



CORRIGENDUM

(Amendments in Technical Specifications after Pre-Bid Conference held on 07.09.2016)

As per the IFB/ Tender Notice No. NITJ/TEQIP-II/NCB/2016/Modernizing-NITs published on 20.08.2016, a Pre-bid Conference, for 04 following machines / equipments, was held on 07.09.2016 for clarifying the issues and doubts about technical specifications and other allied technical / commercial details of the IFB / Tender document.

Category	Name of the Machine / Equipment
A	Field Emission Scanning Electron Microscope (FE-SEM) With EDS System
B	High Resolution Transmission Electron Microscope (HRTEM)
C	LCMS-MS
D	Powder X-Ray Diffraction System

In this connection, prospective bidders are requested to note the revised technical specifications before quoting the same.

The detailed technical specifications for the aforesaid machines / equipments are attached as Annexures A to D.

Others terms and conditions and schedule of receipt and opening of bids against the said IFB/ Tender shall remain the same.

Nodal Officer (Procurement)
TEQIP-II

Annexure “A”

Revised Technical Specifications for Field Emission Scanning Electron Microscope (FE-SEM) With EDS System

<p>Name of machine / equipment /item : Field Emission Scanning Electron Microscope (FE-SEM) With EDS system: High Resolution Schotkey emitter FE-SEM (Field Emission -Scanning Electron Microscope) is a high resolution scanning electron microscope which is intended for use for characterization of nano-materials both conducting and non conducting such as metal, ceramics, polymer and composite for investigating the microstructure and perform chemical analysis using Energy Dispersive X-Ray Spectroscopy (EDS).</p>	
Resolution	0.9 nm at 15KV, and 1.1 nm or better at 1 KV and 1.2 nm at 500 V in normal high vacuum Secondary Electron (SE) mode.
Magnification	100x to 10,00,000x
EHT	0.2 - 30 KV, continuously adjustable and maximum voltage should be sufficient for the highest magnification.
Chamber	Suitable chamber for accommodating a minimum sample size of 150 mm diameter with 9 accessory ports, two of them suitable for EDS attachments. Chamber design should allow changing of the specimens quickly. Holder for multiple specimens (Minimum to accommodate 5 nos of samples or more) specimen stubs 100, with two cross section holders
Stage	5 axis Eucentric motorized stage with movements equivalent to or better X= 110 mm or more Y = 80 mm or more Z = 40 mm or more Tilt = up to 70° or higher R= ±360°
Probe Current	At least 200 nA or more. High resolution to be guaranteed at highest probe current setting.
Detectors	a) Chamber Secondary electron imaging (SEI) detector. b) Annular In-lens SEI detector for high resolution imaging in high Vacuum at low KV. c) CCD-camera with IR illumination for in-chamber viewing. d) High resolution Back Scattered Detector preferably retractable with four quadrant. e) STEM for detection in transmission mode.
User Interface	Keyboard, Mouse, Control Panel with multifunction for the control and adjustment of frequently used SEM parameters, Manual Joystick control for stage axis.
Optics	1) Optics should be appropriate for scanning of lowest particle size. High resolution objective lens to observe large specimens with high resolution. 2) Optics should have final electrostatic lens or equivalent technology to image magnetic material at high resolution 3) Beam deceleration or equivalent technology must be built in for high resolution imaging at low KV.
Display	2 Nos. 21+TFT Monitors for FEG-SEM, configurable for single frame display or 4-quadrant display. Data display date, accelerating voltage, magnification, micron bar/value, film number and user comments, etc. Latest MS Windows based system (graphical user interface, key board, optical mouse). Line profile display. Comprehensive image annotation facilities with desirable fonts and colors.
Vacuum System	Suitable vacuum system having Ion pump, Turbo molecular Pump and oil free Rotary Pump for attaining required and hassle free operations. Two ion getter pumps along with the associated power supplies for the microscope column and vacuum gauges. A turbo-molecular pump backed by a two

	<p>stage dry rotary pump for the specimen chamber.</p> <p>The vacuum system should be operated with computer controlled, pneumatic operated valves with full safe protection for mains/high voltage and vacuum failures. Isolation valves for specimen chamber and high vacuum system during sample loading. Automatic venting with dry nitrogen. Seamless transition between the vacuum modes. Faster vacuum recovery after breaking for specimen exchange (less than 3 min.).</p>
Integrated EDS	Fully automated and integrated EQS system with standard sample for calibration.
EDS	<p>EDS system.</p> <p>A. EDS: LN2 free SDD detector with 50 mm or better crystal area and 127eV or better. Resolution providing reliable and accurate results over the entire spectral range B to U, at typical microscope operating condition. The EDS should be capable of selective element mapping, line scan, selected area analysis, Quantitative Analysis, Qualitative Analysis and Multipoint Analysis.</p>
Automatic electrolytic polishing and etching machine Optional	<p>I. Table top mode, no programming needs to be done.</p> <p>II. Scanning function- the machine should determine</p> <p>III. The current density curve automatically by scanning the sample at pre-defined voltage range, thereby automatically select correct polishing and etching voltage.</p> <p>IV. Mask set with 0.5, 1.2, 2.5 cm² apertures and one without aperture should be quoted.</p> <p>V. Touch pad control with minimum 128x240 dots (16x40 characters and display the parameter like current, electrolysis, temperature and elapsed polishing/etching time.</p> <p>VI. Facility to set a temperature limit for electrolyte at which the cooling is started automatically and the cooling should stop as soon as the electrolyte is cooled to the same limit.</p> <p>VII. There should be facility to connect the polishing unit to an external cooling unit.</p> <p>OUTPUT VOLTAGE / CURRENT SPECIFICATIONS</p> <p>Polishing 0-100 V (1V steps)/6A</p> <p>Etching 0-25V (0.5V steps)/6A</p> <p>External Etching 0-15V (0.5V steps)/1.5A</p> <p>Image processing : Resolution 3072x3024 pixel or better, Continuous averaging up to 256 frames Line averaging upto 256 frames</p>
Work station and computer	<p>Graphical user interface with Windows 7 or 8, microscope control software, DVD or hard disk in various formats (TIFF, JPG, BMP, etc.). The microscope should be controlled from Window 7 or 8 graphical user interface running at a 1280x1024 screen resolution.</p> <p>The workstation should include a 21" LCD/LED monitor, and standard keyboard and optical mouse. Branded desktop PC with following configurations: 3 GHz or higher speed Intel Pentium i7 Processor, 8 GB RAM, 1 TB hard disk, original Intel motherboard, DVD RW, 3 button scroll optical mouse with pad and standard keyboard on USB, 1 serial port, 1 parallel port, 4 USB ports (3.0) rear side, 4 USB ports (3.0) front side, 10/100/1000 Gigabyte NIC, additional bays to increase HOD capacity. Microsoft Windows 7 or 8 operating system and MS Office 2010.</p>
Printer	Color photo laser jet printer with a minimum resolution of 1200 x 1200 dpi. High quality photo laser jet duplex printer (min 18 pages per minute) for image and report printing suited for A4 size paper.
Software	Original licensed software for the comprehensive operation of the microscope, computer, motorized stage / stage control, CCD camera and vacuum interlocks. Software for acquiring SSE and SE images. The software should be embedded in the microscope control software. Latest

	version of Microsoft Office utility.
Calibration	Accessories (standards) for calibration of magnifications, dimensional and resolution.
FESEM Table	Anti-vibration table for chamber, the microscope column and support for monitor, optical mouse, keyboard.
Supporting Tools	Specimen handling tools, stage tools and specimen preparation Tools materials and general tools maintenance of FE-SEM. Conductive carbon tapes of 20m to be provided.
Application notes	The supplier shall provide detailed application notes of FESEM and EDS systems in hard and soft copies.
Table, chair and cupboard	The firm should supply good quality chairs (4 Nos.), Table (one) and Cupboard (One) for storage of the tool, spares, manuals and accessories.
Essential Accessories	i) IRCCD camera ii) Suitable chiller with air circulating system. iii) Compressor iv) Interface between SEM and EDS v) UPS 60 KVA (of standard make such as Emersion Libert, etc) with atleast 2 hour back up with full load. vi) 4 Nos. Spare Filaments as and when required and one filament with machine vii) Combined/Separate Sputtering Carbon and gold coating system.
Manuals	Detailed user instruction manual, operation I instruction manual, trouble shooting manual, CD ROM tutorials for FESEM and EDS. Detailed circuit and fault diagnostic Software, detailed circuit diagram of the equipment (FESEM and EDS), maintenance and service manual should be provided in soft and hard copy.
	Standard operating procedure for each mode (SE, BSE, In lens) including sample mounting should be given separately.
Acceptance criteria	Different types of standard samples to be provided by the company for imaging and EDS analysis.
Recommended essential spares	Quote should also be submitted for recommended essential spares and consumables for uninterrupted operation of the equipment for ten years.
Installation	Site Preparation (Vibration Free Platform for FESEM) should be carried out by the vendor

Annexure “B”

Revised Technical Specifications for High Resolution Transmission Electron Microscope (HRTEM)

Name of machine / equipment /item: High Resolution Transmission Electron Microscope (HRTEM) -High Resolution PC controlled Analytical 200 KV Transmission Electron Microscope with CMOS camera, STEM with bright and dark field imaging, and Energy dispersive X-Ray Micro analysis system. The TEM should allow upgradation to allow an Energy loss spectrometer for elemental analysis with mapping to be added at a later date.

ITEM	Description*
Point resolution	0.25nm or better
Lattice resolution	0.14nm or better
Focal length	1.9mm
Cs	0.5mm
Cc	1.1mm
Focus step	1.0 mm minimum
Acceleration voltage	20-200 KV
Specimen Stage	Type: side entry eucentric goniometer with motorized movements XV Movement: 2mm or more Tilt (XIV): $\pm 30^\circ/\pm 30^\circ$ or better
Magnification	x50-1,500,000 or higher
Specimen tilt	With motorized tilting ± 300 or better with 3.0mm grid
Essential features	<ul style="list-style-type: none"> • Pre-centered single crystal LaB₆ cathode • Anti-contamination device • Peizo Controlled stage movement • Minimum dose system for imaging beam sensitive specimens • Anti vibration air mount for the column • Optimized optical settings to carry out TEM, EDS, Convergent beam diffraction and Nano beam diffraction should be available at a click of a button. The choice to select these modes manually and through the software must be available. • Minimum Spot Size: 1nm or less at TEM mode, 0.5nm or less at EDS, CBD and NBD mode • Stability for Accelerating Voltage: 2 ppm/min. (peak to peak) or better • Convergent Angle for CBED: 1.5 to 20 mrad or more • Acceptance Angle for CBED: $\pm 10^\circ$ or more • Aperture to protect EDS detector from

	scattered X-ray, reducing system noise and enhancing PB ratio
STEM Attachment	<p>Digital STEM with Bright field and High Angle Annular Dark Field Imaging is needed. The STEM specifications are as follows:</p> <p>Resolution STEM image: 0.2nm or better</p> <p>Acceleration voltage: 80, 100, 120, 160, 200, KV</p> <p>Magnification Low Mag:</p> <p>Low Mag: 100x to 15,000x or better</p> <p>Mag: 20,000x to 2,000,000x</p> <p>Scanning system</p> <p>Scanning modes: Digital scan Image scan Line scan Spot Externally controlled scan</p> <p>Image display</p> <p>Image display method: Frame memory (digital)</p> <p>Image observation device: TEM basic unit monitor</p> <p>Image recording device: TEM basic unit PC hard disk</p> <p>Detector: Transmitted electron detector, Scintillator and PMT (Photomultiplier tube)</p>
Accessories	<p>The following accessories should be quoted as standard with the system:</p> <ul style="list-style-type: none"> • A low background Beryllium holder • A specimen cooling holder for low dose or beam sensitive specimen samples like polymers • 4K/4K or better CMOS camera (Bottom mounted). • Beam selection feasibility • SAED option • HAADF option
EDS Microanalyser System	<ul style="list-style-type: none"> • EDS system with 50mm² • SDD (Silicon Drift Detector)
Calibration standards	<p>Standard samples to check system calibration i.e., magnification and camera length should be supplied along with the system, including TEM Standard Au/any other standard sample for TEM resolution, Standard sample for magnification calibration and orientation calibration, STEM Standard Si 110</p>

	dumbbells for STEM resolution, Mn standard for EDS energy resolution
Tool kit	Suitable and essential tool kit is to be supplied with the system for the required maintenance.
Spares, consumables and accessories	All essential spares should be included in the offer. The spares should include emitter (1 No.), two sets of all O-rings, one set of all kinds of valves, a set of screws used in different specimen holders, and all types of consumables. Any cylinders and regulators for gases (such as argon, N ₂) to be used with the instrument or accessories to be provided by the vendor. The supplier should guarantee that all spares should be available for 10 years from the date of installation.
Other accessories and consumables	TEM Grids Acid resistant High precision tweezer. High precision Titanium tweezers (10 no.) Anti-capillary tweezers (10 straight, 10 self-closing) TEM grids (should have one shiny and one matte finish side, all are between 200-300 mesh) (1) carbon coated holey grids (2000 nos).
Display and output	Two larger than 21 high definition monitor(s) for HRTEM operation for split display of image recording/processing, and EDS analyses. One Color Laser Printer and one B/W laser printer (both with photocopy/scanning facility) should be provided.
CPU and software	Latest compatible branded high speed computer (i7) with pre-loaded licensed software for all operating parameters. Specify computer speed, processor, RAM and graphics card. All the computers for HRTEM must be imported /factory fitted and tested with pre-loaded softwares for operating these systems. All softwares used to operate the instrument, acquire and process the data should be licensed and should be factory preloaded. Include an in-situ video software that synchronizes images with data from in-situ devices. Include software that automates adjustment of focus, astigmatism, and misalignment. Include a software for stage and optics control so that one can seamlessly stitch images together. Include a software that facilitate acquiring HREM assays by automatically adjusting the critical imaging parameters of a TEM microscope focus, stigmatism and beam tilt. Include a diffraction analysis software package to automate the selection area of electron diffraction (SAED) patterns and high resolution lattice images of crystalline samples. All software should preferably be from a single supplier for seamless performance. Software for stimulation and magnetic property studies Three no. of offline versions of all softwares

	should be included. A separate PC (with HD monitor) and a laptop with touch screen having all loaded software should be provided.
Safety Devices	The TEM should be equipped with self-diagnostic functions to detect problems like pneumatic pressure abnormality, cooling water temperature abnormality, reservoir tank pressure abnormality, etc.
Installation/ power requirements	All the prerequisites for installation of sample preparation facilities have to be quoted. Institute will only provide electricity at single or three phase 220V, 50Hz, normal quality water and space. Site preparation (vibration free platform for TEM) should be carried out by the vendor.
Recommended essential spares	Quote should also be submitted for recommended essential spares and consumables for uninterrupted operation of the equipment for 10 years.
AMC and Service Support For section A and B	<p>In addition different software features should be provided to the users by the vendor; trained engineers at the convenience of NIT Jalandhar, after the satisfactory installation of the instrument and its accessories. Necessary documents, operational & system manual in the form of CD and hardcopy for all equipments and accessories must be supplied with the system. Service response time, turn-around time & up-time of the equipment should be clearly specified. Service response time must be less than 72 hours.</p> <p>The HRTEM must have provision for on-line diagnosis of faults.</p> <p>Suitable service facility for computer hardware or software related problems should also be provided.</p> <p>Upgradation of all the software has to be supplied free of cost as and when it is upgraded within 10 years of microscope supply.</p> <p>The spare parts should be available up to 10 years from the date of installation.</p>

Revised Technical Specifications for LCMS-MS

Name of machine / equipment /item: High-resolution Mass spectrometry workstation (LCMS/MS) for small molecules and proteomics studies with a Quadrupole time of flight mass spectrometer workstation for exact mass and true isotopic measurements with the following capabilities and features. Vendors will have to make arrangements for all the other accessories, infrastructure including UPS, etc. essential for the successful operation of the equipment. Installation certificate will be issued only after satisfactory working of the instrument (Demo of all the modules) & on site training to NIT Jalandhar Staff and Students. The instrument will consist of Ion source API (ESI /APCI), mass analyzers (Quadrupole and TOF/High Resolution mass analyzer) and data analyzing system.

Ion Source:

- The instrument must be equipped with an atmospheric pressure ionization (API) interface that includes the source and spraying elements. Separate dedicated/combined/multimode ESI and APCI should be provided with the system.
- Cleaning of source elements should be done without breaking instrument vacuum, maximizing instrument uptime.
- Sample introduction by UPLC/UHPLC with mechanism to clean the sample, remove the neutrals and contaminants.
- System should have the capability of easy switching between ESI and APCI without breaking the vacuum.

Ionization Sources:

- The workstation should include separate dedicated/combined/multimode electro spray ionization (ESI) and atmospheric pressure chemical ionization (APCI) capabilities; to allow analysis of polar and non-polar compounds.
- ESI and APCI Source should be capable of handling flow rates up to 2 ml/min or better.
- The instrument must include a standard feature, to facilitate automated exact mass measurements on real time scale.

Mass Analyzer:

Mass Analyzer should be equipped with quadrupole analyzer and collision cell followed by equivalent high resolution mass analyzer/Time of flight mass analyzer system with the below mentioned capabilities:

High Mass Quadrupole Mass Filter:

System should have quadrupole mass filter equipped with stable design and RF-generator as well as High resolution mass capability.

High-transmission CID collision cell:

CID collision cell should be fast and efficient enabling information-rich fragmentation.

Orthogonal time of flight Mass Analyzer/Equivalent High resolution mass analyzer:

TOF analyzer/Equivalent High resolution mass analyzer with orthogonal mounted ion source and ion reflectron with increased mass resolution & accuracy. It should have positive and negative ion modes.

Sensitivity:

- For full scan MS sensitivity for 1pg on column injection of reserpine should produce signal to noise ratio > 500:1 or higher.

TOF Mass Analyzer:

- The TOF/Equivalent HRMS mass range should be 100 to 10,000 m/z or better.
- The Quadrupole mass range 2000 m/z or better.
- Mass accuracy in MS or MS/MS mode should be < 2 ppm or better.
- Spectral acquisition rate in both MS and MS/MS mode should be 30 spectra/seconds or 12 Hz/sec.
- Quoted system should be capable of providing the resolution up to 35000 FWHM or better in MS and MS/MS mode.

Analysis:

- The workstation should offer a broad mass range for multiple charged molecules, i.e., for intact molecular weight determination.
- For small molecule and sequence tag analysis.
- The workstation should be capable of doing quantitative acquisitions with a linear dynamic range of at least five orders of magnitude.
- UHPLC and MS quoted should be manufactured by the same vendor for efficient performance and compatibility.

Computer Software and Hardware:

The workstation should be supplied with:

- Suitable computer workstations and all interfacing hardware and software for instrument control, data acquisition, data storage and data processing.
- Software suite(s) for data acquisition and control of Mass spectrometry.
- The MS control software must have the ability to control both the MS and specified Liquid Chromatography devices.

Multitasking suite of analytical applications and instrument management software operating in Microsoft Windows environment, featuring graphical user interface with multiple windows includes:

- a) Mass Spectrometer Control Software
- b) Spectrum Review and Processing
- c) Chromatogram Review and Processing

Component Identification:

Software to automatically process complex chromatographic datasets composed of many components which may be incompletely separated from one another.

UPLC/UHPLC System:

Quaternary gradient pump UPLC/UHPLC equipped with: vacuum degasser, autosampler, column oven, PDA/DAD detector and 5 number of C18 & C8 RP columns (sub 2 micron size 150 mm length 2.1 mm ID) should be quoted.

The complete UHPLC and MS system should be controlled by single software

Pump:

- UHPLC/UPLC system should have high performance quaternary pump with on-line

vacuum degasser.

- Flow Range: 0.001 to 2.0 mL/min with 0.001 mL/min increment.
- Operating Pressure: Pump should be able to handling the pressure of 15000 psi at 0-1 mL/min or better and ramping.
- Flow Rate precision: 0.075% psi
- Composition precision: <0.2% RSD or 0.02 min SD, whatever is greater.
- Composition accuracy: ± 0.5 % absolute.

Auto Sampler/Sample Manager System:

- Sample temperature must be in the range of 4 - 40°C or better
- Sample capacity should be 80 samples or better.

Column compartment:

- Column temperature range should be from ambient to 80°C or better.

PDA/DAD detector:

- Should be provided with standard flow cell with flow volume of 0.5 L or better.
- Detector type: 512/1024 element diode array
- Light source: Deuterium
- Drift: $< 1 \times 10^{-3}$ AU/h at 230 nm
- Linearity: > 2.0 AU (5%) at 265 nm
- Wavelength Range: 190 ó 800 nm

Pre Requisite for Running the Workstation:

The equipment must be supplied with branded Gas generators suitable for supply of all the gases required by all of the Workstation's components. Any cylinders, regulators, moisture/hydrocarbon traps required in addition must be quoted separately.

- Two 2 ton capacity branded split AC's with 4 star energy rating or better.
- Appropriate 15 KVA online UPS cum stabilizer with at least 1 hour backup.
- Laser Jet Printer (Color) should also be quoted with the system.
- A suitable branded gas generator with built-in compressor capable of providing all the gases at the required purity, pressure and flow rate for the Mass Spectrometer must be quoted. The compressor should be noise-free.
- Appropriate and clear specifications with respect to UPS and other power supplies requirements must be mentioned in the quotations.
- Appropriate and clear specifications with respect to PC(s), (LCD) Monitor(s), etc. must be mention in the quotations.
- Consumables for one year should be quoted by the vendor in optional items.
- If the PC(s), (LCD) Monitor(s), etc. are integral parts of the equipment, it must be mentioned clearly in the quotation.
- Pre requisite for the Mass Spectrometer:
Any other gas cylinder (if any mention) as local Items for the working of the system and UPS should be quoted.

Revised Technical Specifications for Powder X-Ray Diffraction System

Name of machine / equipment /item: Powder X-Ray Diffraction System: The system supplied should be primarily designed for performing x-ray diffraction on powder samples, having sealed tube x-ray source and theta-theta goniometer for horizontal sample mounting in a Bragg-Brentano focusing geometry. The entire system should be provided with the following specifications:

Scope of Supply

X-ray diffraction system is a complete stand alone unit consisting of:

- X-ray generator
- X-ray tube
- Diffractometer
 - Goniometer (vertical/horizontal axis)
 - Detectors for the system
 - Monochromator
 - Slits/ filters
 - Sample stage
- Low temperature attachment
- Software/ Computer/ Printer
- ICDD and ICSD database
- Safety protection systems
- Water chiller for the machine operation
- Other requirements

Technical Specifications

X-ray Generator

- Maximum output power :~ 3.0KW
- Maximum high voltage :~ 50KV
- Maximum current :~ 60mA
- Output Stability :~ Voltage and current stability of $\pm 0.05\%$ or better (for 10% input power supply fluctuations)
- Power of the generator (voltage and current) should be software controlled. The software should be installed in the computer, provided with the system.

X-ray tube

- 1) Copper anode tube: (1 No.)
- Water cooled x-ray source should be sealed ceramic/ glass x-ray tube of the following material:
 - Copper (Cu) X-ray tube
 - Power requirement: 2.0 KW or better
 - It should be line focus and point focus in the same tube.

Diffractometer

Goniometer

- Type : Vertical scanning (Horizontal axis) type - geometry
- Geometry : Bragg Brentano Focusing geometry

- Scan Mode :
 1. - coupled mode
(Incident and detector arms should be coupled so that the and movement should be in the ratio of 1:2)
 2. and 2 independent mode
 3. Continuous scan mode
 4. Step scan mode

- Lowest Scanning speed : $\leq 0.05^\circ/\text{min}$
- Highest scanning speed : $\leq 20^\circ/\text{min}$
- Goniometer Radius : ≤ 250 mm (but not exceeding 350 mm)
- Scan range of 2θ : -90° to 160° or better
- Angle positioning : Optical encoders for positioning the goniometer
- Smallest addressable increment (2θ circle) : 0.001° or better
- Smallest addressable increment (θ circle) : 0.0001° or better
- Different modes of scanning, range of scanning, scanning speed and the scanning step (increment) should be software controlled.
- The software for these scanning details should be available on the company supplied computer provided with system.
- Goniometer along with the above specifications should include following components mounted on its arms:

Detectors for the system

Solid state fast detector (2-d detector with provision of 0 and 1 d) with count rate 10^6 cps/strip or better (1 No.)

Monochromator (If required)

- Monochromator should be single crystal Graphite (002) or equivalent.
- The Monochromator should be aligned with the scintillation detector. There should be a provision to remove the monochromator when the position sensitive detector is to be used.
- Energy resolution of the Monochromator should be better than 6.5% at 8 KeV, for the removal of K radiation along with the removal of fluorescent background.
- It should be usable for both Copper K and molybdenum K radiations.
- Monochromator should be mounted on the exit arm at Bragg angle of the monochromator crystal plane and the mounting should be such that it remains always aligned and hence there should be no necessity to align the monochromator frequently.

Slits and Filters

- Necessary optics to include the divergence, antiscatter, receiving slit, soller slit arrangements for powder X-ray diffraction.
- 5 or more slits should be provided which covers the range of 0.01 mm to 7 mm pc controlled.
- Suitable filter for removing K signal should be provided for Cu and Mo anodes separately.

Sample stage

- Standard sample stage and sample spinning stage with speed in the range of 60-120 rpm
- Size of the sample holder should be such that a sample of at least 20 mm diameter or more could be mounted easily.

- Sample holders for mounting powder samples with a groove of 5/10/20 mm in diameter (05 Nos.).
- Auto sampler with 8 stage or more.
- Single suitable optics and software for thin film and nanomaterial analysis,
- Sample holder for performing X-ray diffraction measurements on thin film samples (2 Nos.)
- Zero background sample holder e.g. Si/quartz single crystal or equivalent for performing XRD measurement on small sample amount/size (~1-2mm³) with cavity.

Software/ Computer /Printer/UPS

- Windows based PC for software on a preloaded computer which along with the software control of the functions the software provided with the system, should be capable of performing following tasks:
 - Data acquisition and analysis which includes automatic and manual peak finding.
 - Background subtraction, K₂ stripping, search match etc.
 - Data acquisition and control of the temperature should be software controlled.
 - 10 Nos. license of XRD analysis software should be coated.
 - All this software should be provided as backup drive.
 - Printer: colour laserjet duplex printer with a minimum resolution of 1200 x 1200 dpi, for image and report printing suited for A-4 size paper.
 - UPS: 60KVA of standard make such as Emerson Libert, etc. with minimum 2 hrs back up.

ICDD and ICSD Database

- PDF2, with license should be provided
- ICSD database should be provided
- Automatic search and match routines for identification of phases should be provided
- The data processing routine software for identification of accurate peak positions, background and profile parameters should be provided.

Six (06) Nos. Air Conditioners (4-star rating with timer) should be quoted.

Safety protection system

Personal safety

- Radiation enclosure with interlocking mechanism should be provided.
- Radiation outside the radiation enclosure be less than 1μSv/hr.
- The doors of the radiation enclosure should be such that X-rays can be generated only after the door is closed.

Instrument safety

- All the necessary interlocks should be provided for X-ray tube protection and 24 hrs of continuous machine operation.
- Emergency stop switch should be provided.
- Indicators should be provided to display that xX-ray is on.
- All the interlocks with respect to the water flow, water temperature etc. should be provided

Water chiller for XRD machine

Supplier should quote for suitable chiller according to the cooling requirement of the machine.

Voltage and frequency of operation: (single phase) 220V (+/-10%)/50Hz (+/-1Hz)

Other requirements

Acceptance criteria

1. The company should send the XRD patterns of the NIST standard samples, recorded on the machine after the fabrication of the system at the factory. Subsequently, they should demonstrate the same parameters after the installation of the machine at NIT Jalandhar. The set of NIST standard samples should be provided by the company.

2. To check the temperatures, company should send XRD patterns of the standard samples, recorded on the machine after the fabrication of the system at the factory, at the temperatures specified by the users. Subsequently, they should demonstrate the same parameters/temperatures on the same samples after the installation of the machine at NIT Jalandhar. These set of standard samples which shows well defined transition temperatures, for testing the temperature, should be provided by the company.

Documentation and warranty

All the documents should be provided in English.

1. Complete set of manuals on operation of all the components of the system in hard as well as soft copy.
2. Hard and soft copy of all manuals of sub-systems.
3. Alignment procedure and hardware setting should be clearly given.

Essentials spares and consumables

1. Tool kit with all mechanical tools and accessories necessary for the system installation and regular operation should be provided.
2. Tool kit for onsite 2 and alignments should also be provided.
3. Necessary spares and consumables required for smooth and efficient operation of X-ray generator and goniometer for five years should be quoted.

Note: The spares and support from the supplier should be available for 7 or more years from the date of installation and commissioning of the quoted model.