DETAILED SPECIFICATIONS FOR FIELD EMISSION SCANNING ELECTRON MICROSCOPE with EDS andEBSD

Essential Specifications:

FESEM instrument must be the state of art, computer controlled user friendly system for high resolution imaging of metallic, non-metallic, ceramics, crystals, thin films, polymers, metal oxides etc. of micro to nano scale dimensions, which will be either coated/uncoated while imaging. The FESEM should have EDS and EBSD capability. The FESEM, EDS and EBSD must have the following technical specification:

Specifications:

1.	Resolution	At least 1.2nm at 30 kV or 1.5 nm at 15 kV and 3.0 nm at 1 kV) The definition of resolution and the method used to determine the same should be specified.
2.	Magnification	X20 (or lower) to X1000,000 (or higher)
3.	Acceleration Voltage	0.2 to 30 kV (or better)
4.	Chamber	Large chamber with at least 7 accessory ports. Anti-vibration table must be inbuilt.
5.	Stage	4 axes (preferably 5 – axes) motorized eucentric stage.Movements equivalent to or better X ≥ 50 mm Y ≥ 50mm Z ≥ 25 mm Tilt = -10^{o} (orlower) to70° (orhigher) R= 0 - 360° Control of stage movement should be through both computer and manual with joystick. Store and recall of sample position functions to select features, centre and zoom selected feature, multidirectional stage drive, compucentric rotation
6.	Probe Current	At least 100nA or more (200 nA preferable).
7.	Detectors	a) High sensitiveEverhart-ThornleySE detector b) In-Lens SEI detector for high resolution imaging in High Vacuum at low kV. c) IRCCD camera d) High resolution state of art back scattered detector (BCD)
8.	Electron Gun	Field emission gun with Schottky field emitter source

9.	User Interface	Keyboard, Mouse, Control Panel with multifunction for the control and adjustment of frequently used SEM parameters, Manual Joystick control for stage axis.
10.	Electron Optics	Beam deceleration technology or equivalent for high resolution imaging at low kV. Ease of operation is desired.
11.	Vacuum System	a. Suitable vacuum system equipped with ion pumps, turbo-molecular pump & rotary pump. b. Chamber pressure better than 10^{-4} Pa / 4 x 10^{-6} mbar c. Pump down time should be less than 5 min
12.	Digital imaging and processing	It should have the following capabilities: a. Design of the imaging and processing should be optimized for field emission scanning electron microscopy b. Image Frame Size: Selectable up to pixel density of 4096 x 3536 or better c. Frame averaging for up to at least 250 frames d. Line averaging for up to at least 250 lines e. Combination of Pixel and Frame averaging f. Combination of Pixel and Line averaging g. Image post-processing h. 4 detector inputs and signal mixing or above, extendable up to 8 detector inputs **Image Display** a. 22” high end TFT flat screen or better b. Standard data zone includes magnification, working distance, EHT, scalebar and date Custom data zone c. Multiple point-to-point and line width measurement systems freelyadjustable for orientation d. Line profile display e. Images can be viewed live, averaged or integrated **Image Storage** a. 1 TB hard disk or better b. Front panel USB ports. CD/DVD recorder c. Storage of SEM images on hard disk in standard TIFF, BMP, orJPEG Formats and in 8-bit or 16-bit depth d. Operating conditions easily stored and file management through Microsoft® Windows operating system
13.	Essential Accessories	a. Chiller. b. Compressor. c. Interface amongFESEM, EDS and EBSD.

		d. 3 Spare Filaments (These filaments should be supplied without any additional cost as and when they are required. It is the responsibility of the supplier to store the filaments and provide it within a short period time.) e. 20 number of single stubs and 10number of multiple sample holders
14.	Integrated EDS &EBSD	
	EDS	Integrated EDS system a. LN2 Free SDD detector with 30mm^2 crystal area and 130 eV resolution or better. b. The elements detection range should be from Beryllium (Be) to Uranium (U). c. The EDS should be capable of selective element mapping, line scan, selected area analysis, quantitative analysis, qualitative analysis, multipoint analysis. d. The provided EDS system should have the capability to be upgraded to WDS for future research requirements. e. Supplied EDS server & analysis software should be capable of performing data acquisition, storing and transfer in common Windows based application format, qualitative & quantitative analysis, line scanning, elemental or dot-mapping (area) including spectrum imaging and phase mapping with specimen drift correction. f. All these capabilities should be applicable for polished flat specimens, fractured samples and nanostructured particulate systems. g. User interactive qualitative and standard less/ standards based quantification with K, L, M, N line database. Real time elemental mapping with auto elemental identification, quantification based on ZAF, PhiZAF. Should have quantification algorithm for uneven surfaces and under tilted conditions h. Pile up correction and background noise reduction, simultaneous imaging and analysis should be possible. i. Thin film analysis software with nanometer scale resolution in both space and depth capabilities should be quoted.
	EBSD	a. The EBSD system should work on the same computer platform as that of EDS system. b. The EBSD camera system should be highly sensitive one to cater to Nano-area analysis application.

		c. It should have a high speed camera with high resolution for EBSD with indexing speed of 650 frames per second or better. d. The EBSD camera should have motorized insertion and retraction mechanism with remote control digital handset. The position accuracy should be at least 0.1^0 or less. e. The camera movement should have audible safety alarm with auto retract mechanism. f. The camera interface to SEM should have sliding and tilting interface plate to correctly position the camera at the shortest possible EBSD EDS for optimal special resolution. g. The EBSD Software should be capable and configurable for Transmission Kikuchi pattern acquisition, indexing and all post processing studies at a later date. h. The EBSD software should be ready to allow data acquisition from large areas using beam/stage control to maintain focus over each mapped field to reconstruct large area Maps. i. Two additional analysis software licences should be provided. j. The EBSD camera should be equipped with 4 forward scattering diodes as imaging detectors to acquire images with atomic and orientation contrast. k. A transmission EBSD holder has to be provided. l. It should have high indexing rate at 5kV or less. m. The system software should include following features:- i. Data Acquisition Software ii. Phase Reflector File Creation Software iii. Pole Figure Software iv. Mapping Software v. ODF Software vi. Imaging and Beam Control Software vii. Stage Control Software viii. Phase Identification Software ix. -- ICSD Data Base
15	STEM	a. The scanning transmission electron microscope (STEM) detector should be capable of detecting bright-field (BF) and dark-field (DF) signals generated by a thin specimen. b. The detector must be automatically inserted into the chamber by a pneumatically driven mechanism. c. The device should consist of a multi hole sample holder,

		and separate diodes for the BF and DF detection. d. Switching between BF and DF detection mode must be possible at any position of the sample. e. The generated signals should be mixed using the GUI.
16.	Future Upgradability	• The specimen chamber should be large and compatible to accommodate other detectors such as WDS, CLD and e-beam lithography system for future requirements (all these must be field installable) without any additional interfacing accessories.
17.	Warranty, Training and Support	a. Three years comprehensive warranty (not including the down time) must be included along with the bid/offer separately. b. Warranty should start from date of installation. c. Service response time, turn-around time & up-time of the equipment should be clearly specified. d. Necessary on-site training must be provided. e. Service response time must be 48 hours. f. The FESEM must have provision for on-line diagnosis of faults.
18.	Required Documents along with technical specifications	For the equipment quoted, the supplier must provide: a. List of at least 5 users in India, with (exactly) similar systems installed preferably in last 5 years. b. The name(s) of the service engineer(s) employed by them who is/are competent to service the equipment being quoted with their locations in India. c. The supplier should provide calibration/traceability certificate of the equipment as per National institute of Standards & Technology (NIST)/National Physical Laboratory (NPL) UK / United Kingdom Accreditation System (UKAS) preferably.
19.	Terms and Conditions	The manufacturing date of the FESEM should be after the order is placed.
20.	Pre-installation requirements	a. Pre-installation requirements such as room size, tolerable limits of EM field and vibration (mechanical), required power rating; utility requirements are to be stated clearly, and to be verified/surveyed by the supplier at the installation site. b. It is the supplier's responsibility to clearly provide details of the above mentioned requirements before 120 days of delivery of the equipment. c. Consumables for 3 years (option) d. UPS specification and requirement should clearly

		specified
21.	Environmental requirements	a. Necessary environmental requirements, i.e., temperature, humidity etc. during the operation of FESEM/EDS system should be specified clearly. b. The operator should be not only trained in operating but also know the installation requirements for smooth uninterrupted functioning of the FESEM
22.	Compliance Statement	a. The supplier must submit technical brochures and proper application notes adequately explaining and confirming the availability of the features in the model of the equipment being quoted. b. Compliance statement needs to be provided by vendors clearly specifying COMPLY/DO NOT COMPLY for all items with remarks. c. Features not matching must be clearly indicated.
23.	Options	Any additional attachments can be quoted as an optional item.