should provide remote/online technical support beyond the warranty period. On-site user training should be quoted as an optional item

Sr No. 67 / Reference No. 70 (Revised)

Detailed Specification of the item : Preparative HPLC

Supply, Delivery, Installation and Commissioning of Modular Analytical cum Preparative LC with Mass Directed Automated Purification:

The HPLC system shall include the following individual stackable self-contained modules.

The HPLC system must be controllable, monitored, capable of performing system maintenance using Microsoft Internet Explorer web browser. Modules should be connected via fibre optic noise resistant high-speed transmission technology to enhance the reliability & sensitivity of HPLC

Pump for Preparative &Analytical flow rates:

- The pump should support both analytical as well as preparative flow rates in a single unit
- Maximum operating pressure should be 40MPa or better
- Flow rate should be settable between 0.01mL/min to 50.00mL/minor better without any hardware changes
- Flow rate accuracy should be ±1% &precision ≤ 0.3% RSD
- The gradient formation should be produced through low pressure mixing
- It should be supplied with reservoir tray, solvent bottles, fittings etc.
- It must have a leak sensor as safety feature
- Pump should be capable of mixing solvents in different proportions for entire flow rate

Column Storage Compartment:

- Column storage compartment should be included with this system
- It should be able to accommodate up to 4Analytical columns of 4.6 X 300mm & 2 Preparative Columns of either 10/20/30/50 cm id with 300mm length. It should also be able to accommodate different flow line switching valves within this compartment.
- Liquid Handler System for Sample Introduction as well as Fraction Collection :

  This unit should be an integrated sample injector as well as fraction collector with below mentioned specifications

  Specifications for Injection Functions:

- Needle drive system should be arm movement in X-Y-Z directions
- Injection method should be loop injection method
- It should have options for injection amount setting range such as 1 to 2000ul. It should be possible to inject samples from Analytical Scale (10ul volume) to Preparative Scale (4ml volume). For this suitable syringe kit with appropriate loop etc. should be supplied as default
- It should have provision to inject samples from 1.5-2 ml & 4-6ml vials
- Injection reproducibility should be ≤ 1% RSD

- A set of 100 vials with caps each for 1.5-2ml& 4-6ml should be provided
- It must be able to perform continuous analyses according to the conditions specified for each sample, including pre-treatment, sandwich injection etc.
- Needle rinse capability both before and after sampling should be possible
- Purging of syringe & rinsing of needle interior as well as exterior should be possible

Specifications for Fraction Collection Functions:

- Preparative valve drive of fraction collector should have arm movement of X-Y-Z
- Preparative method should be on valve based preparation
- It should be able to handle flow rate of at least 50ml/min
- It should have capacity up to 540 tubes of 10mm OD and 252 vials/tubes of 4ml capacity
- It should have fractionation methods such as time-based, peak-based, manual and simulation function
- Liquid handler should have sample rescue function in the event of interrupted analysis or when instrument error occurs
- It should have provision to connect at least 4 different detectors
- Suitable sample trays &racks for this fractions collector should be provided.
- The delay time from the detector to the fractionation head should be calculated automatic-ally every time the flow rate is changed
- Suitable glass test tubes should be provided
- Photodiode Array (PDA) Detector
- The wavelength range should be 190 nm - 800 nm or better
- The photo-diode array detector should have 1024 elements
- The detector should have variable slit width for high resolution as well as high sensitivity
- A standard flow cell of 12µL volume& 10 mm cell path length should be available. It should have temperature control from 19ºC to 50ºC
- Preparative flow cell with variable path length for preparative applications should be provided
- Wavelength accuracy should be ≤±1 nm
- A deuterium lamp [D2] and a Tungsten lamp [W] should be available as Light Source for UV and visible wavelengths respectively.
- The selection of light source should be flexible to select D2, W or both lamps for analysis

- The Drift should be smaller than $0.9x10^{-3}$ AU/Hour or better
- The Noise Level should be smaller than $7x10^{-6}$ AU or better
- Linearity should be 2.0 AU or better (ASTM method)
- It should have a self-aligning mechanism for the light sources and cell.
- Light sources and cell should be accessible from the front for easy maintenance
- Single Quadrupole Mass Spectrometer Detector:

Single Quadrupole Mass Spectrometer is intended for mass directed auto purification purpose. This LCMS should have below specifications

- Mass range should be 10 to 2000 m/z
- Scanning speed should be 10,000 u/sec or better
- Polarity switching time should be 15 ms
- ESI source should be supplied along with LCMS system with a suitable flow rate
- Should have sensitivity in 1 pg levels on column with a sensitivity of 100:1 or better
- Mass accuracy: Should be ± 0.1 Da or better
- Suitable software should be supplied along with this LCMS system which should be able to control Preparative LC also
- Autotuning facility for LCMS should be available
- Nitrogen gas consumption for LCMS shouldbe less than 25L/min. Suitable imported make nitrogen gas generator with built-in compressor shall be supplied with LCMS system
- All tuning as well as calibration solutions shall be supplied with LCMS system
- Cleaning & maintenance of desolvation line should be simple & be able to carry out without breaking the vacuum
- Roughing pump & turbo pump should be an integral part of the LCMS system
- Suitable analytical make-up pump for LCMS should be supplied as standard
- Suitable flow control / divert valve for LCMS should be provided
- Suitable start-up kit for LCMS should be supplied as standard
- Chromatographic Software

- Genuine Windows based software for control of LCMS as well as Preparative LC system should be supplied along with this system. It should be possible to perform all functions of Preparative LC as well as Single Quadrupole MS system with this software.

- It should cover full one-point digital instrument control, qualitative and quantitative processing, report creation and self-diagnosis

- The data should be convertible to other formats. Spread Sheet software and word-processing software can be readily employed to provide data in tables or graphs through industry standard protocols

- It should have sample rescue function in the event of interrupted analysis or when instrument error occurs

- Service, Warranty and Training

1. Tendered price should include delivery, installation, commissioning and training (at least 4 users) at supplier's location

2. Comprehensive warranty for complete equipment for a period of 36 months should be provided. This shall include the following at no extra cost:

- Travel and Labour expenses of Customer Engineer

- Service Parts used for repairs

3. Vendor to provide service guarantee: should the system require service during the warranty period, vendor must guarantee turn-around-time within 24 hours

4. Vendor to provide a copy of Site-Preparation checklist

5. Vendor must demonstrate that it has a proven appropriate set-up and capability to provide after-sales service efficiently and effectively. The supplier should have in his facility a similar system to that proposed in this tender for training purpose

6. Automatic flow line switching from Analytical to Preparative scale & vice versa should be possible. Also automatic switching between two columns should be possible. Appropriate switching valves with required accessories should be supplied as standard with this system

7. One Analytical C-18 Column (5um, 4.6x250) & one Silica Column (5um, 4.6x250) should be supplied along with Preparative LC system.

8. All required kits, tubings, joints, tool kit etc. essential for running & maintenance of the system shall be supplied along with the system

9. The vendor must be reputed one having experience of at least 10 Years for supply of HPLC & Preparative LC systems. They must have more than 1000 installations of HPLC, UHPLC & Preparative LC systems in India. Also vendor should have at least 100 installations of LCMS & LCMSMS systems in India. Vendor must have service as well as application engineers based within Mumbai city

Sr No. 68 / Reference No. 71 (Revised)

Detailed Description of the item : GPC HPLC System

Supply, Delivery, Installation and Commissioning of Modular Analytical cum Semi-Preparative HPLC with GPC System

The HPLC system shall include the following individual stackable self-contained modules. Modules should be connected via fibre optic noise resistant high-speed transmission technology to enhance the reliability & sensitivity of HPLC

1. Pump for Analytical andSemi-Preparative Flow Rates

2. Column Ovenwith valves for automatic column switching and solvent recycling

3. Autosampler with Sample Cooler and Manual Injector

4. Photo Diode Array (PDA) Detector

5. Evaporative Light Scattering (ELSD) Detector

6. Fraction Collector with suitable trays &racks

7. Chromatographic Software with GPC Software

8. Service, Warranty & Training

- Pump for Analytical & Semi-Preparative flow rates
- It should be a suitable high pressure pump
- Operating pressure should be 40MPa or better
- Flow rate should be settable between 0.01mL/min to 10.00mL/minor better without any hardware changes
- Number of solvent channels should be at least four
- Flow rate accuracy should be ±1%
- Flow precision value should be ≤0.07 % RSD
- It should be supplied with reservoir tray with solvent bottles, complete with fittings etc.
- It must have a leak sensor as safety feature
- Pump should be capable of mixing solvents in different proportions for entire flow rate
- Integrated degassing unit

- Column Oven with Column Switching & Solvent Recycling Valves:
- Column Oven should be block heating or forced air circulation type for uniform temperature distribution
- Temperature control range should be 10˚C below ambient to 85˚C
- Temperature control precision should be at least ± 0.5˚C
- It should be possible to accommodate analytical as well as semi-preparative columns inside this column oven
- Column oven should support mounting of two analytical or two GPC columnsalong with two semi-preparative columns
- Automatic flow line switching from Analytical to Semi-Preparative scale & vice versa should be possible. Also automatic switching between two columns should be possible. Appropriate switching valves with required accessories should be supplied as standard with this system
- Solvent recycle assembly with all essential valves & accessories should be provided. Suitable software for solvent recycle purpose, if any, should be included with this
- Autosampler with Sample Cooler & Manual Injector:
- Sample injection volume of Autosampler should be variable between 0.1 µl to 100µl
- It should be variable injection volume type with zero sample loss during injection
- It should be able to handle at least 150vials of 1ml capacity or70 vials of 1.5/2 ml capacity, 40 vials of 4ml capacity. It should also be able to accommodate microtiter plates and deep-well plates in the same autosampler unit
- Flow line rinse capability both before and after sampling should be possible
- It should be capable of a carry-over no more than 0.005 %
- Injection volume accuracy within 1%
- The injection precision should be at least less than 0.4% of RSD value
- It should be supplied with additional sample loop of 2000uL
- Supply of at least 100 sample vials of 1.5/2 mL capacity with caps and septa
- Autosampler should have provision of sample cooler for controlling temperature of the sample vials from 4˚C to 40˚C
- Photodiode Array (PDA) Detector
- The wavelength range should be 190 nm - 800 nm or better

- The photo-diode array detector should have 1024 elements
- The detector should have variable slit width for high resolution as well as high sensitivity
- A standard flow cell of 12µL volume& 10 mm cell path length should be available. It should have temperature control from 19ºC to 50ºC
- Preparative flow cell with variable path length for preparative applications should be provided
- Wavelength accuracy should be ≤±1 nm
- A deuterium lamp [D2] and a Tungsten lamp [W] should be available as Light Source for UV and visible wavelengths respectively.
- The selection of light source should be flexible to select D2, W or both lamps for analysis
- The Drift should be smaller than 0.9 $x10^{-3}$ AU/Hour or better
- The Noise Level should be smaller than 7 $x10^{-6}$ AU or better
- Linearity should be 2.0 AU or better (ASTM method)
- It should have a self-aligning mechanism for the light sources and cell.
- Light sources and cell should be accessible from the front for easy maintenance
- Evaporative Light Scattering Detector (ELSD):

ELSD detector is intended to be used for non-UV absorbing compounds at analytical as well as semi-preparative scale. It will also be used for GPC applications. ELSD should have below mentioned specifications:

- Temperature range of ELSD should be from Ambient to 100˚C
- ELSD should be supplied with nebulizer which will be compatible with analytical as well as semi-preparative flow rates
- Nebulizer temperature 30 °C – 90 °C
- Eluent flow rate in ELSD should be from 5ul/min to 5ml/min
- Typical sensitivity of this ELSD should be around 1ng
- It should be able to process analog data from 0 – 1 Volt
- Nitrogen gas supply required for operation of ELSD should be less than 3L/min. It should be possible to use ELSD with Nitrogen gas cylinder without need of any gas generator
- Fraction Collector

- It should be possible to use fraction collector over wide range of flow rates covering small & large scale preparative work. It should adapt to applications such as manual collection while viewing chromatogram as well as advanced continuous & automated preparative separation & collection performed in combination with autosampler

- Appropriate racks with vials/tubes (for4ml&20ml) should be supplied

- Chromatographic Software with GPC Software:

- Genuine Windows based Chromatography software for full control of this LC should be supplied along with this system. Appropriate GPC software should also be supplied along with this Chromatography software. It should be possible to perform all functions of Analytical LC, Semi-Preparative LC as well as GPC system with this software

- It should cover full one-point digital instrument control, qualitative and quantitative processing, report creation and self-diagnosis

- The data should be convertible to other formats. Spread Sheet software and word-processing software can be readily employed to provide data in tables or graphs through industry standard protocols

- Service, Warranty and Training

1. Tendered price should include delivery, installation, commissioning and training (at least 4 users) at supplier's location

2. Comprehensive warranty for complete equipment for a period of 36 months should be provided. This shall include the following at no extra cost:

- Travel and Labour expenses of Customer Engineer

- Service Parts used for repairs

3. Vendor to provide service guarantee: should the system require service during the warranty period, vendor must guarantee turn-around-time within 24 hours

4. Vendor to provide a copy of Site-Preparation checklist

5. Vendor must demonstrate that it has a proven appropriate set-up and capability to provide after-sales service efficiently and effectively. The supplier should have in his facility a similar system to that proposed in this tender for training purpose

6. Automatic flow line switching from Analytical to Preparative scale & vice versa should be possible. Also automatic switching between two columns should be possible. Appropriate switching valves with required accessories should be supplied as standard with this system

7. One Analytical C-18 Column (5um, 4.6 x 250) should be supplied along with this LC system

8. All required kits, tubings, joints, tool kit etc. essential for running & maintenance of the system shall be supplied along with the system

9. Details of pre-installation requisites

10. The vendor must be reputed one having experience of at least 10 Years for supply of HPLC & Preparative LC systems. They must have more than 1000 installations of HPLC, UHPLC & Preparative LC systems in India. They should have their own facility within Mumbai for demo / training purpose having similar instrument which has been quoted here. Also vendor should have service as well as application engineers based within Mumbai city

Sr No. 69 / Reference No. 72.

Detailed Technical Specifications of Gel Scanner

Application: DIGE-imaging, fluorescence and NIR imaging, filmless autoradiography for Southern, Northern, Western blotting, and gel documentation imaging for routine molecular biology and protein biology works.

Specifications:

- High speed and High-resolution optical scanner with detection modes for Phosphorescence, densitometry, Fluorescence, Chemiluminescence with simultaneous white light imaging for blots and Near IR fluorescence imaging of gels/blots/tissue sections/arrays and micro well plates.
- The machine should have at least 5 log dynamic range
- The excitation light source should have a minimum warranted life time of 20000 hours
- Detectors should have high quantum efficiency, at least 65% in all fluorescence and chemiluminescence modules
- System should have a minimum of 5 internal lasers of 488nm ± 10 nm, 532nm ± 10 nm, 635nm ± 10 nm, 685 nm ± 10 nm and 785nm ± 10 nm as excitation sources on board for broad range of fluorescence and phosphorimaging applications. System should also have at least two Near IR Lasers of 685 nm ± 10 nm or 785nm ± 10 nm excitation sources for NIR fluorescence detection.
- System should have following filters for phosphor-imaging, fluorescence and NIR fluorescence imaging: IP 390BP, 525BP20, 570BP20, 670BP30, IR-short 720BP20 and IR-long 825BP30
- System should have dual PMT (Photomultiplier tubes) based detectorsto cover broad range of fluorescence detection ie blue to near IR range.
- The system must have one bi-alkali PMT and one multi-alkali PMT to achieve the wide dynamic range needed for various multiplexing experiments, selectable as per the laser power requirements.
- System should have resolutions of 10um, 25um, 50um, 100um and 200 um (Selectable).
- System should have pre-scan feature at 1000 um resolution.

- System should be able to detect following radioisotopes:14C,23P,33P,35S,3H,125I and 99Tc etc.,

- System should effectively discriminate between all Cy 2, Cy3, Cy5,cy5.5 dyes and multi spectral western blotting with Q-Dot and Alexaflour.

- System should generate 16-bit image with 5 orders of magnitude of Dynamic range or more.

- System should have high scanning speed of 3 min (50 um 24 x 25 cm)or lower at 50 um for better and fast imaging.
- Detection Sensitivity: : LOD of 0.00518 μCi/g for ^{14}C with autoradiographic standard (CFQ12000) for phosphor-imaging; less than 10 pg for fluorescence and less than 5 pg for IR imaging.

- Maximum Scanning area should 40 x 46 cm for various scanning modes.

- System should be able to simultaneously scan 20 gels or blots, measuring 10 × 8 cm in size. It should also possible to scan up to 9 multiwell plates in a single scan. This feature is required forcomparative data within plates/blots.

- System should also have possibility to scan multi-well plates,tissue arrays and array-slides for fluorescence imaging.

- System should be able to simultaneously scan two DIGE gels, eachmeasuring up to 21.5 × 27.5 cm, with the multi-stage.
- System should be able to scan large format sequencing gels (33 x 42 cm).

- System should possess IP stage, fluor stage, multistage, IP eraser (40 X 46 cm or more) and membrane weight to avoid any gel curling

- System should be provided with a LED based closed image eraser

- At least 5 phosphor screens and cassettes of various dimensions to be included.

- System should be quoted with necessary filters to cover entire visible range. The system should have provision to use any 5 filters as per user need.
- System should have option of using commercially available 2 inch rectangular or other optical filters and should be user changeable.

- System should have suitable software to quantify bands in gels and blots and determine molecular weight of proteins and nucleic acids using suitable calibration markers.

- The analysis software should have provision for quantification of fluorescence signal coming form a 96 and 384 well plates and protein/ tissue microarrays.

- Interface and Software: USB 2.0 interface for fast transfer of data and Suitable software to runs on Windows platform for capturing images and analysis of electrophoresis, quantitation with functions like rotation , trimming, superimposing, negative/positive reversing, etc.

- Should be accompanied with a controlling computer (branded) with specifications –Minimum quad core processor (i5 or more), 16 GB RAM; 2 TB HDD + primary SSD drive; DVD-ROM drive; 64 bit OS; high resolution 22 inch display; LAN and wireless connection.

- 30 min UPS (branded) Back up for the entire system

- After the 1st year of manufacturer warranty (both parts and labour), system should come with 4 years of comprehensive maintenance contract/warranty including parts and labor. The defects, if any, shall be attended to on immediate basis but in no case any defect should prolong for more than 24 hours. The comprehensive warrantyincludes onsite warranty with parts.

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Sr No. 70 / Reference No: 73

Technical specifications of Optical Tweezers Facility

1. Thesystemshouldconsistofadual-beamopticaltweezerswithoptionofmagnetictwistersfully integrated with multimode imaging system (with multiple possible imaging modes such as confocal fluorescence/fluorescence/TIRF/Widefield/IRM/DIC etc.), optical table with vibration isolation,alongwithrequiredcomputers,electronics,software,accessoriesrequiredforoperation, data collection and data analysis. All technical specifications of the multimode imaging system and optical table with vibration isolation being offered by bidder should be clearly stated without any ambiguity. Offered multimode imaging system should be compatible with electronics, software, accessories required for operation, data collection and data analysis of the optical tweezersfacility.Preferencewillbegivenbidderprovidingbest-multimodeimagingsystemifthey meet technical specifications of the dual-beam optical tweezers along with option of magnetic twister.

Dual-Beam Optical Tweezers:

2. The system should be optimized for ultra-sensitive single-molecule experiments, trapping and tracking ofnano-particles.

3. Laser module: Continuous wave (no time-sharing) tweezers, wavelength of 1064 nm, 3W laser power or higher, lasers with different output powerpreferred

4. One of two beams with adjustable power distributionpreferred.

5. Force detection, independent on both optical traps with stabilitypreferred.

6. Steering of beams using advanced piezo mirror or AOD. System with AOD option for beam steering preferred. Technical specification piezo mirror/AOD should be clearlystated.

7. The system should include a force-detection unit, allowing force measurements. System with lowest force resolution preferred. Minimum force resolution to be clearlystated.

8. Fully integrated software suite for system operation with possibility ofscripting

Note: Supply and integration of a Magnetic Twister to apply torque and rotate magnetically sensitive particles is desirable. It should be able generate homogeneous magnetic field of few hundred mT at distance of 1mm. Magnetic twister should provide precise rotational control with accuracy of at least 4 degree using stepper motors and should have integrated software control. Magnetic twister should notdisturbbrightfieldandfluorescenceimaging.Priceofmagnetictwisterifofferedbybiddershould be separatelyquoted.

9. All possible applications of offered system should be clearly stated. Cost should include Installation/ commissionandinitialoperatortraining.On-siteapplicationtrainingandapplicationstart- up kits/consumables must be supplied bybidder.

10. Cost should include 3 year on-site comprehensivewarranty.

11. Cost of Annual maintenance contract (AMC) for additional 2 years subsequent to the warranty period should bequoted.

Bidders should also enclose:

a. List of similar equipment installations made in India or abroad during last 5years

b. Internationally published papers using the offered model should be provided. Enclose complete citations of the publishedpapers.

Sr No. 71 / Reference No. 74.

Technical specification for spectrofluorimeter

- All reflective L-Format optics sample compartment withcomputer controlled 10 position excitation filter wheel with UV cut blue pass and blue cut green pass filters, reference channel excitationcorrection detector, single cuvette sample compartment for 10 mm quartz cuvette, manual filter holders for customer suppliedfilters, computer controlled 6 position emission filter wheel

- Double excitation Czerny-Turner coma-corrected excitation and emission monochromators with triplegratingturrets for extended wavelength selection, computercontrolled excitation shutter and computer controlled slits.

- 450 watt xenon illuminator with all reflective collection optics.

- Cooled PMT housing with computer controlled toggle between photon counting ,analog mode,TCSPC lifetimes or phosphorescence).

- R928P photomultiplier tube.

- Computer work station, mouse and monitor.

Phosphorescence lifetime measurement module, with variable high rep rate pulsed xenon source for excitation in the second entrance port of the excitation monochromator; Choice of light sources would be by a flippingmirror.

Cold finger dewar accessory (77 K)

Liquid nitrogen cooled InGaAs detector (800-1550nm) with appropriate electronics, optics and accessories

Polarization accessory: L-format fully automated dual Glan-Thompson polarizers (250-2500nm).

Photoluminescence quantum yield accessory for solid, liquid, powder and thin films and small light sources, based on an external integrating sphere (wavelength range: 250-2500nm), connected to the instrument usingoptical fibers, included with the accessory. Required neutral density filters should be included.

At least five Neutral density filters, 50x50 mm, 0.03 - 3.0

Solid sample holder for viewing front-face fluorescenceof thin films, powders, pellets, paper, fibers, or microscopic slides. Should include variable alignment angle facility for signal optimization.

All filters required for smooth operation of the instrument.

Instrument should be supplied with minimum 3 years extended warranty.

Sr No. 72 / Reference No. 75. (Revised)

Cryogen-free Physical property Measurement System (PPMS)

Detailed Technical Specification : Physical Property Measurement System (PPMS)

1. Broad System Requirements and Usage

Description: We intend to procure a fully automated computer-controlled cryogen-free SQUID based PPMS operational in the temperature range ≤ 1.8 K to ≥ 1000 K and magnetic fields up to ± 9 Tesla or higher. The instrument should have a strong track record for the specified measurement options including but not limited to the measurements of bulk, thin-film, single crystal and nanoparticle based organic, inorganic samples. Therefore, the following technicalcriteria are to be met by any PPMS being quoted:

The PPMS equipment being quoted should be multi-user friendly with an easy to usesoftware interface, modular hardware design that allows for rapid user training andshould also be easy to change from one measurement mode to another with relativeease. For example, the change from a magnetic property measurement mode to anelectrical transport measurement option should be relatively easy so that our studentscan set-up measurements and collect reliable and reproducible experimental data.

Our faculty members work in diverse areas of research at the intersection offundamental chemistry, physics and new materials synthesis and characterization.Therefore, the PPMS being quoted should be an advanced PPMS system that can gofar beyond the basic physical property measurements. For example, the PPMSshould, in addition to the basic magnetic property measurements, electrical propertymeasurements and thermal property measurements, be capable of measuringmagnetization in samples with low magnetic moment (<0.1 micro emu) using torqueMagnetometry; should be customizable for Ferromagnetic Resonance (FMR)Measurements on thin magnetic films; and be able to perform optical and Ramanmeasurements with suitable accessories.

In addition, the system being quoted should have a modular design providing theflexibility to add any of the above capabilities or other physical propertymeasurement techniques either at the time of procurement or at a later date.

2. PPMS Base System RequirementsThe system being quoted should be a closed-loop cryo-cooling system without theneed for liquid helium and/or nitrogen. Neither liquid helium nor liquid nitrogenshould be needed at any time.The system must accomplish the initial cool-down directly from Helium gas as quickly as possible. Provide supporting data and log files with the offer. A demonstration will be asked during technical evaluation. We are looking for a turn-key solution wherein vendor/OEM should install all the additional accessories including but not limited to He gas cylinders and connectors etc.

Cryo-cooling should be based on a pulse tube cryocooler so that noise associated withmechanical vibrations can be minimized. A two-stage pulse tube cryocooler ispreferred for efficient and faster cooling. Mechanical vibrations should be lowenough to attain all of the mentioned specifications in later sections.

The system should not use recirculation of any remotely located source of liquidhelium as a refrigerant.

Any capillaries, needle valve system or other similar systems used for refrigerantinjection into the sample space for cooling, should be serviceable on the field if everthey get clogged with moisture. Such a service should be possible by trained users. Ifservice personnel is required, the total time required for such a service before themachine can be used should be clearly mentioned. Since this is a machine for ageneral user facility, service times of less than two days are required. Supportingdocumentation for such service must be provided.A sample space with a bore diameter of at least 1 inch is required.

- Compatible sample transferring system and sample holders (or pucks) with necessaryelectrical connections must be included. Such sample holders should be designed tohave a good thermal uniformity across the sample over the measurement temperaturerange of 1.8 K to 1000 K.

- The sample chamber should be sealed to retain either vacuum or an inert gasenvironment during measurements.

- Necessary vacuum and gas purging system should be integral to the base system, andtheir operations should have been fully automated, such that minimum userintervention is required. A high vacuum system, with for example a cryo-pumpingoption, should be included. The high vacuum system should be able to achieve avacuum of less than 10^{-5}Torr.

- All vacuum pumps or any other pumps used for the purpose in 2.8 should be“dry”that is they should not use any oil-based pumping systems.

- All communications on the system must either use a Universal Serial Bus (USB),Controller Area Network (CAN) or similar high speed and high-fidelitycommunications protocols. If a GPIB based communication protocol is employed,the tenderer must provide supporting documentation demonstrating that the bit-ratesand error-rates in GPIB do not in any way compromise the speed and reliability ofdata acquisition.

- Necessary software for performing all measurements (the measurements requested inthis tender and measurements to be acquired through possible future upgrades)should be included. The software should also enable sample loading, unloading, andprovide system status – magnet temperature, sample temperature, system status suchas measurement in progress or idle.

- All system operations, including temperature changes and magnetic field changes,should be completely remotely controllable using the software provided.

- A provision for having different software access levels such as a user-level, engineeror expert level is preferable.

- The software should allow for fully automated measurements and should minimizeuser intervention. This is essential since the instrument will be housed in a generaluser facility.

- Furthermore, communications to and data acquisition from the instrument should bepossible with user-customizable programs such as Labview. Supporting softwaremodules in Labview must also be provided for any customized measurements thatthe user wishes to set-up. Such programs should enable both magnetic field andtemperature control and full data acquisition capabilities of the software providedwith the system.

- A superconducting magnet, with the following specifications, should be included inthe base system:

- A longitudinal magnetic field (along the axis of the sample bore) of ± 9 tesla or greater with a magnet charge time of less than 10 minutes for 0 to 9 teslais required.

- Magnetic field stability of better than 5 ppm/hour (*please provide data*).

- Field homogeneity of better than 100 ppm over an on-axis distance of at least1 inch is required (*please provide data*).

- Magnet electronics and power supply should be fully interlocked so that themagnet is fully protected in case of a failure of other supporting systems suchas the cryo-cooler.

- There should be a suitable built-in magnetic shield so that the stray fieldsshould be less than 5 Gauss at a distance of 30 cm from the surface of thesystem when the magnet is fully charged to 9 Tesla. This is important bothfrom a safety stand-point and from ensuring that the stray magnetic fields donot interfere with other measurements in the proximity of the system. *(pleaseprovide data).*

- The magnet charging or control modes should be completely softwareintegrated. At the least, there should be linear, oscillating and no overshootmodes. Please specify the field overshoot in the 'no overshoot' mode for fieldstrengths of 1, 3, 9 and 14 Tesla.

- Magnet control should be fully software-integrated.

- Magnets health and status monitoring and protection from accidentalquenches should all be handled through internal electronics or software. Thisis absolutely essential as the system is intended for a general user facility.

- The cooling of the magnet should be efficient. After a service warm up, themagnet should cool down to its operating temperature in less than 16 hours.This is essential to ensure that the downtime of the system is minimized.Please provide the time needed for a full system cool down. Further, providethe approximate helium gas usage for such a full cool down. This data isimportant to determine the resources (time and money) required for bringingthe system back up after a service warm up.

- A fully automated variable temperature option should be integral to the base system.The variable temperature option should meet the following specifications:

- The cryostat assembly should enable fast, efficient and continuous cool downfrom 400 K to 1.8 K or warm-up from a temperature of from 1.8 K to 400 K.Please provide approximate helium gas usage for sample cool down from400 K to 1.8 K. The time required for a cool down from 400 K to 1.8 K or awarm up from 1.8 K to 400 K should both be less than 1 hour. Please providesupporting data.

- Temperature changes to the sample – either cool down or warm up shouldbe fully automated with the system software.

- The system should enable cooling or heating of the sample at any magneticfield; the system should be able to hold the measurement temperature towithin 0.1% in the temperature range of 1.8 K to 20 K under magnetic fieldsof up to 9 T or more and to within 0.05% at temperatures of 20 K to 400 K. Pleaseprovide temperature stability data at 1.8 K at a magnetic field of 9 Tesla. Thedata should have been collected as prescribed below: a) Set the sampletemperature to 1.8 K at 0 tesla magnetic field (nominally zero field); b)stabilize the sample temperature at 1.8 K for 10 min; c) continuously rampthe magnetic field to 9 Tesla while recording the temperature. Please providethe recorded data in a temperature versus time format, clearly indicating thethree steps above.

- A high fidelity PID-Temperature control should be fully integrated with thebase system and associated software.

- Necessary thermometers and heaters for temperature control should beprovided with the base system.

3. Magnetic Property Measurement

a. A vibrating sample magnetometer option that can perform both and AC and DCmagnetic property measurements should be included in the quotation.

b. The system should be capable of measuring over the temperature range of 1.8 K to400 K or more in magnetic fields ranging from – 9 to +9 Tesla or ±14 Tesla. Please provide data of DCmagnetization versus temperature (during both warm up and cool down) at magnet-icfields of 1, 3, and 9 Tesla on a sample with a total magnetization of 10 micro emu orless. The data should have been collected at 1 second or smaller averaging time.Shorter averaging times are required to speed up data acquisition which is essentialfor a general user facility such as this.

c. The system should provide for temperature stability during a DC magnetization (M)versus magnetic field (H) measurement. Please provide data of M-H curves collectedat 1.8 K, 10 K, 300 K and 400 K on a sample with a total magnetization of 10 microemu or less.

d. The RMS sensitivity in zero field should be at least 0.5 micro emu and at anymagnetic field other than zero should be at least 5 micro emu.

e. Brass and quartz sample holders for sample mounting should be included. Thesample holders must be suitable for powders, pellets and thin films.

f. Sample preparation/alignment box with a mirror should be included.

g. VSM coil set bore size should be 6 mm or larger.

h. The VSM oscillation frequency should be tunable from 10 Hz to 50 Hz over the entiretemperature range.

i. VSM measurements should be fully integrated with the software such that sampleauto-centering and complete measurements should be possible through the softwareinterface.

j. NIST standard samples must be provided for calibration of magnetic moment at lowand high magnetic fields/temperatures.

k. In addition, the following DC magnetic property measurement options must beincluded in the quotation:

    - DC magnetization option must integrate First Order Reversal Curve (FORC)measurements and their analysis. Measurements should be possible on avariety of samples including bulk, thin films and nano materials.

    - FORC measurements must provide a quantitative fingerprint of the magneticreversal mechanism, separating reversible and irreversible switchingmechanisms, calculate reversal mechanism phase fractions and calculatecoercivity and interaction field distributions. Supporting datasheet/brochurewith measurements is essential to support the claims.

l. In addition, the following should be possible with the AC magnetic propertymeasurement option:

- AC drive amplitude range of 0.005 Oe to 15 Oe or greater should be possible.(*please provide data*)
- AC drive frequency of 10 Hz to 10 kHz or above should be possible. (*pleaseprovide data*)
- A phase resolution of less than or equal to 0.5 degrees should be possible.
- The system and integrated software must allow for accurately separating thereal and imaginary components of AC response.Magnetization resolution should be less than or equal to 2×10^{-8} emu for ACMeasurements
- It is critical that the system is capable of performing AC magnetization andDC magnetization measurements without any change in the hardware,sample motor or sample mount.
- AC magnetic susceptibility option must be capable of performing real-timeautocalibration at each measurement point while performing measurementsrather than relying on a calibration table or data that was collected at aprevious time. This is important for highly accurate measurements.
- Thermometer for measuring temperature should be mounted directly on theAC coil so as to reduce errors from thermal lags.
- Options for measuring higher harmonics should also be quoted.
- The magnetic property measurement system should be field-upgradeable to a hightemperature VSM oven option

4. Electrical Property Measurement

a. 4-wire and 2-wire resistivity options with simultaneous Hall Effect measurementsand magneto-transport measurements should be possible with in-built electronics.

b. Must have two built-in independent sources and meters so that two measurement channels are truly independent

c. Such measurements should be possibleover the temperature range of 1.8 K to 400 Kin magnetic fields ranging from – 9 to +9 tesla or above.

d. A horizontal sample rotator with the following specifications should be provided

e. An angular step resolution of ≤0.002 degrees per step should be provided

f. The axis of rotation should be perpendicular to the sample bore.

g. The angular range should provide for a full 0- to 360-degree rotation.

5. Thermal Transport

- Temperature range ≤1.9 K to 400K or wider. The vendor should provide data for the supported temperature range.

- The option should simultaneously measure a sample's thermal conductivity, Seebeck coefficient, and electrical resistivity with a single sequence command.

- Provide the data for the standard reference sample for conductivity, Seebeck coefficient, resistivity along with the calculated thermoelectric figure of merit.

- User should be able to measure the Nernst Ettingshausen effect with this option. Please provide supporting data/publication for reference.

- Thermal conductance measurement accuracy: ± 5 % or better and dynamic range should be 10 μW/K - 1 mW/K for 1.9K measurements.

- Typical accuracy of the Seebeck coefficient: ± 2 % or better

- Typical accuracy for Thermoelectric Figure of Merit: ± 10 %

- Seebeck coefficient measurement range: 1 μV/K to 1 V/K or wider

- At least 10 publications should be attached in support of 1.9 K to 400K measurement Temperature range, accuracy and resolution of Thermal measurement by the quoted instruments.

6. Heat Capacity:

- Temperature Range: 1.8 K – 400 K. Provide supporting information to validate the complete temperature range.

- Using relaxation technique, two-tau model fit analyses, corrections of backgrounds from sampleplatform, adhesives through sophisticated software routines that is fully integrated to the main system software (claim need to be supported by references of the papers published and patents).

- Sample quantity should be as minimal as possible without compromising the quality and precise measurements (1 mg or more).

- Measurement Accuracy: less than 3% over 2K – 300K.

- Heat Capacity resolution: less than 10 nJ/mole.K at 2 K temperature (to be specified by the company and the claim needs to be supported by references of the papers published and patents).

- Thermometers on the platform.

- At least 10 publications should be attached in support of Heat capacity measurement from1.8 K – 400 K by the quoted instruments.

7. Torque Magnetometry Measurement:

- Should measure magnetic torque $mB\sin\theta$ for ≤1.9 K to ≥ 400 K temperature range.

- Moment sensitivity of 3 x 10^{-7} emu at 9T or better
- Must include sample rotation along horizontal rotation axis with rotation range of -10 degrees to 370 degrees
- Angular step rotation must be 0.005 degrees/step or better
- Vendor must provide a data of Torque Curves of 100 nm thick magnetic film as a function of the angle of the applied field (with respect to the film normal). Data must show the anisotropy of the sample at 1.5T, 2.5T, 5T and 9T magnetic fields.
- There should be Four independent channels for performing DC resistivity
- The vendor has to provide at least 10 publications in support the measurements and accuracy of Torque magnetometry by quoted instrument.

7. Future upgrades

The system should provide field-upgradation possibility for the following options:

- The system should allow for the installation of an optical probe for highsensitivity photomagnetic measurements
- Field upgradability to Raman and other related optical spectroscopytechniques should be available.
- The system should also allow for adding a He3 dilution refrigerator to attaintemperatures of ~ 50 mK.
- The prices of these upgrades should be quoted as options. Such pricingshould be locked in for at least 18 months from the date of our purchaseorder.

8. Terms and Conditions

a. The vendor is responsible for the installation of the system at the institute.

b. The price quotation should include the cost of installation and training of potentialusers.

c. The system should be provided with at least three years of warranty, on all parts andlabour, from the date of installation. Additionally, the main component of the equipment, as well as all spare parts, should be available for the next ten years. Hence vendor should quote the top of the line model and not the model which are likely to be obsolete soon.

d. The vendor should have a track record of having previously supplied at least five advanced PPMS systems in India with identical available options (as in sections 1-6). Detailsof such systems should be provided along with a copy of purchase orders/pricings.

e. The vendor should have qualified technical service personnel for the equipmentbased in India and should assure a response time of <48 hours.

f. Vendor must provide at least 10 customer satisfaction letter/certificates from Indian Institutes/Labs where similar measurement systems are installed and working satisfactorily. The document must not be older than one year. Installation reports are not a valid document for the said purpose.

g. The lead-time for the delivery of the equipment should not be more than 6 monthsfrom the date of receipt of our purchase order.

h. The indenter reserves the right to withhold placement of final order. The right toreject all or any of the quotations and to split up the requirements or relax any or allof the above conditions without assigning any reason is reserved.

i. Wherever requested data must be supplied along with technical compliancedocuments. Technical bids without supporting data will be deemed as technicallynon-compliant.

j. All guaranteed specifications may have to be demonstrated at the time of installation.Any necessary standard samples for that purpose should be brought by the serviceengineers.

k. Printed literature and published papers in support of all compliance to the prescribedspecifications may be provided.

l. The vendor must provide a compliance statement in a tabular form with respect to eachtechnical specification in the tender document duly supported by the manufacturer'sliterature and published papers. Any other claim will not be accepted and may leadto rejection of the bid.

m. Technical evaluation by the institute may include a demonstration to verifythe functionalities and capabilities of the system quoted. The institute reserves the rightto provide samples after opening the technical bids for the purpose of verification ofpromised specifications. Any discrepancy between the promised specifications andmeasurements will be deemed as technical non-compliance.

n. The vendor must quote for a non-comprehensive AMC price beyond the 3-yearwarranty, with price lock-in for 2 years beyond the standard 3-year warranty period.Services per year should be included in the AMC.

o. The quote should also include additional spares sufficient for two years of systemusage, assuming an average usage of 120 hours of operation per week. In addition, 8sample pucks that are compatible with the system should be provided for physicalproperty measurements.

9. Other Details

a. Please quote for each item/option separately. Depending upon the budgetary provision and priority, the items to be purchased will be decided.

b. The offer must be supported with the measurement data and literature.

c. Pre-installation on site to the quoted accuracy in the given technical specifications for the demonstration of the performance of the equipment.

d. Standard samples to be provided by the company for testing the instruments at the time of installation on site to the quoted accuracy in the given technical specifications for the demonstration of the performance of the equipment.

e. Guaranteed specifications to be demonstrated at the time of installation. Any necessary standard samples for that purpose should be brought by the service engineers.

f. Printed literature and published papers in support of all compliance to the prescribed specifications should be provided.

g. The vendor must provide compliance statement IN TABULAR FORMwith respect to each technical specification in the tender document duly supported by the manufacturer's literature and published papers. Any other claim will not be accepted and may lead to rejection of the bid.

h. Technical evaluation by the institute may include demonstration to verify functionalities and capabilities of the system quoted.

Sr No. 73 / Reference No. 76.

TECHNICAL SPECIFICATIONS FOR TLC INTERFACED MASS SPECTROMETER

Mass Detector should be used for the below applications:

Should be used as a Stand-Alone Independent Compact Mass Spectrometer by using Direct Injection Mode/ Diverter valve. MS should have Power On/Off switch & take minimum time to re-build Vacuum to get ready for analysis.

Reaction Monitoring for compound identification and conformity via Direct Injection of crude reaction mixtures

Should have capabilities to interface to TLC interface module for direct mass analysis of TLC spots (TLC-MS)

Rapid pump down which allows availability for the system run samples just 30 minutes after being moved

Should have connection to up to 16 digital and analog I/O to optimize the instrument for any chemistry workflow. The mass spec should be able to fit in a fume hood

Technical Specifications:

System should be supplied with ESI (Electron Spray Ionization) – source

Polarity: Positive and Negative Ion Switching in single analysis should be possible

Mass Range must be at least from m/z 30 to 1,200 or better.

Acquisition Speed: 10,000 Dalton/Sec or better(compatible with HPLC, UPLC and TLC-MS Interface)

Accuracy: + 0.2 m/z units over entire acquisition range or better

Stability: + 0.1 m/z units over 12 hour – 18 deg C – 24 deg C Operating temperature or better

Polarity Switching Speed – 50 ms or better

Analyzer: Single Quadrupole analyzerhaving preferably automated mass calibration to calibrate the entire mass range of analyzer on startup or before run to ensure mass accuracy is desired

Nitrogen gas generator with purity of at least 99.5% and upto 100 psi pressure upto35L/min capacity or better

Software for acquisition and interpretation of mass data to be included with suitable PC

Please include necessary consumables for Mass and TLC-MS interface for smooth operation

System should be supplied with TLC interface module

A device which can provide a simple, means of obtaining mass spectra directly from TLC plates which should combine with MS for quick identification of products in complex mixtures without additional sample preparation. System should be equipped with liquid pump for solvent delivery. Oval head for elution built-in and circular head for TLC spot elution.

Warranty: One year from the date of successful installation/commissioning of equipment.

Sr No. 74 / Reference No. 77.

Detailed Technical Specification: React IR In situ FTIR

A real-time, *in situ* mid-FTIR reaction analysis system equipped with a multi-reflection ATR (Attenuated Total Reflectance) probe & can also be utilized as a general purpose mid-FTIR for the off-line analysis of liquid samples.

General Requirements:

- One vendor should manufacture, sell, service and provide technical support for the entire reaction analysis system including spectrometer, probe technology, sampling interfaces and software.
- Instrument should have facility to use it in batch mode (with the help of probe) as well as in flow mode (with the help of flow cell) in real time. Price for this flow set up should be included item wise.

Hardware and Sampling Technology Requirements:

- Diamond must be available as ATR sensor materials

- Optical Range: 3500 $cm^{-1}$to 800 cm^{-1}or better

- All probe wetted parts should be compatible with typical organic reagents and solvents using no O-ring or brazed seals of any kind, and materials of probe construction must be chemically and physically inert consisting only of Hastelloy C-22 and gold.

- The ATR sensor must have than 6 reflections or more for the best sensitivity.

- An RTD (resistance temperature detector) must be integrated into the probe tip to automatically capture temperature of the reaction mass with each spectrum collected.

- The ATR sensor should not protrude outside the probe body eliminating the possibility of damaging the sensor

- A wide variety of sampling technology must be currently available for purchase fulfilling the requirements to monitor a wide variety of chemistry

    - Pressure range: vacuum to 65 bar or better

    - Temperature range:**-80 ºC to 180 ºC or better**

    - pH range from 1 to14

- The fibers should be housed in a single protective conduit to minimize possibility of damage

- The fiber and probe assembly should be designed to be serviceable so that any individual component can be replaced by the system vendor.

- A sensitive MCT detector should be included.Advanced cooling and heating facility should be included.

- **Purge:** No purge required

Software Requirements:

- Software should be designed specifically for reaction analysis

- All data analysis functionality should be available in real-time as well as in post reaction mode

- Integrated quantitative analysis software available with capability to predict absolute concentration in real-time

- Temporal resolution (time between spectra) should be changeable in real-time while acquiring experimental data so that the sensitivity can be optimized based on reaction kinetics

- An algorithm should be provided at no additional cost that will automatically deconvolve the three dimensional data sets providing concentration profiling of reaction species along with their alculated infrared component spectra

- An algorithm should be included that automates the picking of peak height or peak area to zero or baseline points to find the best fit to the multivariate deconvolved trend, and the functional groups that correlate to each of those peaks (and trends) should be provided

- Real-time data treatments to aid in the interpretation of the data (including at a minimum: baseline correction, solvent subtraction, normalization and 1st,2ndand 3rd derivatives)
- User defined trends for advanced math functions applied to relative concentration values
- Dynamic and automatic real-time solvent subtraction to effectively remove solvent characteristics from the data making it easier to interpret the data
- Automated and real-time export of spectral and profile (concentration) data to specified location on local workstation or to intranet
- Backwards compatibility to analyze data collected with older software versions from the same manufacturer
- Capable to import off-line analytical data to scale and quantify Infrared peak profiles
- The software should run under Windows 7, 8 and 10 operating systems with all service pack versions, and should be touch screen enabled
- Warranty : Instrument should be supplied with 3 years Comprehensive Warranty

Sr No. 75 / Reference No. 78. (Revised)

Technical Specifications for ATR-FTIR Spectrophotometer

ATR- FTIR Instrument with choice of accessories, wide range sampling modules and software for quick, easy and reliable IR-analysis of solids, liquids, gaseous and gel like samples.

Powerful but easy to use functions for verifying and identifying IR-spectra and performing quantitative analysis should be part of the software.

General Specifications:

1. Wavenumber range: preferably between 8000 to 340 cm^{-1}.
2. Wavenumber accuracy: Should be better than 0.01 cm^{-1}
3. Spectral resolution: Should be better than 0.75 cm^{-1}
4. Preferable S/N Ratio: 1 Min: >45,000:1 (= <9.7 x 10-6 AU noise) peak-to-peak, 4 cm^{-1} resolution
5. Interferometer: We prefer permanently aligned mirrors with high stability cube corner mirror design. Interferometer should be capable of acquiring data in both scanning directions to ensure the maximum signal-to-noise ratio in the shortest possible time.
6. IR-Source with Optimized light flux, long life-time > 5 years. Diode laser, high wavenumber accuracy and precision
7. Detector: High sensitivity, Temperature-controlled detector. Please mention detector sensitivity, wavelength range. Detector must be easily replaceable and auto aligns with security lock. Detector must have 24-bit A/D converter for fast response.
8. Sealed and desiccated optics
9. Internal validation unit with reference standards for automated instrument tests of every setup and every measurement mode

10. Automated instrument tests for operational and performance qualification

11. Easy exchange of different sampling modules

12. Standard compartment FTIR baseplate should preferably have suitable slide mount holder to accept 2 x 3-inch cards/slide (standard in the industry) and thus should be compatible with various slide- in sampling accessories (optional).

13. Automatic recognition and individual calibration of modules and ATR-crystal plates, automatic performance test and load of appropriate measurement parameters when changing the configuration.

14. The modules should be easily interchangeable. Suitable measurement settings for the used configuration are automatically loaded.

15. Possibility of extension of spectrometer for operation in regions with high humidity (use of ZnSe for all IR light-transmissive optical components including the moisture resistant beam splitter)

16. ATR-sampling module, with diamond crystal for enabling a fast and reliable FT-IR-analysis of solids and liquids

17. Diamond crystal single reflection, monolithic providing long life-time >10years. (Please provide list of all compatible accessories: single reflection vs multi-reflection, and choice of crystal)

18. Working plate: trough-like stainless steel plate; Spectral range: 350-8,000cm-1

19. Pressure controlled clamp

20. Working distance (max. sample height) 20mm

21. Easy cleaning of the ATR applicator. 360-degree rotation possible of the pressure rotor.

22. Temperature: room temperature up to 120°C.

23. Desiccant and set of tools

24. Suitable PC should be provided along with the instrument.

25. Warranty: 5 yr. comprehensive warranty with spare parts and consumables if any.

26. Software Preferred Requirements:

27. Easy to use and powerful for routine and research experiments. The software should provide customizable work spaces.

28. The spectrometer software should provide wizards for routine applications (baseline correction, zapping, subtraction, curve fitting, normalization, FSD etc). This wizard should guide the user through the full measurement and evaluation process and should change its appearance at each step for highest convenience in real time.

29. All spectral data resulting from one measurement must be stored within one single file. Additionally the results of manipulations (e.g. calculation of derivatives, FSD) and evaluations (e.g. peak picking, quantification) performed on this data shall be stored in the same spectrum file for easy data handling and well-arranged filing.

30. Software must have real time diagnostic features of critical components of FTIR like laser, source, detector and interferometer, and alignment. The software must offer detailed information about the nature of the failure and suggest possible remedy and be capable of sending real time error reports.

31. Continuous monitoring of all the spectrometer components, performance and environmental factors like humidity.

32. Software fully compliant to GLP and GMP regulations.

33. Instrument/software equipped with spectra library of common small molecules/polymers etc.

34. An advanced ATR correction that includes the compensation of the anomalous dispersion effects must be available.

35. Functions for the removal of different shaped base lines should also be included.

36. The software should have provision for analyzing multiple files at the same time, i.e should include macro wizard.

37. The software should have preferably have 3-D data representation /view, and should be able to show real-time time-course data collection and viewing for time-dependent experiments (Preferably at a single wavenumber unit)

38. The spectral collection software should be compatible (i.e direct command) with the external water recirculation unit for temperature ramp measurements with heating and cooling functions without any manual intervention.

    Optional:

39. Flow-through Cell: Stainless steel body with 100 micrometers thickness or better, with ZnSe windows, operating pressure: 30psi-60 psi, windows with clear aperture with channels to improve cross-flow characteristics.

40. Multi-bounce flow through ATR sampling accessories with heating facility. ATR must be heated up to 120 °C. Temp Accuracy: ±0.5 °C, Temp. Sensor: 3 wire Pt RTD (low drift, high stability)

41. Demountable transmission cell. The cell should include circular CaF2 windows 32 x 3 mm, suitable mount and 50µm mylar spacers – 12 nos, and suitable syringes for injection.

42. High humidity ZnSe windows and Beam splitter as optional items for consideration. The given beam splitter should be moisture resistant.

Sr No. 76 / Reference No: 79 (Revised)
Detailed Description of Item : Benchtop 3D Bioprinters

Printer Technology:

Portable, benchtop printer with small footprint which can print soft materials, bioinks, biomaterials and various cell types.

- Precision should be at least 1-micron on x, y, and z axes to allow to print the highest resolution structures.

- Build volume should be greater than 5 cm in z-direction and greater than 10cm in at least one other dimension.

- It should be possible to 3D print into Petri Dish, 6, 12, 24, 48, 96 & 384 well Microplates, and Slides bought from various commercial suppliers. All these options should be able to be selected via a drop-down menu either in the computer software or by a touch screen on the machine.

- The system should be compatible with any Bioinks and should be an open system

- The system should be supplied with accessories required for mixing live cells and printing bioink.

- The whole setup including the controller etc. should be bench type which can be placed inside a 4 feet wide laminar hood or biosafety cabinet.

- The system should be capable of able to photocuring layer by layer with UV of 405 nm and 365 nm, Droplet printing, and accommodate syringe printhead.

- The Bioprinter should be a standalone system with inbuilt computer and touch screen controller for complete functionality. Or, the manufacture should provide the desktop computer, and software license necessary to the instrument to separate computer

- Weight shall be less than 25 kg

Print Heads:

Should have minimum 3 to 6 printheads to print multi-cell tissues easily and quickly with multiple bioinks. Must be provided with exchangeable pneumatic print heads which can perform the following function individually or in combination:

(a) Cooling upto 4 °C or better

(b) Heating upto 60 °C or better

(c) Photocuring with UV Light (365 nm) and Blue Light (405 nm). The machine should offer the flexibility of photocuring after printing each layer or photocuring of the entire part after complete printing is done.

- heating upto 250 °C for printing thermoplastic such as PLA & PCL.

- Each print head must have individual temperature control.

- Should be able to print wide range of bioinks including silk fibroin, collagen solutions, gelatin methacrylate, alginate, poloxamer, hyaluronic acid, and polycaprolactone (PCL). It should also be able to print novel synthesized polymers and new polymer blends and composites developed in-house.

- Should have an autocalibration feature for print heads to improve convenience of use and minimise damage due to use by multiple users. The calibration of system should be user friendly and with minimum input and option for both manual and automated calibration should be available.

Print Bed:

- Print-bed temperature should be controlled with heating options (up to 50^{o}C or better) and be compatible with Petri dish, well plates and slides.

Extruder:

- Pressure ranges should be between 0 and 150 psi to accommodate a wide range of viscous materials and it must be easily possible to select a desired pressure value in this range.

- Pneumatic extrusion should cause minimal shear stress on cells while enabling unlimited design freedom and the manufacturer should be able to demonstrate more than 90% cell viability for at least 2 cell lines in standard bioinks supplied by the vendor.

- Mixer: Shall have provision for mixing two different materials before printing. Any accessory to enable this feature shall be included.

- The extruders should be able to use disposable and commercial disposable syringes of at least 5mL in volume, making it easy to load custom bioinks.

Other Details:

- Accepted Print Files should be STL, G-Code. It would be desirable to have acceptability towards other print file types such as *.obj as well. It must be possible to download the G-code file used for a particular print.

- The printhead should be interchangeable so as ensure upgradation of printheads with the new developments.

- Connectivity should be via Wi-Fi, Ethernet or pen drive.

- Should be compatible with Windows, MAC and Linux Operating Systems

- Power requirements: 24V DC@ 6-8 amps; AC input 100-240V, ~2 Amps, 50-60Hz; Operating voltage of 230V, 60Hz.

- Should be provided with operating and service manual

Warranty and Service:

- Price offered should include warranty of 3 years on all parts from the date of installation. Additional 2 year warranty as option shall be included.

- Service: A certified service engineer should be easily accessible and available on demand within 48 hours of any problem in the instrument. Two compulsory visits per year for maintenance must be included apart from the installation.

- Installation and training: Vendor should provide training on operation and application at IIT Bombay after installation. The training event needs to be performed once a year for three years.

- Spares: The supplier of the instrument must confirm in writing that the spares for the entire instrument will be available for a period of at least ten years from the date of installation.

- If the system does not have an inbuilt computer and touch screen controller for complete functionality, then the supplier will supply suitable computer with Windows 10 (windows 7 also acceptable, if vendor commits to providing free instrument firmware upgrade compatible to Windows 10 when available), 6th Generation Intel (R) Core™ i5 processor or better, DVDRW, ≥500GB HDD, ≥8GB RAM, ≥21” LCD monitor, 4 or more USB ports and other necessary features to ensure smooth operation of the system. Laser Jet B/W printer with wireless networking and duplex

- Stabilizer: 1 KVA servo stabilizer.

Other Accessories Needed:

- Compatible plastic syringes for at least two different volumes (pack of 100 each)
- Thermoplastic printing compatible metal syringes (5 each)
- Syringe tips required:
- Metal tips for metal syringes of at least two different sizes (10 each)
- Plastic tips boxes of at least three different sizes (50 each)
- Some size examples are 23 gauge, 27 gauge and 32 gauge. Equivalent acceptable.
- Bio inks: include Gelatin Methacrylate, Pluronics, PCL, collagen methacrylate, photoinitiator
- Others
- Accessories, starter kit and consumables: All necessary consumables for demonstration of full functionality and installation such as tips, syringes, needles, inks, materials, start-up kit shall be included with the system. Shall enclose a detailed catalogue with price for all available accessories from OEM.

Sr No. 77 / Reference No. 80.

Name of the equipment: High Performance Computing Cluster (HPCC)

Detailed Description of Item : An HPC cluster is a collection of many separate high-end compute servers (nodes) interconnected through fastlow-latencyinterconnect.

Each of the HPC clusters generally has

- Head node or login node, where users log in
- specialized data transfer node and high-end storage to handle large amounts of data to the tune of 5 petabytes.
- compute nodes (where majority of computations is run)
- Specialized high-memory compute nodes (have at least 1TB of memory)
- Graphical Processing Unit (GPU) nodes (for machine-learning and extensive computation)
- Specialized switch to connect all nodes

Sr. No. 78 / Reference No. 81. (Revised)

Ferroelectric Characterization Unit

Detailed specification of the equipment:

- The output of the test system must be an arbitrary waveform generator in order to produce any waveform for hysteresis, pulse, leakage, and CV tests *without a hardware configuration change* . i.e **all measurements should be carried out without changing the electrodes or sample orientation.**

- **For best resolution and flat frequency response, the charge measurement input should operate as an electrometer *over the entire test frequency from 2 MHz to 1/30th Hz*.**

- The voltage ramp rate of the output must be controlled such that the current capacity of the measurement input is not exceeded during a test.

- The test frequency must extend from a test period of 30 seconds for accurate measurement of large area bulk ceramic capacitors down to 30 seconds in Hysteresis for characterizing small-scale but leaky thin-film multi-ferroic capacitors.

- Pulse measurements should be as narrow as 0.5µs

- The minimum required leakage resolution is 1pA with evidences on company website about the accuracy.

- For accuracy on small area capacitors, the parasitic input capacitance must be less than 10 femto farads/volt.

- The software operating the tester must be programmable and capable of executing all measurement types in an arbitrary order ***without configuration change***.

- Captured data must be automatically stored and easily transferred to other testers using network protocols.

- **The tester software must be adaptable to future changes in the host computer operating system.**

- The tester must be capable of capturing external sensor data synchronously with polarization measurements.

- In particular, the tester must be compatible with non-contact optical displacement sensors and have dedicated software for capturing, correcting, and presenting displacement information.

- **Computer and Ferroelectric Test System should be separate and connected through USB Cable, so that in future any advanced new computer can be utilized with Ferroelectric Test System.**

- **System should not work with any dedicated sample holder. Any kind of sample should be connected with appropriate wirings and measured & can be connected to any available cryogenic chamber or any available furnace.**

BASIC FERROELECTRIC TEST SYSTEM

Detailed specifications are listed below:-

Output Range: **±100V** using built-in amplifiers (No external Amplifiers allowed for better resolution)

- 16-bit Arbitrary Waveform Generator output
- **32,000 points from 16 milliseconds to 30 seconds**
- Pulse Widths down to 0.5µs and up to 1s
- Controlled output ramp for maximum accuracy
- Minimum Leakage Current = **1pA**
- **Minimum Charge Measurement Using Electrometer = 0.8fC**

🕐Polarization Measurement

- **18 bit analog to digital converters – 76 µV sensitivity on 10 pF Csense**
- 0.5µs capture rate with 100ns interlace facility
- Polarization, output voltage, and SENSOR inputs captured simultaneously with no more than 10ns skew between channels.
- Minimum charge sensitivity – **0.8 fC**
- Maximum PUND/Hysteresis Frequency – **2MHz**
- Minimum area resolution – **0.080u2**
- Maximum charge resolution - **5.26 mC**
- Maximum area resolution >- **52.6 cm2**
- Maximum hysteresis loop frequency - **250 KHz @+/-10V Built-in**
- Minimum hysteresis loop frequency – **0.0333 Hz (30 second period)**
- Hysteresis Waveforms - **Mono/Arb/Sine/Tri/Double bipolar/10% Pulse/Monopolar sine/Zero/inverse cosine/Custom/Continuous Sine.**
- Input Capacitance- **-6Ff**
- **Electrometer Input at all test frequencies.**
- **System is independent from Computer, so that in the future any available advance computer can be interface with System**.
- 4 communication methods with accessories, USB, GPIB, RS232, or I2C.
- 2 external 18-bit, ±10V high-impedance voltage inputs for interfacing with external displacement, temperature, current, or magnetic sensors.

- Executes hysteresis, remanent hysteresis, small signal CV, IV, fatigue, imprint, PUND, retention, pyroelectric, static and dynamic magneto-electric, and piezoelectric displacement from one hardware configuration ie. **Without changing the probes or electrodes connected to the sample.**

- Software should allow user to create any custom test profile, execute that profile, store the results in a permanent but unalterable database assigned to the experiment, and recall that data at any time in the future to plot or export it as commanded by the user.

- Must correct displacement measurements for test fixture drift and offset.

- **Compatible with Quantum Design PPMS, Dynacool and Lakeshore cryogenic chambers.**

- **Test System should be independent from dedicated Test Fixture(Sample Holder) and has facilities to connect any available sample holders for thin film / bulk ceramic samples. This makes hooking up external equipment to the test system simple to use.**

Sr No. 79 / Reference No. 82.

Contact-type Profilometer

Detailed Description of Item

Notes and essential terms for qualification:

1. The vendor should provide details of at least five customers from India (at least three from IITs or other government research facilities in the past three years) where a similar system/equipment from the manufacturer has been working successfully. Wherever the system is being used, background checks may be done at the expense of the vendor.

2. The price quote must include the price of the software, required accessories, packing, shipping, taxes, and duties, etc. Educational/research/academic discounts may be applied, if applicable. An authorization letter should be furnished along with the quotation.

3. A compliance statement should be enclosed with the quotation. Point by point list of the product specifications against what is asked must be provided in the compliance statement to demonstrate that the requirements have been met.

4. Kindly quote every setup and accessories as per the IIT Bombay's tender specification format with all the supportive brochures, documents, and literature. In case of incorrect format or insufficient attachment, no clarification will be asked and could be subject to a direct rejection of the bid.

5. As and when the queries are raised against any technical point, it must be addressed promptly, positively within seven working days. In case the response is not received within seven working days, the offer will be rejected on technical grounds.

Technical Specifications:

1. Mode and method of scanning: Contact-type using stylus or tracer

2. Measurement parameters: (a) 2D and 3D form and surface profiles, surface texture, surface contours, and roughness (b) Measurements must be run in a fully automatic manner.

3. Sample type: Performance must be demonstrable on samples provided by IIT Bombay to all the shortlisted bidders, and the final technical qualification will be decided after the demonstration and evaluations of results.

4. Measurement range, resolution, and accuracy:

(a) Z-axis: travel range of 24 mm or more, motorized, resolution of 1 nm or better

(b) X-axis: travel range of 12 mm or more, motorized, resolution of 5 nm or better, speed of 200 mm/sec or faster

(c) Vertical column with travel range 500 mm or more, motorized, resolution of 50 nm or better

(d) Additional Y-axis table of minimum 200 mm x 200 mm dimension to allow fully-automated 3D contour measurements

(e) Y-axis: travel range of 200 mm or more, motorized, resolution of 50 nm or better, the loading capacity of 20 kg or more, speed of 200 mm/sec or faster

(f) Drive speed: 40 mm/sec or faster in each direction

(g) Drive straightness: 0.25 microns or better over 100 mm, and 0.5 microns or better over 200 mm in each direction

(h) Probe unit accuracy of +-(0.3 + |0.02H|) microns or better

(i) Accuracy between two measured points +-(2 + 0.02L) microns or better

(j) The drive unit must allow automatic inclination from -45 deg to + 10 deg to enable precise alignment of the drive unit with the test component

5. Stylus/tracers:

(a) (Qty. 2 nos.) standard length stylus, R 5 micron, 40 deg, diamond tip

(b) (Qty. 1 nos.) long-range stylus, R 5 micron, 40 deg, 25 mm depth, diamond tip

(c) (Qty. 1 nos.) long-range stylus, R 2 micron, 60 deg, 25 mm depth, diamond tip

(d) (Qty. 2 nos.) standard length ball stylus, R 250 micron, sapphire tip

(e) (Qty. 1 nos.) long-range ball stylus, R 250 micron, depth 25 mm, sapphire tip

6. Working environment:

(a) System monitoring and logging of temperatures and vibrations

(b) Insensitive to vibrations

(c) Insensitive to ambient lighting

(d) Insensitive to temperature changes.

(e) Can maintain the required accuracy in ambient temperatures ranging from 20 deg – 28 deg

(f) Noise-free operation

(g) Protective enclosure

7. Operating voltage: 100-240 VAC, 50-60 Hz

8. Vibration isolation table: Standard active vibration isolation table or unit and worktable. The performance of the machine must not be affected by any induced and natural vibration.

9. Software:

Compatible software for data acquisition and analysis in a single platform and package with the following capabilities:

(a)Automated and user-friendly operations, profile form measurement, volume measurement, step height measurement, surface roughness measurement, surface texture measurement, edge and contour measurement and analysis, micro-contour analysis, advanced 3D analysis using Y-table, export of measurement data in standard file formats, offline processing capability.

(b) No 3rd party software other than MS Office and OS

(c) Software License Validity: Minimum 19 years and above with free updates when released

(d) Minimum 5 additional software for analysis.

10.Computer: Branded and updated PC with Windows 10 operating system, i7 processor, 32 GB RAM, 2 TB hard drive, two flat-panel 27-inch monitors, DVD writer, keyboard, mouse, joystick.

11.Documentation (Manual, Drawings, if any, and Literature): Complete set of documentation in hard copy as well as softcopy.

12.Installation and Commissioning:

(a) The lead time for the delivery of the equipment should not be more than three months from the date of receipt of the purchase order.

(b) The instrument to be installed, tested, and commissioned by the manufacturer's qualified engineer/representative at IIT Bombay and performance must be tested on NIST certified standards.

(c) Trained service engineers in India (preferably in Mumbai) should be available to resolve any technical problems in the future.

13.Warranty: Twenty-four months of warranty after successful installation/commissioning and acceptance. Including replacement of parts.

14. Annual maintenance cost: For the next three years after warranty (must be quoted year-wise manner).

15. Spares Availability Assurance: The vendor must confirm the availability for at least ten years of the spare support of the offered system.

16 Standards: NIST Certified Standards Certified standards for form, roughness, step height calibration must be supplied.

17. Required accessories:

(a) XY leveling table with digital heads

(b) Stand/trolly for the computer

(c) UPS

18. Training and installation

(a) Installation: Required.

(b) Minimum of three days of on-site training. Training to operate the instrument must be given to our research scholars free of charge.

Sr No. 80 / Reference No. 83. (Revised)

Technical Specifications of Gel Scanner with Fluorescence

Application: Filmless autoradiography or phosphor-imaging for Southern, Northern, Western blotting for routine molecular biology and protein biology works.

Specifications:

- LASER based scanner to detect radioactive signals using phosphor imaging, samples containing radioactive probes are exposed to a storage phosphor screen (imaging plate).
- High speed and High-resolution optical scanner with detection modes for Image Phosphorescence and upgradable to Fluorescence and/or Near IR fluorescence scanning system.
- System should have a minimum of one internal LD LASER with excitation wavelength of 635 nm as excitation sources for phosphor-imaging applications.
- System should have provision to accommodate at least 5 internal LASERs for future upgradation to fluorescence and NIR imaging.
- System should have BP 390 filter for phosphor-imaging and should have provision to accommodate at least 8 filters for future upgradation to fluorescence and NIR imaging.
- System should have one bi-alkali PMT (Photomultiplier tube) based detector for phosphor-imaging.
- The system must have provision to accommodate one multi-alkali PMT for fluorescence and NIR applications.
- System should have resolutions of 10um, 25um, 50um, 100um and 200 um (Selectable).
- System should have pre-scan feature at 1000 um resolution.
- System should be able to detect following radioisotopes:14C,23P,33P,35S,3H,125I and 99Tc etc.,
- System should generate 16-bit image with 5 orders of magnitude of Dynamic range or more.
- System should have high scanning speed of 3 min (50 um 24 x 25 cm) or lower at 50 um for better and fast imaging.
- Detection Sensitivity: LOD of 0.00518 µCi/g for ^{14}C with autoradiographic standard (CFQ12000) is needed.
- Scanning area should be 33 x 43 cm for phosphor-imaging. User should be able to select the scanning area as per the size of sample.
- System should possess stages/screen holders to scan magnetic IP screens as well as non-magnetic IP screens.
- System should be provided with a LED based closed image eraser
- At least 2 phosphor screens and cassettes of various dimensions to be included.
- System should be provided with suitable software to quantify bands in gels and blots and determine molecular weight of proteins and nucleic acids using suitable calibration markers.
- One year of warranty (both parts and labor)

Sr No. 81 / Reference No: 84 (Revised)

Technical Specifications for Solid State NMR 400 MHz

Supply, Installation and commissioning of 400 MHz Nuclear Magnetic resonance spectrometer with Solid-state probes.

Detailed specifications:

Item No. 1:	**Supply, Installation and commissioning of 400 MHz FT-NMR spectrometer with solid + liquid probe.**	
S. No.		**Details**
1.1.	**Spectrometer Frequency**	400 MHz state of the art solid-state NMR spectrometer with two channels to carry out high resolution Solid -state NMR experiments such as 1D,2DNMR with various combination of selected nuclei, having capabilities for most up-to-date multi dimensional NMR experiments
1.2.	**Super conducting Magnet**	• Latest technology based stable and actively shielded superconducting magnet • Operating filed at 9.4 T (operating frequency of 400 MHz for ^{1}H) • Shim coil – cryogen cool and room temperature • Stray field at least 0.5 meter in radial and 1.0 meter n axial • Helium hold time >300 days with alarm function for low helium level • Nitrogen level sensor • Magnet stand with Air spring and damped isolator ADI for vertical damping • All support equipment for cryogen filling the magnet such as Liquid He transfer line, liquid Nitrogen transfer line, etc. • High performance cryo and room temperature shim system for optical line shape. • Special tool kit for magnet • An efficient shimming system to obtain excellent line shape in solid state configuration.
1.3.	**Console**	• Two or more channel cabinet for future up-gradation • Broad Band frequency generation for all channels • Communication between all channels by appropriate communication system • Multiple Digital receivers with excellent capability and elimination for artifacts such as signal acquisition, filtering, sampling, multi nuclei acquisition, etc. • Analog to digital converter (ADC) with bandwidth 5

		MHz or more • Preamplifier with proper filters for detecting broad range of nuclei 31P to 109Ag • At least one 1H and broad band amplifiers with minimum power levels of 500W for both 1H and for X channels respectively with detection and decoupling capability. • Variable temperature set up from -150 oC to 150oC with a resolution of 0.1 oC • 10A gradient amplifier for pulse field gradient shimming and gradient enhanced spectroscopy • 2H lock transceiver(in case of liquid-state probe usage) • Pneumatic sample load/spin/eject system on both solid and liquid state
1.4.	**Probe**	1. Solid state CP MAS Probe of 4mm diameter with MAS ≥ 12 KHz spinning speed. Nuclei ^{1}H, ^{2}H, ^{7}Li, ^{13}C,^{15}N to ^{31}P, etc. Please specify the following: • Configuration of the coils. • X-channel should be tunable from 31P to 15N. • Best resolution and line-shape using the standard sample. • Best Signal-to-noise (S/N) ratio values for each nuclei of the probe measured using standard samples (Please provide data and mention the sample used). • ^{1}H &^{19}F high power decoupling for up to 50ms. • Solid state NMR measurement Temperature range-50 ^{o}C to 200 ^{o}C. • Tuning accessory for auto-tuning capabilityfor all X-nuclei should be possible • Automated magic angle adjustment should be possible • Kindly provide printed specification sheet. 2. Liquid state Broadband Probe to cover in the nuclei ^{1}H, ^{13}C, ^{15}N,^{19}F, ^{11}B, ^{31}P, etc.
1.5.	**Acquiring & Processing system**	• **Hardware:** A compatible high-end workstation with preferable Windows operating system, minimum of 24 inchLED monitor, CD/DVD read/write drives, USB ports. It should have latest operating system with latest upgraded software for 1D, 2D, and 3D acquisition and

		processing. PC with minimum Pentium i9 Quad or higher processor, 1TBSSD, > 16GB DDR4 RAM, 24 inch LCD monitor, Minimum 4 USB ports and two Ethernet ports for data acquisition and internet. Compatible high-end laser jet printer. • **Software**: Most comprehensive latest NMR software to run up-to-date hetero-nuclear multi-dimensional NMR experiments including latest experiments for reconstruction of multi-dimensional NMR study, for control, data acquisition and processing, and automatic recording of multiple experiments. Package should include all the latest pulse sequences for multi-dimensional & multi-receive NMR experiments available with the vendor. The licensed software modules should include tools for Structure Analysis, Integration and Deconvolution of 1D, 2D and 3D spectra, NMR simulation, Multiplet analysis, Relaxation data analysis, etc. Automatic setup with acquisition, analysis and quantification of the NMR samples. High-end graphic tools for plotting one- and multiple-dimension spectra, for drawing structure and for making presentations on NMR experiment. Structure elucidation software. • Any software upgrade (pulse sequence and processing) or new software (pulse sequence and processing) that are released during warranty/AMC periods should be given to the user free of cost
1.6	**Installation**	a. All items for preventive maintenance Kit should be provided by the engineer during installation b. 100 nos. of liquid NMR tubes with caps should be provided. c. 10 nos. of appropriate size Zirconia rotors with caps suitable for standard and Variable temperature experiments should be provided. d. Sample packing kit (2 nos) and Cap remover (2 nos) should be provided
1.7	**On-site training**	• Initial on-site training to the staff for 2-3 weeks or as long as required to do all possible representative experiments and for routine maintenance. This can include advanced training for setting up variable temperature

		NMR experiments/special applications using software installed pulse sequences from the manufacturer.
1.8	**Warranty**	a. The entire instrument and the components should be under complete standard warranty period of 1 year. This includes replacement of damaged parts and engineering/ service support at the cost of the supplier. In case, the machine is down for more than 1 week during the warranty period, number of days accordingly should be compensated by providing additional extended warranty free of cost.
1.9	**Additional Indigenous items (Should be quoted in Indian currency):**	a. A suitable UPS for the whole system with a minimum of one-hour backup time. b. A suitable oil-free air-compressor complete with dryer and proper ratings/specification capable of catering to all the needs. c. Liquid nitrogen and helium for installation.
2.0	**Other requirements and Conditions**	a. All the technical details of all the basic items, essential accessories and optional items should be produced. b. The minimum power required for the operation of spectrometer with all the accessories must be specified in the quote. c. Specify the pre-installation requirement including the minimum ceiling height, room size etc. d. Standard samples for calibration of ^{13}C, ^{15}N, ^{1}H and ^{31}P nuclei should be included.
2.1	**Optional**	a. Extended warranty for upto 3 years (with engineering support and damaged part replacement) b. After completion of the first three years of warranty, the supplier should provide additional free 2 years of AMC in INR (preferably with part but definitely with engineering support with possibility of combined AMC covering other NMR spectrometers in the department). c. VT Liquid sample probe: Measurement temperature range -50 oC to 150 oC.

Item No. 1:	**Supply, Installation and commissioning of 400 MHz FT-NMR spectrometer with solid + liquid probe.**	
S. No.		**Details**
1.1.	**Spectrometer**	400 MHz state of the art solid-state NMR spectrometer with

	Frequency	two channels to carry out high resolution Solid -state NMR experiments such as 1D,2DNMR with various combination of selected nuclei, having capabilities for most up-to-date multi dimensional NMR experiments
1.2.	**Super conducting Magnet**	7. Latest technology based stable and actively shielded superconducting magnet 8. Operating filed at 9.4 T (operating frequency of 400 MHz for ^{1}H) 9. Shim coil – cryogen cool and room temperature 10. Stray field at least 0.5 meter in radial and 1.0 meter n axial 11. Helium hold time >300 days with alarm function for low helium level 12. Nitrogen level sensor 13. Magnet stand with Air spring and damped isolator ADI for vertical damping 14. All support equipment for cryogen filling the magnet such as Liquid He transfer line, liquid Nitrogen transfer line, etc. 15. High performance cryo and room temperature shim system for optical line shape. 16. Special tool kit for magnet 17. An efficient shimming system to obtain excellent line shape in solid state configuration.
1.3.	**Console**	2. Two or more channel cabinet for future up-gradation 3. Broad Band frequency generation for all channels 4. Communication between all channels by appropriate communication system 5. Multiple Digital receivers with excellent capability and elimination for artifacts such as signal acquisition, filtering, sampling, multi nuclei acquisition, etc. 6. Analog to digital converter (ADC) with bandwidth 5 MHz or more 7. Preamplifier with proper filters for detecting broad range of nuclei 31P to 109Ag 8. At least one 1H and broad band amplifiers with minimum power levels of 500W for both 1H and for X channels respectively with detection and decoupling capability. 9. Variable temperature set up from -150 oC to 150oC with a resolution of 0.1 oC 10. 10A gradient amplifier for pulse field gradient shimming and gradient enhanced spectroscopy 11. 2H lock transceiver(in case of liquid-state probe usage) 12. Pneumatic sample load/spin/eject system on both solid and liquid state
1.4.	**Probe**	7. Solid state CP MAS Probe of 4mm diameter with MAS ≥ 12 KHz spinning speed. Nuclei^{1}H, ^{2}H, ^{7}Li, ^{13}C,^{15}N to ^{31}P, etc.

		Please specify the following: 5. Configuration of the coils. 6. X-channel should be tunable from 31P to 15N. 7. Best resolution and line-shape using the standard sample. 8. Best Signal-to-noise (S/N) ratio values for each nuclei of the probe measured using standard samples (Please provide data and mention the sample used). 9. ^{1}H &^{19}F high power decoupling for up to 50ms. 10. Solid state NMR measurement Temperature range-50 ^{o}C to 200 ^{o}C. 11. Tuning accessory for auto-tuning capabilityfor all X-nuclei should be possible 12. Automated magic angle adjustment should be possible 13. Kindly provide printed specification sheet. 8. Liquid state Broadband Probe to cover in the nuclei ^{1}H, ^{13}C, ^{15}N,^{19}F, ^{11}B, ^{31}P, etc.
1.5.	**Acquiring & Processing system**	15. **Hardware:** A compatible high-end workstation with preferable Windows operating system, minimum of 24 inchLED monitor, CD/DVD read/write drives, USB ports. It should have latest operating system with latest upgraded software for 1D, 2D, and 3D acquisition and processing. PC with minimum Pentium i9 Quad or higher processor, 1TBSSD, > 16GB DDR4 RAM, 24 inch LCD monitor, Minimum 4 USB ports and two Ethernet ports for data acquisition and internet. Compatible high-end laser jet printer. 16. **Software**: Most comprehensive latest NMR software to run up-to-date hetero-nuclear multi-dimensional NMR experiments including latest experiments for reconstruction of multi-dimensional NMR study, for control, data acquisition and processing, and automatic recording of multiple experiments. Package should include all the latest pulse sequences for multi-dimensional & multi-receive NMR experiments available with the vendor. The licensed software modules should include tools for Structure Analysis, Integration and Deconvolution of 1D, 2D and 3D spectra, NMR simulation, Multiplet analysis, Relaxation data analysis, etc. Automatic setup with acquisition, analysis and quantification of the NMR samples. High-end graphic tools for plotting one- and multiple-dimension spectra, for drawing structure and for making presentations on NMR experiment. Structure elucidation software. 17. Any software upgrade (pulse sequence and processing) or new software (pulse sequence and processing) that are released during warranty/AMC periods should be given to the user free of cost

1.6	**Installation**	• All items for preventive maintenance Kit should be provided by the engineer during installation • 100 nos. of liquid NMR tubes with caps should be provided. • 10 nos. of appropriate size Zirconia rotors with caps suitable for standard and Variable temperature experiments should be provided. • Sample packing kit (2 nos) and Cap remover (2 nos) should be provided
1.7	**On-site training**	**6.** Initial on-site training to the staff for 2-3 weeks or as long as required to do all possible representative experiments and for routine maintenance. This can include advanced training for setting up variable temperature NMR experiments/special applications using software installed pulse sequences from the manufacturer.
1.8	**Warranty**	• The entire instrument and the components should be under complete standard warranty period of 1 year. This includes replacement of damaged parts and engineering/service support at the cost of the supplier. In case, the machine is down for more than 1 week during the warranty period, number of days accordingly should be compensated by providing additional extended warranty free of cost.
1.9	**Additional Indigenous items (Should be quoted in Indian currency):**	1. A suitable UPS for the whole system with a minimum of one-hour backup time. 2. A suitable oil-free air-compressor complete with dryer and proper ratings/specification capable of catering to all the needs. 3. Liquid nitrogen and helium for installation.
2.0	**Other requirements and Conditions**	14. All the technical details of all the basic items, essential accessories and optional items should be produced. 15. The minimum power required for the operation of spectrometer with all the accessories must be specified in the quote. 16. Specify the pre-installation requirement including the minimum ceiling height, room size etc. 17. Standard samples for calibration of ^{13}C, ^{15}N, ^{1}H and ^{31}P nuclei should be included.
2.1	**Optional**	1. Extended warranty for upto 3 years (with engineering support and damaged part replacement) 2. After completion of the first three years of warranty, the supplier should provide additional free 2 years of AMC in INR (preferably with part but definitely with engineering support with possibility of combined AMC covering other NMR spectrometers in the de-

		partment). 3. VT Liquid sample probe: Measurement temperature range -50 oC to 150 oC.

Sr No. 82 / Reference No. 85. (Revised)

Technical Specifications for Semi Preparative HPLC

Supply, Delivery, Installation and Commissioning of ModularAnalytical cum Semi Preparative LC

The HPLC system shall include the following individual stackable self-contained modules.

The HPLC system must be controllable, monitored, capable of performing system maintenance using Microsoft Internet Explorer web browser. Modules should be connected via fibre optic noise resistant high-speed transmission technology to enhance the reliability & sensitivity of HPLC

Pump for Preparative &Analytical flow rates:

- The pump should support both analyticalas well as preparative flow rates in a single unit
- Maximum operating pressure should be 40MPa or better
- Flow rate should be settable between 0.01mL/min to 50.00mL/minor better without any hardware changes
- Flow rate accuracy should be ±1% &precision ≤ 0.3% RSD
- The gradient formation should be produced through low pressure mixing
- It should be supplied with reservoir tray, solvent bottles, fittings etc.
- It must have a leak sensor as safety feature
- Pump should be capable of mixing solvents in different proportions for entire flow rate

Column Storage Compartment:

- Column storage compartment should be included with this system
- It should be able to accommodate up to 4Analytical columns of 4.6 X 300mm & 2 Preparative Columns of either 10/20/30/50 cm id with 300mm length. It should also be able to accommodate different flow line switching valves within this compartment.

Liquid Handler System for Sample Introduction as well as Fraction Collection :

- This unit should be an integrated sample injector as well as fraction collector with below mentioned specifications

Specifications for Injection Functions:

- Needle drive system should be arm movement in X-Y-Z directions
- Injection method should be loop injection method
- It should have options for injection amount setting range such as 1 to 2000ul. It should be possible to inject samples from Analytical Scale (10ul volume) to Preparative Scale (4ml volume). For this suitable syringe kit with appropriate loop etc. should be supplied as default
- It should have provision to inject samples from 1.5-2 ml & 4-6ml vials
- Injection reproducibility should be ≤ 1% RSD
- A set of 100 vials with caps each for 1.5-2ml& 4-6ml should be provided
- It must be able to perform continuous analyses according to the conditions specified for each sample, including pre-treatment, sandwich injection etc.
- Needle rinse capability both before and after sampling should be possible
- Purging of syringe & rinsing of needle interior as well as exterior should be possible

Specifications for Fraction Collection Functions:

- Preparative valve drive of fraction collector should have arm movement of X-Y-Z
- Preparative method should be on valve based preparation
- It should be able to handle flow rate of at least 50ml/min
- It should have capacity up to 540 tubes of 10mm OD and 252 vials/tubes of 4ml capacity
- It should have fractionation methods such as time-based, peak-based, manual and simulation function
- Liquid handler should have sample rescue function in the event of interrupted analysis or when instrument error occurs
- It should have provision to connect at least 4 different detectors
- Suitable sample trays &racks for this fractions collector should be provided.
- The delay time from the detector to the fractionation head should be calculated automatically every time the flow rate is changed
- Suitable glass test tubes should be provided

Photodiode Array (PDA) Detector

- The wavelength range should be 190 nm - 800 nm or better
- The photo-diode array detector should have 1024 elements
- The detector should have variable slit width for high resolution as well as high sensitivity
- A standard flow cell of 12µL volume& 10 mm cell path length should be available. It should have temperature control from 19ºC to 50ºC
- Preparative flow cell with variable path length for preparative applications should be provided
- Wavelength accuracy should be ≤±1 nm
- A deuterium lamp [D2] and a Tungsten lamp [W] should be available as Light Source for UV and visible wavelengths respectively.
- The selection of light source should be flexible to select D2, W or both lamps for analysis
- The Drift should be smaller than $0.9x10^{-3}$ AU/Hour or better
- The Noise Level should be smaller than $7x10^{-6}$ AU or better
- Linearity should be 2.0 AU or better (ASTM method)
- It should have a self-aligning mechanism for the light sources and cell.
- Light sources and cell should be accessible from the front for easy maintenance

Chromatographic Software

- Genuine Windows based software for control of LCMS as well as Preparative LC system should be supplied along with this system. It should be possible to perform all functions of Preparative LC as well as Single Quadrupole MS system with this software.
- It should cover full one-point digital instrument control, qualitative and quantitative processing, report creation and self-diagnosis
- The data should be convertible to other formats. Spread Sheet software and word-processing software can be readily employed to provide data in tables or graphs through industry standard protocols
- It should have sample rescue function in the event of interrupted analysis or when instrument error occurs

Service, Warranty and Training

- Tendered price should include delivery, installation, commissioning and training (at least 4 users) at supplier's location
- Comprehensive warranty for complete equipment for a period of 36 months should be provided. This shall include the following at no extra cost:
- Travel and Labour expenses of Customer Engineer
- Service Parts used for repairs
- Vendor to provide service guarantee: should the system require service during the warranty period, vendor must guarantee turn-around-time within 24 hours
- Vendor to provide a copy of Site-Preparation checklist
- Vendor must demonstrate that it has a proven appropriate set-up and capability to provide after-sales service efficiently and effectively. The supplier should have in his facility a similar system to that proposed in this tender for training purpose
- Automatic flow line switching from Analytical to Preparative scale & vice versa should be possible. Also automatic switching between two columns should be possible. Appropriate switching valves with required accessories should be supplied as standard with this system
- One Analytical C-18 Column (5um, 4.6x250) & one Silica Column (5um, 4.6x250) should be supplied along with Preparative LC system.
- All required kits, tubings, joints, tool kit etc. essential for running & maintenance of the system shall be supplied along with the system
- The vendor must be reputed one having experience of at least 10 Years for supply of HPLC & Preparative LC systems. They must have more than 1000 installations of HPLC, UHPLC & Preparative LC systems in India. Also vendor should have at least 100 installations of LCMS & LCMSMS systems in India. Vendor must have service as well as application engineers based within Mumbai city

Sr No. 83 / Reference No. 86.

Detailed Description of Item : MICROBALANCE

- Maximum weighing Capacity: **3.1 gm**
- Max. Capacity : **1.1 | 2.1 | 3.1gm**
- Scale Interval (d): **0.001 | 0.002 | 0.005mg**
- Typical Repeatability: **0.0005mg**
- Linearity: **0.003**
- Pan Size: **Ø 30 mm**
- Stabilization time: **5 sec**
- Sensitivity drift between +10 °C and +30 °C **: 1 ppm/K**

- **Display**: TFT touch screen operation with brilliant, readable, display &easy to operate user interface.

- The balance should have most advance **monolithic block technology for Load cell.**
- Balance should itself **automatic levels the System with the help of motorized levelling.**

- The draft shield should be **Automatic, motorized, round, glass draft shieldwith learning capability, illumination and integrated motion sensor.**

- **Off Centre Loading feature required for reduction in off Centre load error**.

- The balance should have USB, RS232 ports available for various modes of communication to printer and PC.

- If required, the balance should be easily hooked up with **external software's without any additional intermediate softwares.**

- **A single level password**always ensures unauthorized parameter changes in setup menu.

- The weighing Pan should be not less than **Ø30mm**

- The **weighing pan should be of Titanium material**, **as it has most of all the chemical compatibilities.**

- The **balance should be future upgraded as per customer requirements.**

- The Instrument should be supplied with 3 years warranty

Sr No. 84 / Reference No. 87. (Revised)
Detailed Description of item : Microwave Synthesizer

S. No.	Item/Parts	Technical Specifications for the Microwave Synthesizer
1.	**Model Name:**	Make, model and model number of the instrument should be clearly mentioned. Photographs of the actual model should be provided.
2.	**Microwave synthesis system**	1. System must have a built-in operating system with fluorescent display and alphanumeric keypad for entry of operating parameters. System must operate stand alone as well as through PC. 2. System should have in built magnetic stirring facility as well as standard cooling facility to be provided (Air compressor) 3. The microwave should be focused on to the reactants to ensure homogeneous heat distribution and create reproducible reaction conditions. 4. The reactor module should be able to handle organic synthesis, nanomaterials synthesis, zeolites, inorganic synthesis using various type of solvents (polar, non-polar, caustic)
3.	**Microwave power**	1. Microwave heating system must have a measured minimum focused installed power of 900 watts & output power of 300 watts or more. The system should be monomode.
4.	**Vessels**	The instrument must be capable of conducting pressurized as well as normal pressure reaction in the same system. 1) Pressurize vessels of following specifications should be offered a) Volume: 10 ml Pressure: 35 bar (515 PSI) or more MOC: Glass No of Vials (10ml): 100 nos. Caps and septa – 100 nos. Vessel should be of vent & reseal technology Teflon coated magnetic stirrer (3mm)- 50 no Spill cup Pressure calibration tool, pressure regulator and tubing. b) Normal pressure reaction vessels: 100 ml glass vessel. At least 3 nos 2) System should have facility to clean cavity in case of spillage. Suitable accessories which will withstand temperature of more than 260 degrees Celsius should be offered along with system. 3) Accessories must be provided to protect the instrument from damage at high temperatures.

5.	**Temperature and pressure control systems**	System should have infrared temperature control option as standard, and the system should have pressure sensor as well. The system should also have a pressure attenuator.
6.	**System software computer system, and power backup**	1. System software must automatically adjust the power delivery based upon sample load and pre-programmed control settings.. 2. Free future software up-gradations and re-installations if any.
7.	**Upgradability**	System must be upgradable for following & accessories for the same should be offered as optional 1) Accessory for sub ambient temperature from -80 deg C to 300 deg C 2) Accessory for gas purging 3) 80 ml or above pressurize reaction vial & accessories 4) 35 ml vial accessories 5) Reaction vials for carrying out reaction from 100 micro liter to 2 ml 6) Accessory for sub ambient temperature from -80 deg C to 300 deg C 7) Accessory for gas purging 8) Upgradability for Peptide synthesis
8.	**Warranty and maintenance**	1. System must carry a minimum three-year warranty.
9.	**Training**	The manufacturer should provide onsite training initially during installation
10.	**Patents**	System having patents will be preferred. Please mention patent number if so.

Sr No. 85 / Reference No: 88 (Revised)

Detailed Technical Specifications for Photon counting fluorimeter

1. Computer controlled photon counting fluorimeter
2. Standard, a continuous 150W ozone-free xenon source delivering excitation light from 230nm to the NIR.
3. Spectrometers with 1200g/mm ruled gratings, blazed at 330 nm at the excitation for the optimization of the excitation intensity in the UV-VIS range, and blazed at 500 nm at the emission channel for the optimization of the fluorescence signal in the VIS-NIR range. Both monochromators have continuously adjustable entrance and exit slits operated under computer control for the selection of the band-passes in the range 0- 30nm.

4. Software for the control of the instrument and data analyses.

5. Configured computer [Computer (minimum of i5, 8G RAM, ITB Hard drive, and 22-inch monitor) and appropriate software for running the instrument].

6. **NIR Detector (800nm-1550nm)**

7. **Liquid Cuvette (**Quartz Cuvette, 4ml volume, 10x10mm optical path, open top with cap. AS well as Quartz Cuvette with 1 ml volume**)**

8. **multi sample holder (at least two)**

9. **Solid Sample Holder (**olid Sample Holder Designed for viewing front-face fluorescence of thin films, powders, pellets, paper, fibers, or microscopic slides. Variable alignment angle**)**

10. **Bandpass filters and adapter (**Bandpass filter, 320 nm ± 12.5 nm FWHM, 25.4 mm diameter; Bandpass filter, 340 nm ± 12.5 nm FWHM, 25.4 mm diameter; Filter holder adaptor: receives 1-inch (and 25mm) round filters and fits in 2x2-inches square standard filter holders from the instrument**)**

11. **Higher Order Sorting Filters (**Set of 5 2-inch x 2-inch square filters cut-on at 370, 399, 450, 500 and 550nm.

12. **Peltier Accessory (**Rapid Peltier temperature controlled single sample holder ~ - 15 degree C to ~ +105 degree C, with stir and stir bar, water circulator and software driver**)**

13. **Polarization Accessory**

14. **Stopped Flow Accessory (**Stopped Flow, rapid kinetics accessory. Two 2.5 ml syringes, Injection port. Ideal for studying reaction kinetics; External trigger cable.

15. Minimum 3 years (preferred 5 years) of comprehensive warranty

Sr No. 86 / Reference No. 89.

Detailed Technical Specifications : DLS & ZETA POTENTIAL MEASURING SYSTEM TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS

PARAMETERS TO BE MEASURED
Particle Size and zeta potential measurements for globular proteins, nanoparticles, and polymers (most colloidal-sized materials) in any non-absorbing liquid. Capability to measure molecular mass and A2. Transmittance value measurement will be added advantage

Temperature control range
0ºC to 90ºC +/- 0.1ºC

Condensation control
Purge using dry air

Laser Source
Diode Laser 630nm – 660 nm; Laser Power 4-40 mW

Detector
Photo Diode

Laser warm-up time
20 min or better

PARTICLE SIZE MEASURING RANGE
Measuring principle: Dynamic Light Scattering
Range: 0.4 nm to 9 micrometer or better
Maximum concentration: 40 % w/v
Measurement angles: Minimum Two angles - 173º -175º and 13º -15 º preferably Side angle 90º in addition
Minimum concentration (protein): 0.1 mg/mL (lysozyme)
Temperature control: 20 deg. C - 90 deg. C

ZETA POTENTIAL MEASUREMENT SPECIFICATIONS
Measuring Principle: Electrophoretic Light Scattering
Sensitivity: 1 mg/mL (lysozyme)
Zeta potential range: greater than +/- 500 mV or more
Mobility range: greater than +/- 20 micrometer.cm/V.s
Zeta Potential Size range: 3 nm – 100 micrometer
Maximum sample concentration: 40 % w/v

MOLECULAR MASS MEASUREMENT SPECIFICATIONS
Measuring Principle: Static Light Scattering (Having Debye Plot will be preferable)
Molecular-mass range: 1 kDa – 20 MDa or better
Transmittance Measurement capability is added advantage

SOFTWARE SPECIFICATIONS

1. Software capabilities for specifically carrying advanced measurements for proteins.
2. Software codes for running micro-rheology characterization will be an added advantage
3. User friendly, preferably windows Based Presentation of Input parameters, results and analysis on a single page

Cuvettes
1) 4 quartz cuvettes for size measurement:
a) small volume <= 350 microliter

- b) Larger volume up to 3 mL
- 2) A box of disposable plastic cuvettes (10 to 15 mm) with caps for size measurements
- 3) For zeta measurements: 4 pairs of electrode cuvettes
- 4) Flow cell cuvette
- 5) Standard size particles for calibration purpose of DLS and Zeta potentials

MISCELLANEOUS
1) Suitable PC/laptop with appropriate specifications should be included in the quote.
2) Ability to carry out micro-rheology experiments will be an added advantage.

Warranty: Comprehensive Minimum 36 months. Afterwards: 2 years of Annual maintenance contract should be included.

OPTIONAL:
(1) Autotitrator for pH and conductance measurements along with suitable accessories.
(2) Viscosity measurement system can be provided

Sr No. 87 / Reference No. 90.

Detailed Technical Specifications for Gas Chromatograph-Mass Spectrometer (GC-MS)Technical Specifications for Gas Chromatograph-Mass Spectrometer (GC-MS)

Gas Chromatograph coupled with Single quadrupole with following specifications.

Sl. No	Requirement	Specification
1	GC	Microprocessor based Fast GC with EPC/ PPC/AFC, and able to support 3 inlets, 3 detectors. GC must have a touchscreen display with Graphical User Interface (GUI)
2	Column Oven	1. Minimum two suitable capillary columns 2. Temp. Range: Ambient +4 to 450°C 3. Ramp rate: maximum 110°C/min or more 4. Cooling rate: 450°C to 50°C within 10 min or better with optional cooling ramps 5. Built-in oven light that facilitates column installation should be available 6. Should have oven power safety (power off when door is open)
3	Split/Splitless injector port – 1 No.s	7. Split/split less capillary inlet 8. Maximum temperature: 400 °C or better 9. Split ratio: 6000:1 or more 10. Pressure setting range 0–90 psi or better with control of 0.001psi for whole range 11. Carrier gas Flow Control should have Constant flow, constant pressure 12. Pressure program ramps: minimum3 steps
4	Auto Injector	13. Automated liquid sampler with 15 Vials capacity
5	Single Quadruple Mass Spectrometer	14. Ionization modes: EI & System should have dual filament design with automatic switching. 15. Ion Source temperature: up to 350°C 16. Electron energy range up to 200 eV or better 17. Mass Range: 1.6 to 1000 amu or better. 18. Mass analyzer: Quadruple should be of solid metal, with pre- rods for matrix elimination or equivalent. 19. Vacuum pump: Dual inlet/stage Turbomolecular pump (>250 L/s) Ionization 20. Mass axis stability: ±0.1 amu over 48 hours 21. Mass resolution: Unit mass 22. Detector: Sealed long-life electron multiplier tube 23. Scan rate: >18,000 amu/s or better and should provide sensitivity for all mass range 24. Detection Limit: EI/CI MSD | S/N Ratio : 1,500:1 with 1 pg/µL OFN, 1,200:1 or better (CI) for 1 pg/µL OFN 25. CI mode: System should include Chemical Ionization mode for molecular confirmation of compounds.

6	**Optional Technique**	26. The vendor may quote chemical ionization mode for headspace reagent gas using solvent based for molecular weight confirmation of compounds, Quote **optional** with nitrogen gas cylinder (Purity 99.999%), regulators, purification panel and tubing for nitrogen gas
7	Database and software	27. NIST 2020 library with license, Library data base in CD ROM should be provided
8	Gas Cylinders	28. Filled gas, regulators, gas purification panel, tubing for Helium gas.
10	Reagent Gas for CI mode	29. Methane/Isobutane gas cylinder (Purity 99.995%) with required Accessories to be quoted. (If vendor is providing **optional technique** then not required).
11	UPS	30. 7.5 KVA UPS with 30 min back up
12	Warranty	31. 3 years for quoted GCSQ system
13	PC & Printer requirements for GCMS	32. CPU: Intel Core i5 – 3.20GHz or Higher 33. RAM : 8GB or Higher 34. Hard Disk : 500GB or Higher 35. Operating System: **Windows 10 Professional 64 bit (Software should be License version)** 36. Monitor**:** 21'' wide (minimum) color LCD, No. of pixels 1680*1050 37. USB Ports**:** 5 ports of version 2.0 38. Laser Printer A4 or Larger 39. MS office: MS Office 2010 or 2013 or 2016 and version of-Microsoft Excel (32 bit) 40. Adobe Acrobat 41. Internet Explorer.

Sr No. 88 / Reference No. 91.

Detailed Technical Specifications for the Melting Point Apparatus

Positions for melting capillaries	3
Positions for boiling capillaries	1
Precision magnifying lens	1
Magnification of lens	2.5 x
Display	Color, TFT, 320 x 240, 3.5″
Determination temperature range	Ambient + 10 °C to 400 °C
Temperature resolution	0.1 °C

Accuracy of the oven temperature at 0.5 °C/min	up to 250 °C ± 0.3 °C 250 °C to 400 °C ± 0.3 °C to ± 0.5 °C
Repeatability of melting point at 0.5 °C/min	± 0.1 °C
Accuracy of boiling point at 1.0 °C/min up to 400 °C	± 0.5 °C
Temperature gradients, °C/min	0.1, 0.2, 0.5, 1, 1.5, 2, 2.5, 3, 5, 10, 20
Heat-up time (50 °C – 350 °C) at 25 °C	~ 4 min
Cool-down time (350 °C – 50 °C) at 25 °C	~ 13 min
Electrical supply	100 – 240 V (±10 %)
Power consumption	150 W
Storable methods for melting point	50
Storable methods for boiling point	50
Compliant with Pharmacopeia methods	PH. EUR., USP and JP
Interfaces	1 x PS/2 1 x RS232 1 x USB
Languages	en / de / fr / it / es / ja / cn

Functional principle

The Melting Point M-560 is an instrument for manual (visual) determination of melting point, melting range, and boiling point at ambient temperatures +10 °C up to 400 °C. The melting point of three samples can be determined at the same time. The boiling point can be determined for one sample. Samples are observed through the lens.

Melting point

The melting point capillary sits in a hollow of the metal block, which is electrically heated and controlled by a temperature sensor. The heating block is capable of being maintained accurately at a predefined temperature by the heating element, and of being heated at a defined rate. The melting point is determined manually.

Boiling point

The boiling point is determined by the “Siwoloboff” method. The Melting Point M-560 can be used to determine the boiling point of a small amount of liquid. The heating block has one insert available for boiling point tubes (outside left). The boiling point is determined visually.

Warranty: The instrument should be supplied with 3 years extended warranty.

Sr No. 89 / Reference No. 92. (Revised)

Detailed Technical Specifications for UV-VIS- NIR with Diffuse Reflectance Spectrophotometer

- Wavelength Range and Spectral Bandwidth : 85nm–3300nm:
- Resolution of 0.1 nm
- Wavelength accuracy of UV/VIS region +/- 0.2 nm; NIR region :+/- 0.8 nm and repeatability of UV/ VIS region : +/- 0.08 nm NIR region : +/- 0.32 nm
- Wavelength scanning speed of UV/VIS region approx. 18000 nm/min. NIR region approx. 700000 nm/min in wavelength scanning UV/VIS region Max. About 4500 nm/min. NIR PMT/InGa As region Max. about 9000 nm/min. NIR Pbs region. Max. About 4000 nm/min (excludes time required for switching)
- Automatic light source switching synchronized with wavelength
- Double beam Photometric system
- 50W halogen lamp (minimum of 2000 hr Life)
- Grating – grating type double monochromator Concave diffraction monochromator.
- Main monochromator. Aberration correction type Czerny Turner monochromator. Diffraction gratings are high performance blazed holographic gratings
- Detector :UV/VIS region. PhotomultiplierR-928 NIR region. In
- GaAs photodiode/cooled PbS optical conductive element Sample Compartment : Inside dimensions 150 W x 260, D x 140 H (mm)
- Temperature: 15 Deg.C – 35 Deg.C
- Ambient C°Humidity: 35-80% (no condensation, less than 70% at temp. above 30 C°70% at temp. above 30
- UV 10mm Cell GS Kit
- Thermoelectric Single-Cell Holder
- Peltier Accessory **(**Rapid Peltier temperature controlled single sample holder ~ - 15 degree C to ~ +105 degree C, with stir and stir bar, water circulator and software driver**)**

- Powdered Sample Holder for Integrating Shpere
- Super Micro Black Cell (50-400 uL)
- Film Holder
- Diffusive reflectance accessory for carrying out analysis on powdered, solid or gel samples in the wavelength range preferably 200-900 nm: The accessory should have features likes Automatic re-cognition, system suitability checks, automatic optimization, zero alignment, zero set-up, plug-in module design: (i) Integrating Sphere Attachment 70mm and above diameter and is ISO compliant (ii) multi-purpose sample holders for different samples, KBr powder etc.
- Computer (minimum of i5, 8G RAM, ITB Hard drive, and 22-inch monitor) and appropriate soft-ware for running the instrument
- Appropriate software for running the UV-vis NIR instrument
- Minimum 3 years (preferred 5 years) of comprehensive warranty

Sr No. 90 / Reference No: 93

Detailed Technical Specifications for 600 MHz NMR Spectrometer

Supply, Installation and commissioning of 600 MHz Liquid-state Nuclear Magnetic resonance spectrometer with accessories.

Detailed specifications:

Supply, Installation and commissioning of 600 MHz Liquid-state Nuclear Magnetic resonance spectrometer with accessories.

Detailed specifications:

Item No. 1:	**Supply, Installation and commissioning of 600 MHz FT-NMR spectrometer with liquid probes.**	
S. No.		**Details**
1.1.	**Spectrometer Frequency**	600 MHz state of the art liquid-state NMR spectrometer with three channels to carry out high resolution Solution-state NMR experiments such as 1D, 2D and 3D NMR with various combination of selected nuclei, having capabilities for most up-to-date multi-dimensional NMR experiments
1.2.	**Super conducting Magnet**	D. Latest technology based stable and actively shielded superconducting magnet E. Operating field at 14.1 T (operating frequency of 600 MHz for ^{1}H) F. Standard bore size of 54 mm G. Field drift ≤ 10 Hz/hr H. Room-temperature shims for optimal line shape (please mention the number of room-temperature shim coils); and automated gradient shimming capability with associated accessories (software/hardware). Shim system

		cooling during high-temperature experiments should be possible I. Radial ≤ 0.8m and Axial distance ≤ 1.5 m for the stray 5 Gauss field from the centre of the magnet. (please specify the overall Magnet dimensions/weight/ceiling height requirements) J. Helium hold time >300 days with alarm function for low helium level and He sensor K. Nitrogen level sensor L. Magnet stand with integrated vibration damping M. All supporting equipment for cryogen filling such as Liquid He transfer line, liquid Nitrogen transfer line, etc N. Special tool kit for magnet
1.3.	**Console**	• Three or more channel cabinet, with possibility for future up-gradation to four channel • Broad-Band frequency generation for all channels • Communication between all channels by appropriate communication system • Multiple Digital receivers with excellent capability and elimination for artifacts such as signal acquisition, filtering, sampling, parallel multi nuclei acquisition, etc. • Analog to digital converter (ADC) with bandwidth 5 MHz or more • Spectral width ≥ 7.5 MHz • Preamplifier with proper filters for detecting broad range of X-nuclei • ^{2}H preamplifier for ^{2}H observe and decoupling and for lock • ^{1}H preamplifier for ^{1}H and ^{19}F observe and decoupling • At least one ^{1}H and 2 broad band amplifiers with minimum power levels of 100W for ^{1}H and 500 W for X channels respectively with detection and decoupling capability. • Variable temperature set up from -150°C to 150°C with a resolution of 0.1°C • 10A gradient amplifier for pulse field gradient shimming and gradient enhanced spectroscopy • ^{2}H lock transceiver • Pneumatic sample load/spin/eject system • Variable temperature accessories to cover the entire range of temperatures should be included along with specifications
1.4.	**Probes**	• 5 mm triple resonance probe ($^{1}H/^{13}C/^{15}N$) probe optimized for ^{1}H observation and $^{13}C/^{15}N$ decoupling (si-

		multaneous irradiation possible) with ^{2}H locking, Z - shielded gradient and Auto-tuning/matching capability. Please specify the following: 18. Configuration of the coils. 19. Pulse widths for ^{1}H, ^{13}C, and ^{15}N using standard samples. Please specify the sample used. Typical pulse length for 1H should be 10 µs or similar 20. Best resolution and line-shape (under sample spinning and non–spinning conditions). Please specify the line - widths measured using the standard sample. 21. Best Signal-to-noise (S/N) ratio values for each nuclei of the probe measured using standard samples (Please provide data and mention the sample and NMR tube used). 22. Maximum gradient strength (≥ 50 G/cm and should have facility to do gradient encoded spectroscopy 23. Gradient recovery times (not more than 100 µs). 24. Decoupling pulse width, power, bandwidth, duty cycle capability on each RF channel. 25. Temperature range over which the probe can be used should be -150°C to +150°C. 26. Kindly provide printed specification sheet. • 5mm double-resonance broadband probe optimized for X-nuclei observation with ^{1}H decoupling and ^{1}H observation with pulsed-field gradient and ^{2}H lock and Mutiple-solvent suppression capability (2D experiments for e.g. INADEQUATE should be possible along with capability of homonuclear gated decoupling) All specifications as described in part (a) of this section should also be provided • Spinners for room and high temperature operations: 8 numbers • Spinner for reduced volume sample (3mm) **Note:** same spinners should be applicable for low and high temperature applications as well. If not, appropriate spinners for both temperature ranges should be included • Depth gauge
1.5.	**Acquisition & Processing**	9. **Hardware:** A compatible high-end workstation with preferable Windows operating system but compatible with Linux OS, minimum of 24 inch LED moni-

		tor, CD/DVD read/write drives, USB ports. It should have latest operating system with latest upgraded software for 1D, 2D, and 3D acquisition and processing. PC with minimum Pentium i7 Quad or higher processor, 1TB HDD, > 16GB DDR RAM, 24 inch LCD monitor, Minimum 4 USB ports and two Ethernet ports for data acquisition and internet. Compatible high-end laser jet printer and mouse. 10. **Software**: Unlimited licenses for the most comprehensive latest NMR software to run up-to-date hetero-nuclear multi-dimensional NMR experiments including latest experiments for reconstruction of multi-dimensional NMR study, for control, data acquisition and processing, and automatic recording of multiple experiments should be included. Package should include all the latest pulse sequences for multi-dimensional & multi-receive NMR experiments available with the vendor. The licensed software modules should include tools for Structure Analysis, Integration and Deconvolution of 1D, 2D and 3D spectra, NMR simulation, Multiplet analysis, Relaxation data and dynamics data analysis, non-uniform sampling, etc. Automatic setup with acquisition, analysis and quantification of the NMR samples. High-end graphic tools for plotting one- and multiple-dimension spectra, for drawing structure and for making presentations on NMR experiment. 13. Should have capabilities to do Mixture and Pure Material Analysis • Component Analysis in a quantitative manner and can be done A • Quantitation can be done absolute and relative manner 14. A module that has capabilities to do similarity analysis of complex biological macromolecules in a quantitative manner. Analysis should include deviation in chemical shift and intensity of two spectra, if exist, and provide correlative analysis plot. 15. Any software upgrade (pulse sequence and processing) or new software (pulse sequence and processing) that are released during warranty/AMC periods should be given to the user free of cost

1.6	**Installation**	14. All items for preventive maintenance Kit should be provided by the engineer during installation 15. All cost for Liquid He during charging of the magnet and in case of quench, if happens. 16. 100 nos. of NMR tubes (with caps) for standard experiments should be provided 17. 50 nos of 3 mm reduced volume tubes with caps
1.7	**On-site training**	1. Initial on-site training to the staff for 2-3 weeks or as long as required to do all possible representative experiments and for routine maintenance. This can include advanced training for setting up biological NMR experiments/special applications using software installed pulse sequences from the manufacturer.
1.8	**Comprehensive Warranty**	18. Comprehensive Warranty for five years for the instrument and accessories /compressor etc.)from the date of installation. Adequate number of engineer visits (minimum 2) every year should be covered during the warranty period. **Note:** Warranty price should be given yearly basis for the 5 years & also quotation should be provided by OEM. In case, the machine is down for more than 1 week during the warranty period, number of days accordingly should be compensated by providing additional extended warranty free of cost.
1.9	**Additional Indigenous items (Should be quoted in Indian currency):**	4. A suitable UPS for the whole system with a minimum of three hours backup time. 5. Oil free reciprocating air Compressor of sufficient capacity and appropriate dryer with filter for supply of dry air with appropriate dew point for smooth operation of pneumatic unit, autosampler and variable temperature unit (taking into account the humid weather in Mumbai) 6. Liquid nitrogen and helium for installation and for an additional 1 year during warranty period
2.0	**Other requirements and Conditions**	25. All the technical details of all the basic items, essential accessories and optional items should be produced. 26. All standard samples such as line-shape, shimming samples etc should be included.

		27. The minimum power required for the operation of spectrometer with all the accessories must be specified in the quote. 28. Specify the pre-installation requirement including the minimum ceiling height, room size etc. 29. In case probes need to be sent back for repair, on-site replacement with temporary spare probes should be possible
2.1	**Optional**	8. 3-channel Room temperature probe optimized for ^{1}H detection, ^{15}N and X-channel broadband decoupling, ^{2}H lock and pulsed-field gradient capabilities 9. Additional 2 workstations for data processing having similar configuration as acquisition PC 10. Autosampler with a capacity of 24 samples or above.

Sr No. 91 / Reference No. :94. (Revised)

Detailed Description of the item : TG-DTA MS and DSC.

This tender contains two parts (a) TG(DTA) with MS and (b) DSC. Both the parts can be fulfilled by the same vendor or individual parts can be given by different vendors.
TG (DTA) MS measurement system with a skimmer type gas introduction interface with EI and soft ionization (photoionization) technique combined to aquadrupole mass spectrometer.DSC Should also be quoted with the system as per specs given below.
The details specification of the systems should be as follows :

- TG (DTA) with MS:

A suitable TGA system capable of working independently of MS. The switching between TG(DTA) and TG(DTA)-MS mode should be simple and quick.

Thermo-gravimetric Analyzer (TGA):

Balance system	Differential triple coil system type
Sample holder	Twin holder type
Sample pan and material	Standard O.D.5mm × 2.5mmh (about 45μL) Al, Pt, alumina
Sample amount	Maximum 1g (about 90μL) or higher Depending on the specific gravity of the sample
Thermocouple	13%RhPt-Pt or suitable thermocouple
Heating furnace	Standard temperature type electric resistance furnace
Range of measured temperature	Room temperature to 1,000°C
Measurement atmosphere	N_2, Air, CO_2, (He + O_2 20%), software-based gas switching facility during the time course measurement
Heating rate (program)	1°C/hour-20°C/min or better
Measurement range	TG , maximum ±250mg or better DTA , maximum ±1,000μV/F.S or better
Temperature program settings	Temperature scan and Isothermal measure-ments. Sets the measurement control and an-alytical station on the PC screen
Automatic Furnace	Electric opening and closing mechanism of electric furnace Auto Sampler

Mass spectrometer (MS) :

Method	Quadrupole type mass spectrometer
Detector	Secondary electron multiplier tube
Measurement atmosphere	He and synthetic air (He + O_2 20%)
Ionization mode	Electron ionization (EI) mode Photoionization (PI) mode (Possible to select EI or PI in each measurement.)
Filament (EI)	Yttria coated iridium
Ionization energy	EI 70eV (changeable) PI 10.2eV
Range of mass number	*m/z* 1-410 or better
Resolution (resolving power)	1 amu or better
Detection limit of partial pressure	1.0×10^{-12}Pa
Measurement mode	TIC(SCAN) mode (extractive chromatography from TIC data) SIM mode (Maximum 16 channels)
Vacuum	Turbo-molecular pump Rotary pump

Skimmer interface part

Method	Double orifice type skimmer method
Material	Quartz (Standard mode)
Gas introduction method to QMS	Direct introduction by jet separator method

- Suitable Quartz ports connecting the TGA to MS should be provided.
- Measurement control Software.
- The Software should be Windows 10 based.
- All the measurement and control for the TG (DTA) and MS should be from single software.
- All the processing software for the TG (DTA) and MS should be available.
- Multiple display of results should be possible- TG(DTA) and MS Data in both 2 D and 3D view.
- NIST Library should be part of the system for MS analysis.
- Standard samples (In, Sn)-5gm or more, Standard sample (Zn), Standard reference (α-Al_2O_3).
- Standard samples (calcium sulfate)
- Tweezers, Micro Spatula, Pt Pan with lid (4 nos), Al Sample pans with lid (500nos).
- Al_2O_3 sample pan (4 nos).
- Brand new He gas cylinder with regulator should be quoted along with the system.
- PC should be of following Specs or better – CPU i5 or better. 16GB RAM, 1TB HDD, Graphics Card with 4GB memory, 24-inch LED Screen, Keyboard, Mouse (Branded).
- A Color Laser Printer also should be quoted along with the system.

(b) DSC

DSC principle	Heat flux type
Sample pans	Standard 5mm O.D. × 2.5mmh (about 45µL) Al, Pt; Ag Suitable sample pans for liquid samples and solid samples should be provided. Both closed pan (lid crimped to pan) and open pan measurement should be possible.
Measurement temperature range	-150°C to 500°C or better
Measurement atmosphere	Inert Gas (N_2Ar) Possible to measure it by static or flow atmosphere

Heating / cooling temperature rate	Heating and cooling rate : 1°C /hr to 100°C/min or better Cooling type and rate : Liq. N_2 cooling system with appropriate cooling rates.
Heating or cooling rate stability	±5%
Measurement range Heat Flow Resolution Noise Level Temperature repeatability and Precision Real-time observation of sample	±400mW 0.2 µW 1.1 µW ±0. 1 °C Camera is preferred with variable functions like zoom, thumbnail, side-by-side display of RGB images which are an added advantage.
Temperature program settings	Sets the measurement control and analytical station on the PC screen

- Mass Flow controller for two gases.
- Standard samples (In, Sn)-5gm or more, Standard sample (Zn), Standard reference (α-Al_2O_3).
- Tweezers, Micro Spatula, Pt Pan with lid (4 nos), Al Sample pans with lid (500nos).
- Suitable method for Activation Energy Calculation
- Heat capacity Calculation Software, sapphire and suitable reference sample forheat capacity measurement
- Purity Analysis software
- PC should be of following Specs or better – CPU i7 or better. 16GB RAM, 1TB SSD, Graphics Card with 4GB memory, 24 inchLED Screen, Keyboard, Mouse (Branded).
- All the tools and tackles required for analysis for the above systems should be part of the supply.
- Comprehensive Warranty- For the complete system above should be 3 years.

Sr No. 92 / Reference No. 95.

Detailed Description of the item :High purity ingots of Aluminium, Arsenic, Beryllium, Gallium, Indium, Antimonide – source materials for the Molecular Beam Epitaxy system

MBE Source materials:

Aluminium:

- Very low alpha emitters content (U, Th)
- Ultra high purity
- Grade: 6N5+ PHP
- Dimensions: 6 mm diameter x 20 mm length
- Weight : 1.5 g
- Packing: 10 pieces in individual laminated foil
- Qty: 300

Arsenic:

- Ultra High purity
- Grade: 7N5+
- Dimension: D 65mm x L130mm
- Weight: 2220g
- Form: Ingot
- Qty: 2

Beryllium:

- Grade: 99.99 + %
- Package: 1g nugget net weight bottle under argon blanket gas.
- Qty: 5g

Gallium:

- Grade: 7N5+

- Form: Ingot
- Packing: 25gm ingot in protective seal
- Size: D 9mm x L 67mm
- Qty: 1kg

Indium:

- Grade: 7N5+
- Form: ingot
- Packing 10gm shots
- Size: D 13mm x L 14mm
- Qty: 510gm

Antimony:

- Grade: 7N5+
- Form: Ingot
- Packing: 230g/ingot in vacuum seal
- Size: D20mm x L 110mm

Sr No. 93 / Reference No.: 96.

Detailed Description of the item : <u>Power Device Characterization System</u>

1. Key Generic Requirements:

i. The tenderer must provide an installation scheme showing the physical space (footprint) of the item(s) as well as space required for routine access and all installations including related accessories.
ii. The vendor should have installed similar types of systems in centrally funded technical institutes or government research labs. Purchase order (PO) and user list should be provided as supporting evidence.
iii. The compliance sheet should be provided by the vendor. The absence of the compliance sheet may result in the cancellation of the purchase order.
iv. For each compliance, supporting evidence such as manuals and other necessary and supporting documents needs to be provided.
v. The vendor should have an Indian representative which can take care of the urgent troubleshooting or any queries on an urgent basis.
vi. Installation and training of the system should be demonstrated.

2.(a) Technical Specifications (Generic):

The primary purpose of the equipment is to measure high voltage and high current data of on-wafer as well as packaged high power devices such as transistors, diodes, IGBTs based on conventional and emerging wide-bandgap semiconductors such as GaN, SiC, Ga_2O_3, diamond etc.

1. High Voltage and High current Parameter Analyzer
2. High Voltage and High current Probe Station
3. Accessories

The above components can be from different manufacturers but should be quoted item-wise in a single bid/quotation.

2.(b) Technical Specifications (Specific):

- **PARAMETER ANALYZER**

The mainframe system should include automated measurement collection and data storage/extraction with latest analysis software. Software upgrades should be assured for the first three years after installation for the mainframe.

1. Power device curve tracer/analyser mainframe with rack mount kit
3.Extended 3 year Warranty
4. Ground Unit with Triax Cable
5. Packaged DUT Test Fixture and Associated Accessories
6. Accessories for all Instruments and fixtures
7. HV Plug connector Panel Mount

8. SHV Cables (3 Nos., Minimum length of 1.5m)
9. Cable for 500A Ultra High Current Probing
10. High voltage Bias Tees
11. Protection adapter for High Power Source Monitor Unit (HV-Triaxial output)
12. HV Triaxial to SHV Adapter
13. Ultra-High Current Expander Fixture and Adapter
14. Free mainframe calibration should be included for the first three years
16. On-site installation and training
15. Measurement Modules, Numbers and Specifications as given in Table below

No.	Measurement Module	Quantity	Main Specifications
1	Medium Power SMU	1	• Up to 100 V, 100 mA force • 10 fA current resolution
2	High Voltage SMU	1	• 1500 V/8 mA;3000 V/4 mA (Pulsed & DC)
3	Medium current SMUs	6	• 1 A/30 V (Pulsed); 100 mA/30 V (DC)
4	High Voltage SMU Current Expander	1	1. 1500 V / 2.5 A (Pulsed), 2200 V/ 1.1 A (Pulsed)
5	Ultra-High Current Expander	1	• 500 A/60 V (Pulsed), 7.5 kW peak power
6	Multi Frequency CMU	1	• 1 kHz to 5 MHz • 0 to ±25 V using internal DC bias • 0 to± 3000 V using HVSMU and High Voltage Bias-Tee
7	On-Wafer Gate Charge Measurement	1	-

- **PROBE STATION**

1	**FEATURES / BENEFITS**		
	A) Operator safety and device protection		
		i) Safety category 1 interlocks on a dark box door	
		ii) Dedicated chuck design for highest isolation	
		iii) Unique high-voltage probe arm design with protected guard area	
	B) Measurement accuracy		
		i) Low-noise test environment with EMI-shield concept extended for high-voltage, high-current and high-power applications	
		ii) Seamless integration with measurement equipment (parameter analyser) for best measurement accuracy	
	C) Low cost-of-ownership		
		i) Probe concept allows expansion for other applications such as RF (S-parameter) measurements	
		ii) Unique high-voltage and high-current probe arms designed for standard probe tips and/or replaceable HCP probe tips	

2	**POWER HANDLING (CHUCK)**			
		i) Maximum voltage: 3,000 V (triax) and 10 kV (coax) (Thermal Chuck: capable of 3 kV @ 200°C and 2.5 kV @ 300°C with triax)		
		ii) Maximum current: 100 A (pulsed)		
3	**MEASUREMENT PERFORMANCE**			
	Chuck (Triaxial Configuration)			
			Thermal Chuck*	
	i)	Chuck leakage	@ Ambient	@ 300 C
		a) 10V (typical)	100 fA	200 fA
		b) 3kV (typical)	10 pA	50 pA
	ii)	Chuck resistance	Ambient	
		a) Force-Guard (10 V)	25 TΩ	
		b) Force-Shield (10 V)	3 TΩ	
		c) Guard-Shield (10 V)	500 GΩ	
	iii)	Probe leakage	Ambient	
		a) 0 V (typical)	< 10 fA	
		b) 3 kV (typical)	< 1 pA	
4	**CHUCK SYSTEM**			
		i) Diameter: 150 mm		
		ii) DUT sizes supported: 10 mm x 10 mm, 2 inch, 4 inch and 6 inch wafers		
		iii) Surface: Gold-plated		
		iv) Supported wafer thickness: ≥100 µm		
		v) Configuration: Triaxial design		
		vi) Universal connector for high-voltage and high-current measure-ments		
5	**THERMAL CHUCK SYSTEM**			
		(i) Flatness: ≤10 µm at ambient, ≤ 30 µm at 200°C		
		(ii) Temperature range: +30°C to 300°C		
		(iii) Resolution: 0.1°C		
		(iv) Accuracy: ± 1°C and ± 1% above 100°C		
		(v) Transition rate (from 30°C to 300°C): ATT: 25 min		
		(vi) Dual triax connector for low leakage and vacuum structures for thin wafers		
6	**INTERFACE WITH PARAMETER ANALYSER**			
		(i) Complete kit for interfacing with parameter analyser		
		(ii) Test equipment interface to mount parameter analyser accessories and protection adapters- 2 HV Triax measurement Feed-throughs, sup-port for HV-bias-T		
		(iii) Mount for parameter analyser module selector		
		(iv) Test Equipment Interface plate to mount accessories of ultra-high current/ultra-high voltage modules of parameter analyser		
7	**VIBRATION ISOLATION PLATFORM**			
8	**EMI-SHIELDED SAFETY ENCLOSURE MOUNTED ON TABLE**			
9	**MECHANICAL PERFORMANCE**			
	A) Chuck Stage			
		i) Travel: 155 mm x 155 mm (6 inch x 6 inch)		

		ii) Resolution: 5 µm	
		iii) Planarity over 150 mm (6 inch): < 10 µm	
		iv) Load stroke, Y axis: 90 mm	
		v) Z height adjustment range: 10 mm	
		vi) Z contact / separation / load stroke: 0-3 mm adjustable	
		vii) Theta travel (fine): ± 8°	
	B) Platen		
		i) Platen space (typical): Universal platen: space for up to eight positioners	
		ii) Z-Height adjustment range: Maximum 20 mm (depending on configuration)	
		iii) Minimum platen-to-chuck height: 16 mm (universal platen)	
		iv) Separation lift: 200 µm	
		v) Separation repeatability: < 1 µm	
		vi) Vertical rigidity / force: 5 µm / 10 N (0.2 mils / 2.2 lb.)	
		vii) Accessory mounting: Magnetic	
	C) Manual Microscope Stage (On Bridge)		
		i) Travel range: 50 mm x 50 mm (2 inch x 2 inch)	
		ii) Resolution: ≤ 5 µm (0.2 mils)	
		iii) Microscopes: For stereo microscopes with large working distance	
10	**MICROSCOPE**		
		i) Type: Trinocular stereo zoom	
		ii) Zoom range: 1 : 6.7	
		iii) Magnification: 15-100x	
		iv) Camera port For cameras with C-mount	
		v) Illumination: Long life-time LED ring light	
11	**SAFETY**		
		i) Interlock: Hardware (safety category 1)	
		ii) Interlock connector: BNC-Twinax (specific interlock cables available for various measurement instruments)	
12	**RF positioners, tips and cables (compatible for DC and RF setup)**		
		i) 6x Probe posnr, HV, 100tpi, magnetic base, left	
		(ii) HV/HC cables	
		iii) 2x High current probe holder with BNC connection and 5 replaceable probetips (up to 100A current)	
		iv) 6 probe holders with 2 x HVTriax and 3 x HV Coax (3KV) probes	
		v) 2 boxes of 12um and 25um tungsten needles (25 tips per box)	
		vi) 2x East/West RF arms	
		vii) High-voltage tesla chuck connection cable, high voltage chuck connector-Keysight	
		(viii) Hi-current probe holder (500V/10A DC/60A pulse) with operating temperature from -55C to 300C and isolation resistance >100G Phms @500V with cable and positioner capability	
		(ix) Tweezers, Tools and Accessories	
13	**DIGITAL Camera with Monitor**		
		1/2.8" CMOS with C-Mount and mounting thread - Capture Resolution on SD-card: Still image: 8.0MP (3840 x 2160) Video: Full HD 1920 x 1080 - Live Display Mode through out	

		USB: 1920 x 1080 (Full HD) @ 30 frames per second or HDMI: 1920 x 1080 (Full HD) @ 60 frames per second - Pixel Size: 2.8 x 2.8 microns Data transfer: HDMI (1080p) and USB 2.0 - SD card slot (maximal: 32 GB) Motic Images Plus 3.0 application software for PC and Mac 24" LCD monitor: HDMI, DisplayPort, VGA inputs - 178° wide-angle view, C-RING, Dust cap, Macro Tube, power supply, 4-dot calibration slide	
14		**3-year Warranty on the probe station and its accessories (except probe tips) should be included**	
15		**ON-SITE INSTALLATION AND TRAINING**	

- **Demonstration for onsite acceptance**
  Complete, integrated installation of the parameter analyser and the probe station should be demonstrted on-site. Full capability of the parameter analyser (current, voltage, capacitance and charge measurements) and its various modules and fixtures should be demonstrated on a test device (packaged and on-wafer) supplied by the vendor. Similarly, probe station capability in terms of the chuck temperature range (30 to 300 C) and high current, high voltage capability must be demonstrated.

Sr No. 94 / Reference No. : 97

Detailed Description of the item :Arbitrary Waveform Generator (AWG)

Technical specification of the Arbitrary Waveform Generator. All the specifications assume a 50 Ohm load, and port impedance, unless explicitly stated.

S. No.	Technical Specification	Value	Remark
1.	Sampling Rate	At least 2.4 GSPS	
2.	Number of Analog Channels	4 (four)	
3.	Trigger Input	1 per channel	
4.	Analog Bandwidth	At least 750 MHz	
5.	Record Length	At least 64 M Samples per channel	
6.	DAC Resolution	16-bit	
7.	Coupling of channels	AC and DC, switchable	
8.	Marker outputs per Analog Channel	At least 1 Marker output per channel	
9.	Amplitude Range (50 Ohm load)	1.5 V Peak-to-peak or more	
10.	Amplitude Resolution	0.1 mV	
11.	Amplitude Accuracy	±2% of setting ≥ 100 mV p-p	
12.	Rise/Fall time	<500 ps for 0.2 V step	
13.	Amplitude Offset Range	± 750 mV or more	
14.	SFDR (10 MHz – 500 MHz)	-80 dBc or better	
15.	Worst Harmonics	-57 dBc or better (within the amplitude specification listed above)	
16.	Marker Jitter	60 ps or better	
17.	Run Modes	Continuous, Triggered, Gated	

18.	Sampling Clock resolution	At least 7 digits	
19.	Trigger to Output delay	3.6 micro-second	
20.	Output Skew Control Range	200 ps	
21.	Output Skew resolutions	25ps	
22.	10 MHz reference	SMA, 50 Ohm	
23.	Ability to synchronise multiple units	Yes (include the maximum number of channels that can be synchronised in the technical document)	

	Optional items:	
1.	Real time pre-compensation for pulses	
2.	Memory upgrade up to 500 MSa per channel (if not available on the standard unit)	
3.	Computer i5; Win10 OS; 8GB Ram; 512 SDD; 15” display	
4.	Measurement software for AWG	
5.	Installation and Training	

Additional requirements from the prospective supplier

- The supplier should provide Authorisation Certificate from the OEM for the Quoted Brand of the equipment.
- The supplier should state categorically whether they have fully trained technical staff for installation of the equipment.
- The supplier should have a minimum 03 (three) years of experience in supplying and successfully installing equipment of similar specifications and should provide references (installation sites) from premier Institutes in India or abroad (preferably Government Organisations in India). Provide the list along-with contact details of the users.
- At the time of commissioning the successful bidder has to demonstrate/ training the complete functioning of the equipment.
- After-sales service support for repair/ replacement of non-functional parts should be available in India (including all services under warranty).

Sr No. 95 / Reference No. : 98.

Detailed Description of the item : Technical Specifications for Time Tagger - Streaming time-to-digital converters

4-channel streaming time tagging system with 42 ps or better time resolution (RMS jitter) with USB 3.0, 65 Mtags/s, 2ns dead time and +/- 3.3 V input range, +/- 2.5 V trigger level range, synchronizable, full software package, free software and firmware updates included

Description	**Specifications**
Timing Precision	
RMS jitter	42 ps or better
FWHM jitter	100 ps or better

Digital resolution	1ps or better
Processing capabilities	
input channels	4
dead time	2 ns
data transfer rate	65 M tags/s or better
burst memory	512 M tags or more
maximum input frequency	500 Mhz or more
Input signals	
input impedance	50 Ω
input signal range	-3 V to 3 V
Maximum input level (no damage)	-5 V to 5 V
trigger level range	-2.5 V to 2.5 V
Minimum pulse width	500 ps
Minimum pulse height	100 mV
External clock input	
Frequency	10MHz or 500 MHz
Coupling	AC 50 Ω
Amplitude	1 to 3 Vpp
Data interface	USB 3.0

Additional requirements from the prospective supplier

- The supplier should provide Authorisation Certificate from the OEM for the Quoted Brand of the equipment.
- The supplier should state categorically whether they have fully trained technical staff for installation of the equipment.
- The supplier should have a minimum 03 (three) years of experience in supplying and successfully installing equipment of similar specifications and should provide references (installation sites) from premier Institutes in India or abroad (preferably Government Organisations in India). Provide the list along-with contact details of the users.
- At the time of commissioning the successful bidder has to demonstrate/ training the complete functioning of the equipment.
- After-sales service support for repair/ replacement of non-functional parts should be available (including all services under warranty).

Sr No. 96 / Reference No. : 99. (Revised)

Detailed Description of the item :

TIME-RESOLVED SPECTROMETER UPGRADE WITH EXISTING UP CONVERSION SYSTEM SINGLE PHOTON COUNTING SYSTEM, PS LASER SOURCE AND TCSPC DETECTOR – UV Transient response PL setup

- **System should be integrated into the Existing femtosecond laser and Up conversion spectrometer in the Lab, utilizing the existing optical components, and supporting the same sample excitation conditions as in the up conversion experiment.**
- **The upgrade should not require any additional table space.**
- **Complete System quoted should also be able to work in standalone operation with a dedicated picosecond pump light source as well as with an external pump beam provided by the existing femtosecond laser. All the necessary electronics and drivers should be quoted with the system**

Tender specifications are as follow:

Picosecond light source

- **Spectral range: 360-860 nm**
- **Pulse duration: <150 ps. Typically: <100 ps.**
- **Easily characterizable temporal pulse profile (for kinetic deconvolution)**
- **Repetition rate: 1-10 MHz**
- **Externally triggerable**
- **Average output power: 6 µW/nm @ 1MHz**
- **Computer-controlled**
- **Set of bandpass filters (FB340-10, FB400-40, FB500-40) should be Included as part of the system**

Picosecond Time-Correlated Single Photon Counting

- **Electronics and software for measuring fluorescence over nanosecond and longer time window with a 25 ps minimum step size.**

TCSPC Detector

- **Spectral range: 220-650nm**
- **Temporal response: 50 ps**

System should carry a one-year warranty.

Sr No. 97 / Reference No. :100.

Detailed Description of the item : Deep Reactive Ion Etching System(DRIE)

1. Key Generic Requirements:

- The tenderer must provide an installation scheme showing the physical space (footprint) of the machine(s) as well as space required for routine access and all installations including the gas lines, MFCs, and other related accessories.
- The vendor should have installed similar types of systems in centrally funded technical institutes or government research labs. Purchase order(PO) and user list should be provided as supporting evidence.
- The compliance sheet should be provided by the vendor. The absence of the compliance sheet may result in the cancellation of the purchase order.
- For each compliance, supporting evidence such as manuals, SEM images, and other necessary and supporting documents needs to be provided.
- The vendor should have an Indian representative which can take care of the urgent troubleshooting or any process related queries on an urgent basis.
- Safety features like interlocks to prevent errors in operation, RF interlock, emergency shut-down options along with necessary protocols should be separately mentioned.

2.(a) Technical Specifications (Generic):

5. The system must be cleanroom compatible with all the necessary support systems such as vacuum systems, cooling systems, power supply systems, computer hardware, and software provided.
6. The machine must be software controlled with appropriate software and hardware interlocks to protect the machine from any possible operational or non-operational failure thereby ensuring the safety of the operator as well as the machine.
7. The process is required to contain all the necessary sensors and control to aid in safety monitoring, performance monitoring, automatic operation, and diagnostic of the system. A complete set of system operation and maintenance manuals must be provided.
8. A library of process recipes for materials that can be processed by the machine well documented by the company must also be included.
9. Suitable gauges calibrated as per international traceable standard must be provided for monitoring vacuum in the process chamber as well as load-lock and providing feedback for controlling process pressure in the chamber. Further, pressure gauges to monitor the lines between chamber and turbopump, and turbopump to backing pump should be included to ensure the best possible vacuum performance.
10. The process pressure control in the reactor chamber should be automatic and closed-loop through software-controlled throttle valves.
11. The control computer system/PLC should be a state-of-the-art system with a pre-loaded operating system and the software required for running the machine. The control panel must contain all the buttons required to operate the machine.
12. The software must allow for configurable user groups with different access privileges. Three different modes operator, engineer, and admin should be provided for easy and safe handling of the tool.
13. The software must allow the user to write and edit machine recipes.
14. The software must provide full system monitoring and recording of full system states in log files.
15. The system must provide access to sample process history and security protocols.
16. The system must provide system fault detection and diagnosis.
17. Automatic and manual control modes should be available in the software.
18. Installation, training, and SiC etch process demonstration.

2.(b) Technical Specifications (Specific):

14. The system is targeted towards deep Silicon Carbide (SIC) etching through standard processes.
15. The system should be capable of carrying out etching on small pieces mounted on a suitable and compatible carrier wafer. The source diameter should be suitable to achieve uniformity over a 4-inch wafer diameter also. The chamber diameter and load-lock transferring mechanism should be able to accommodate 4-inch wafers to enable future up-gradations.
16. The wafer mounting chuck should enable electrostatic clamping.
17. Standard MFCs controlled 6 lines (Cl_2, BCl_3, argon, O_2) along with CF_4 and SF_6 should be closely coupled to the plasma source to enable minimum cycle time. Provisions for more gas lines to be able to hook up with the system to enable future upgradations, if any, should be provided.
18. The reaction chamber should be machined from a single metal block (preferably aluminum) with an anodized inner surface for chlorine processes. A separate air-inlet port (for by-products protection), as well as a viewing port, should be provided with the main reaction chamber.
19. The loading mechanism should be a software (recipe) driven and fully automated with a robotic transfer mechanism to move the wafer from loadlock into the process chamber and back on the execution of a process recipe. There should also be an option to manually override the transfer.
20. The substrate should be cooled using through Helium backside circulation. The helium flow rate and pressure are considered process parameters. The flow rate/pressure should be controlled through a software-controlled MFC.
21. The substrate electrode temperature should be from -10 ^{0}C to +40 ^{0}C settable with the stability of 1-2 ^{0}C or better.
22. The system should come with provisions for separate pumps for the reaction chamber (RC) and the load lock chamber (LLC). Altogether there should be 3 pumps, 1 Turbomolecular pump with a

pumping speed of 1300 litres/sec or better, 2 dry pumps (one each for RC and LLC) with a pumping speed of 1500 litres/min or even better.

23. Regarding TMP pump and Dry pump, additional each one (TMP & Dry pump) will be supplied as spare pump at IIT Bombay site, or the vendor should keep each pump at the vendor's side in case of emergency.
24. The load lock chamber vacuum pumps must be able to pump the load lock chamber down to approximately 10^{-1} Torr. suitable for typical wafer transfer to the main process chamber within approximately 10 minutes. It should be able to pump down to 5×10^{-5} Torr. with overnight pumping.
25. The main chamber must be able to reach and maintain a vacuum level of less than 0.1 - 10 Pa (7.5×10^{-4} - 7.5×10^{-2} Pa) during standard etching processes.
26. Oil-free dry backing pump with 1300 lpm or more rating with N_2 purge standby to minimize N_2 usage when no etching is in progress. The backing pump must be resistant to corrosive gases.
27. The backing pump must include a microprocessor-based diagnostic accessory for quick identification of faults that may occur from time to time.
28. The plasma should be inductively coupled with an operating frequency of standard 13.56 MHz. The plasma generator power/bias rating should be 1 KW/300 W or better with a maximum power upgrade of 600 W.Suitable matching techniques should be provided to minimize reflected power. The vendor should also provide detail about techniques/methods.
29. The power supply cooling can be either air-cooled or water-cooled. Any specific requirements for this (ex: Chiller) should be mentioned as a mandatory item along with the system.
30. The RF coupling to plasma should be done through Alumina, AlN, or, any other suitable dielectric.
31. The circulator will be required to be controlled remotely from the touch-screen of the main system, e.g. its switching ON/OFF, set & monitor the temperature.

3. (a) Process demo:

The system is going to be extensively used for etching SiC. The demo process of etching on samples provided from IITB (Details of the sample mentioned below) should be carried out to develop the process. The process recipe needs to be replicated by the installation engineers on a similar set of samples after the installation of the machine is completed at the IITB site.

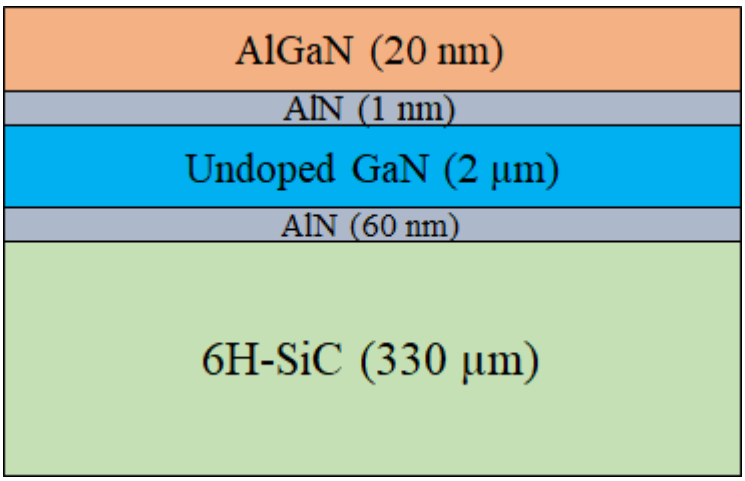
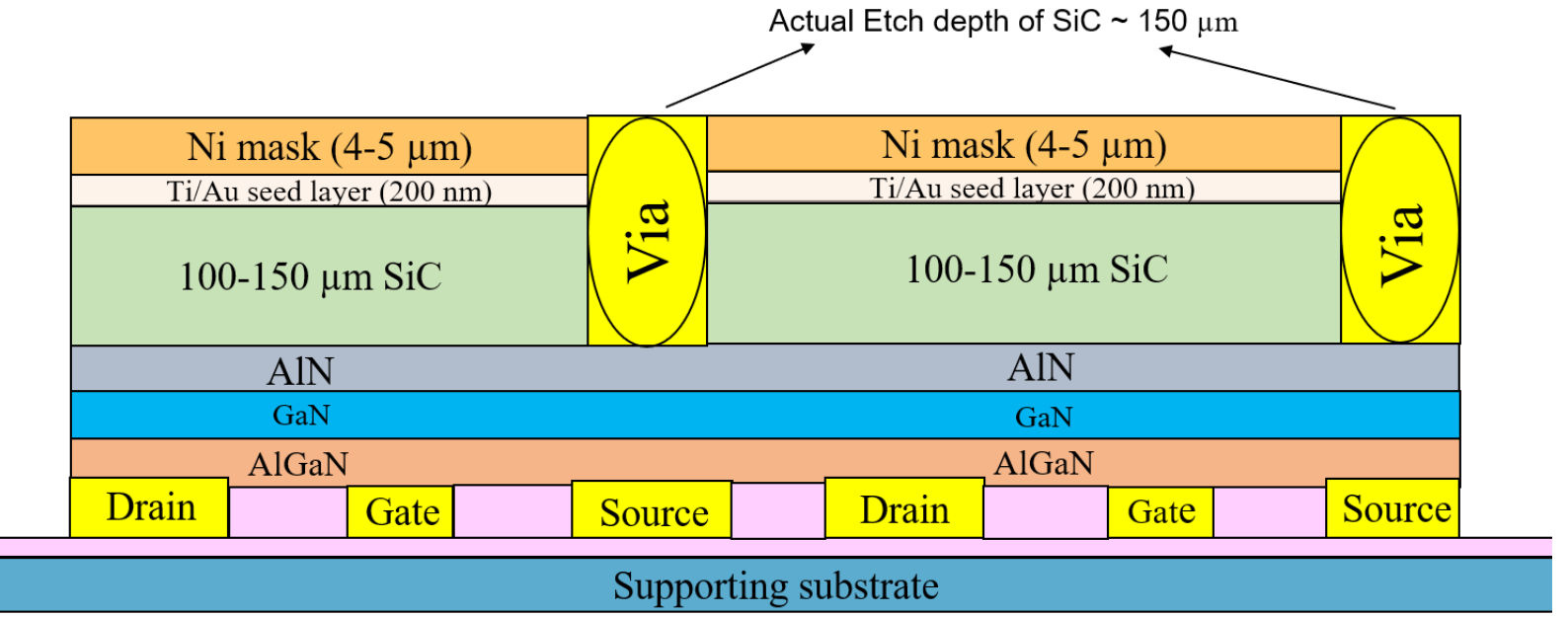


Fig. 1 Schematic of the as-grown heterostructure (Before actual fabrication) used for the process development at IITB.

Fig. 2 Schematic of the fabricated device showing the actual depth of SiC required to be etched using the



DRIE process.In the above diagram, Ni thickness can be increased to 10-15 um.

3. (b) Sample preparation for DRIE (Process description): Figure 2 shows the schematic of the final fabricated HEMT device with all the electrodes (Source, drain & Gate) and etch depth of SiC (Via) for reference. The device is fabricated on AlGaN/GaN-based heterostructure grown using MOCVD on a SiC substrate. The structure comprises a 6H-SiC substrate (~330 µm) followed by a 60 nm AlN buffer layer and a 2 µm of undoped GaN layer. The undoped GaN is followed by a thin layer of 1 nm AlN and finally, a 20 nm of AlGaN barrier layer is grown on the top.

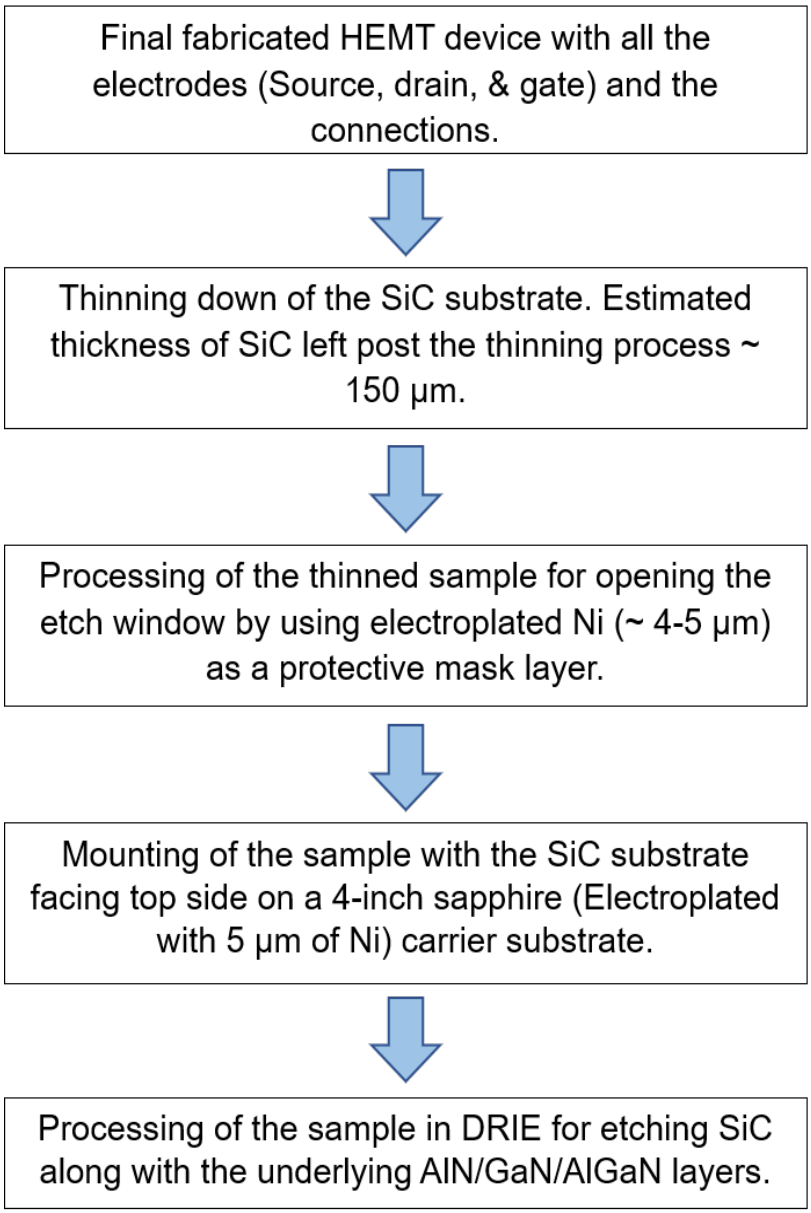


Fig. 3 Process flow for preparation of the samples required for the DRIE process post the fabrication of final HEMT devices. In the above flowchart, Ni thickness can be increased to 10-15 um.

Figure 3 shows a top to bottom approach process flow for preparation of the samples required for the DRIE process post the fabrication of final HEMT devices. As shown in the schematic in figure 2, the total etch-depth is approximate ~150 µm of SiC (~ 145-150 µm),

4. Optional Item

a. Dry gas abatement system should be quoted.

b. Additional N2 process gas line.