



UNIVERSITY OF ENGINEERING & TECHNOLOGY, LAHORE

CENTRE FOR NANOTECHNOLOGY & ADVANCED MATERIALS RESEARCH TENDER NOTICE

Sealed proposal on single stage two envelope basis (technical & financial proposals) are hereby invited by the University of Engineering and Technology, Lahore from the authorized dealers distributors or suppliers etc, in accordance with the specification attached with Tender Document for supply of the following equipment on C&F Basis.

The proposals Tender documents can be obtained from the day of publishing of advertisement on PPRA Website from the office of the undersigned during office hours **(08:00 am to 04:00 pm)** on production of tender fee receipt of **Rs. 3500/-** (Non-Refundable) deposited in the University Main Account No. **553-33** maintained with Habib Bank Ltd., Engineering University Branch Lahore, copy of the bidding documents is available for information and can also be downloaded from the university website. In case the bidding documents are downloaded from website, the required cost of the bidding documents shall be paid/deposited in UET Account No. **553-33** with HBL, Engineering University Branch Lahore at the time of submission of bids.

List of Equipment		
1. Focused Ion Beam Scanning Electron Microscope (FIB-SEM)	6. Ion Beam Milling Machine (IBM)	10. Low Speed Precision Saw
2. High-Resolution Transmission Electron Microscope (HR-TEM)	7. Twin Jet Electrolytic Polisher	11. Abrasive Cut off Machine
3. Scanning Electron Microscope (E-SEM)	8. Nano Indenter/Atomic Force Microscope (AFM)	12. Mounting Press
4. Optical Microscopes	8. Chemical Vapor Deposition (CVD)	13. Grinding and polishing Machines (Twin disk)
5. X-Ray Diffractometer (XRD)	9. Thermal Evaporator with Glove Box	

The Bid security/earnest Money @ **2%** of the estimated cost in shape of call deposit receipt in the name of Treasurer, UET Lahore is required to be submitted along with the Proposal/Tender, otherwise the offer shall be rejected for being non-responsive.

The last date for submission of tenders is **26-12-2017** at **10:00 AM**. The Proposals/Tenders will be opened on same day at **10:30 PM** in the Conference Hall adjacent to Vice Chancellor Office by the Central Procurement Cell in the presence of the bidders or their authorized agent who may wish to attend.

- The registered firms/companies under GST and of good repute are eligible to participate.
- No telephonic/telegraphic/email/faxed tender is acceptable.
- Procurement shall be governed by the PPRA Rules-2014 (amended up to 2017)


DIRECTOR

Center for Nanotechnology & Advanced
Materials Research (CNAMR)
UET, Lahore.

UNIVERSITY OF ENGINEERING & TECHNOLOGY, LAHORE



TENDER DOCUMENT

FOR THE PURCHASE OF

**LAB EQUIPMENT
ON C&F BASE**

For

**CENTER FOR NANOTECHNOLOGY AND ADVANCED MATERIALS
RESEARCH, UNIVERSITY OF ENGINEERING & TECHNOLOGY, GT
ROAD, LAHORE.**

REQUEST FOR PROPOSAL-2017

TENDER PRICE: Rs. 3,500/-

Issue date: / / 2017

Last date of submission: 26 / 12 / 2017 till 10:00 AM

FOR OFFICE USE ONLY

<p>Serial No. _____</p> <p>Sold to: -</p> <p>M/S _____</p> <p>Date of Sale _____ Bank Challan No.</p> <p>Date _____</p>

**CENTER FOR NANOTECHNOLOGY AND ADVANCED MATERIALS
RESEARCH, UNIVERSITY OF ENGINEERING & TECHNOLOGY, GT
ROAD, LAHORE.**

A. Malik

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1 Invitation to Bid:

University of Engineering and Technology (UET), Lahore intends to purchase & deploy the equipment in the “**Center for Nanotechnology and Advanced Materials Research**”. UET invites the bids for the equipment from registered Firms responsible for delivery & installation of equipment at university of Engineering and Technology, Lahore according to the specifications given in the Lots as follows:

- Lot 1:** Focused Ion Beam-Scanning Electron Microscope (FIB-SEM),
High-Resolution Transmission Electron Microscope (HR-TEM), (Annexure A)
- Lot 2:** Scanning Electron Microscope (E-SEM) (Annexure B)
- Lot 3:** Optical Microscopes (Annexure C)
- Lot 4:** X-Ray Diffractometer (XRD), (Annexure D)
- Lot 5:** TEM sample preparation equipment (Ion Beam Milling Machine, Twin Jet
Electrolytic Polisher) (Annexure E)
- LOT 6:** Nano Indenter/Atomic Force Microscope (AFM), (Annexure F)
- LOT 7:** Chemical Vapor Deposition (CVD) Equipment (Annexure G)
- LOT 8:** Thermal Evaporator with Glove Box (Annexure H)
- LOT 9:** Metallographic Sample Preparation Equipment (Annexure I)

- i). The Single Stage – Two Envelope Bidding Procedure shall be followed.
- ii). Responding organizations shall deliver sealed envelopes of the “FINANCIAL & TECHNICAL PROPOSALS” before or on **26-12-2017 at 10:00 AM and will be opened by the CPC, UET, Lahore at 10:30 AM**. The Proposals after the due date & time will not be accepted. The proposal shall be delivered to UET, Lahore before time.
- iii). The procedure for single stage two envelopes shall be as follows:
 - a) The bid shall be a single package consisting of two separate sealed and packed envelopes, clearly labeled as Technical Bid & Financial Bid.
 - b) In the first instance, the “**Technical Proposal**” shall be opened and the envelope marked as “Financial Proposal” shall be retained unopened in the custody of the CPC, UET, Lahore.
 - c) The Central Procurement Cell (CPC), UET, Lahore shall evaluate the technical proposal in the manner prescribed in the bidding document, without reference to the price and may reject any proposal, which does not conform to the specified requirements.
 - d) During the technical evaluation, no amendments in the technical proposal shall be permitted by CPC, UET, Lahore.
 - e) After the evaluation and approval of the technical proposals, the CPC, UET, Lahore shall open the financial proposal of the technically accepted bids, publically at a time, date and venue announced and communicated to the bidders in advance.
 - f) The financial bids of the bidders found technically non-responsive shall be returned unopened to the respective bidders; against a written request by the technically disqualified bidder and adopting the following procedure:

- If technically disqualified bidder states that he is agreed with the decision of CPC, UET, Lahore and disqualified bidder is not filing any grievance against the decision of CPC, UET, Lahore.
 - If the bidder files grievance petition and the same is rejected by the UET, Lahore's grievance redressal committee.
 - The time for filing the grievance has lapsed.
 - The contract has been signed by UET, Lahore with the lowest evaluated bidder.
- iv). Bids for individual or multiple lots may be submitted. However, the bid for separate items from a lot will not be acceptable.

2 Instructions to Bidders:

- i). It is a sole responsibility of the bidder to examine the Tender Document, reading all instructions and terms and conditions carefully.
- ii). A tender must be accompanied by **2%** of the **estimated cost as Earnest Money** in the shape of Deposit-at-call in the name of Treasurer, University of Engineering and Technology, Lahore without which Financial Bid will not be entertained. The estimated cost for all equipment is **392.50 Million PKR**. No Bank Guarantee or any other document will be accepted.
- iii). Queries of the Bidders (if any) for seeking clarifications regarding the bidding documents of the equipment must be received in writing to the university till **15-12-2017** during office hours. Any query received after said date will not be entertained.
- iv). The Bidder should be fully and completely responsible for all the deliveries and deliverables to the University.
- v). The Primary & Secondary Contact for all correspondence in relation to this bid is as follows:

Primary Contact:

Name: Dr. Adnan Maqbool
 E-Mail: adnanmaqbool@uet.edu.pk
 Phone # : **042-99029207**

Secondary Contact:

Name: Dr. Asif Hussain
 E-Mail: asif.hussain@uet.edu.pk
 Phone # : **042-99029207**

- vi). Bidders should communicate with the Primary Contact via email only. In the case of an urgent situation where the Primary Contact cannot be contacted, the bidder may alternatively direct their enquiries via email to the Secondary Contact.
- vii). Bidders are also required to clearly mention the below in their proposals:
 - a) The name & designation of the authorized representative with whom all correspondence will be carried out.
 - b) Contact Details (landline, mobile, fax, email).

- viii). Bidders should **clearly indicate the Name and Full Address of their Principals** in favor of which L.C. shall be opened.
- ix). The bidders must submit Performa invoice in original form/shape from their principals duly signed and clearly indicating:
 - a) The complete specifications of each item as per tender document,
 - b) The name of the manufacturer and country of origin along-with a certificate (as under) authorizing them to quote on their behalf.
“This is to certify that M/s _____ have obtained quotation from us against invitation to tender due on _____ and we have agreed to supply/manufacture the equipment strictly in accordance with the specifications laid down in the said invitation to tender”.
- x). Bidders must attach attested **Photocopies of their NTN, GST and other related certificates** with the tender.
- xi). The tenders received through fax and e-mail shall not be acceptable.
- xii). Country of Origin, Model, and date of manufacturing and launching / assembly of all equipment should be mentioned.
- xiii). The equipment quoted must be from indicated country of origin, having operational as well as instructional manuals in English, etc.
- xiv). Bidders must provide the list of references for installations in Pakistan / out of Pakistan for similar equipment (contact details: telephone number, email id etc.)
- xv). UET reserves the rights to confirm the performance of supplier independently from the references in Pakistan.
- xvi). Pre-bid meeting will be scheduled on **18-12-2017 at 12:00** noon with the bidders in conference room adjacent to VC, office.
- xvii). Successful Bidders will provide following items:
 - a) Supplier’s signed invoice should show separate value of each item duly signed in ink bearing the Bidder’s stamp.
 - b) Signed & stamped packing list should show measurement, quantity and weight of packages & their numbers.
 - c) Freight memo.

3 Terms and Conditions:

- i). All procurements shall be governed by the PPRA Rule, 2014.(amended up to 2017).
- ii). Bidders are advised not to quote different options for a single item (only one option is to be quoted).
- iii). Letter of Credit will be arranged by the UET, Lahore. Insurance for transportation from the Lahore Dry Port to UET, Lahore premises will be arranged by UET, Lahore.
- iv). The prices should be coated in foreign currency on C&F base dry port Lahore. Exchange rates will be considered for evaluation as on the date of opening of the tenders.
- v). Custom Duties and other taxes, if any, levied by the Govt. of Pakistan shall be paid by the UET, Lahore and should not be included in the quoted prices.
- vi). The equipment must be **Brand New and Complete** with respect to all aspects bearing original packing of manufacturer, strictly conforming to the given specifications. Bidders are required to submit the following certificate along with their offer.

“It is certified that the prices quoted in the tender are final and are not in excess to the printed price list of the manufacturer. In case of any discrepancy noticed subsequently, bidder hereby undertakes to make compensation to the UET, Lahore.”

- vii). The University reserves the right at the time of award of contract to increase or decrease the quantity of equipment.
- viii). Any conditional, ambiguous, incomplete, supplementary or revised offer after the opening of tender shall not be entertained.
- ix). Any overwriting / crossing etc. appearing in the offer, may be properly signed by the person signing the tender. All pages of the tender must be properly signed.
- x). The Earnest Money shall be returned to the technically disqualified Bidders with their unopened/ sealed financial bid.
- xi). If the acceptance of tender issued during the validity period of the tender is not accepted by the bidder, the Earnest Money shall be forfeited and the equipment purchased will be at the risk and expense of the bidder.
- xii). In case the offer is withdrawn, amended or revised during the validity period of the tender, the Earnest Money shall be forfeited.
- xiii). In case, the bidder fails to execute the contract strictly in accordance with the terms and conditions laid down in the contract, the security deposited by the bidder shall be forfeited and the equipment purchased will be at bidder’s risk and expense.
- xiv). The university will get the equipment inspected at UET, Lahore, through an authorized surveyor and reject the equipment, if not found according to the given specifications.
- xv). **After Sale service and supply** of spare parts must be guaranteed for a **period of five years**.
- xvi). **Delivery period will be three months (90 days)** from the date of establishment of Letter of Credit. Suppliers may however, quote their best delivery period.
- xvii). Bidder shall be bound to provide installation/commissioning **Free of Cost on site (UET, Lahore)**.
- xviii). The technical training of such equipments shall be arranged by the company/bidder free of cost to nominated personals from UET, Lahore.
- xix). In case of any material is found in non-conformity to the specifications provided in the tender, either on account of inferior quality, defective workmanship, faulty design, faulty packing; or is short supplied, wrongly supplied, the supplier is bound to replace such material free of charge or pay the full cost of replacement.
- xx). UET, Lahore, reserves the right to claim a penalty for compensation of losses caused by delay in the delivery of equipment that will be 0.05% per day of the total ordered cost.
- xxi). Within a week of receipt of contract, the successful bidder shall sign the contract and return it to the UET, Lahore.
- xxii). Complete specification of the equipment duly signed in ink and stamped.
- xxiii). The shipment against the contract must not take place on Indian or pro-Indian ship (Like Israel, etc.) or those ships which come to Pakistan after touching Israeli/Indian Ports.

4 Bidder’s Eligibility and Qualification Criteria:

- i). Bidders must be Registered/ Incorporated under the laws of Pakistan.

- ii). Bidder's Business experience must be of at least four (4) years (Copy of work orders/contracts signed with parties in last 4 years must be provided).
- iii). Bidders must be registered for Sales Tax purposes and has valid National Tax Number (NTN).
- iv). Provides bank statements/ financial statements of last four years depicting sound financial strength.
- v). Bidder must submit bid for complete lot of equipment along with relevant bid security.
- vi). Bidder must not be blacklisted by any of Provincial or Federal Government Department, Agency, Organization or autonomous body or Private Sector Organization anywhere in Pakistan.
- vii). If applicable, a letter from manufacturer or partner must be accompanied with the technical bid mentioning the bidder as authorized partner/reseller/distributor of the product.
- viii). The bidders are required to submit the company profile including:
 - a) Technical capabilities of the supplier
 - b) Engineering capabilities of the supplier
 - c) Managerial capabilities of the supplier
 - d) After-sale service capabilities of the supplier

5 Tender Cost:

The Bidder shall bear all costs/expenses associated with the preparation and submission of the Tender(s) and the UET, Lahore shall in no case be responsible/liable for those costs/ expenses.

6 Preparation/Submission of Tender:

The Tender and all documents relating to the Tender, exchanged between the Bidder and UET, Lahore, shall be in English.

Technical Bid shall comprise of the followings:

- i). Covering letter duly signed in ink and stamped by authorized representative.
- ii). Submission of undertaking on legal valid and attested stamp paper that the firm is not blacklisted by any of Provincial or Federal Government Department, Agency, Organization or autonomous body or Private Sector Organization anywhere in Pakistan.
- iii). Certificate of Company/ Firm Registration/ Incorporation under the laws of Pakistan. Valid Certificate for Income Tax & General Sales Tax/Provincial Sales Tax
- iv). Evidence of eligibility of the bidders per section 4 above
- v). Tender Document issued by UET, Lahore duly signed in ink and stamped.
- vi). Performa invoice in original form/shape from their principals duly signed. List of complete specifications in the same order given in the Annexure of the equipment.
- vii). Proof of the 2% of the estimated cost as earnest money in the name of treasurer UET, Lahore must be submitted
- viii). A letter mentioning the country of origin, model, and date of manufacturing and

launching / assembly of all equipment.

Financial Bid shall comprise of the followings:

- i) The prices of the equipment should be quoted in foreign currency on C&F base Lahore. Exchange rates shall be considered for evaluation as on the date of opening of tender.
- ii) The Earnest Money as discussed earlier in **Instructions to Bidders.**
- iii) Firm/Supplier should clearly indicate packing, handling, forwarding, documents charges, air freight etc.

7 Tender Validity:

The Tender shall have a minimum validity period of **ninety (90) days from the last date for submission** of the Tender. UET may solicit the Tenderer's consent to an extension of the validity period of the Tender. The request and the response shall be made in writing. If the Tenderer agrees to extension of validity period of the Tender, the validity period of the Bid Security shall also be suitably extended. The Tenderer may refuse extension of validity period of the Tender, without forfeiting the Bid security.

8 Rejection of the Bid:

UET may reject all bids or proposals at any time prior to the acceptance of a bid or proposal. UET will upon request communicate to any bidder, the grounds for its rejection of all bids or proposals, but will not be required to justify those grounds. UET shall incur no liability, solely, by virtue of rejection of bidders. However, bidders shall be promptly informed about the rejection of the bids, if any.

9 Award Criteria:

The bidder who is qualified, technically passed will be determined as the lowest evaluated bidder will have to fulfill below conditions as a necessary requisite:

- a) The successful bidder shall have to deposit security, **10% as Performance Guarantee** in the shape of deposit at call of the total offer on acceptance of the tender.
- b) The successful Bidder shall arrange/deposit **Stamp Paper** of value @ 0.25% of issuance of supply order/contract.
- c) The Bid Security shall be returned to the successful Bidder on furnishing the Performance Guarantee.

Having a minimum validity period of ninety days from the last date for submission of the Bid or until furnishing of the Performance Guarantee, whichever is later.

10 Redressal of Grievances:

UET, Lahore has constituted a Grievance Redressal committee comprising of odd number of persons, with proper powers and authorizations, to address the complaints of bidders. For any grievance please contact Primary Contact, who will be responsible for scheduling the meeting of the Grievance Redressal committee.

Technical Specifications

FOCUSED ION BEAM-SCANNING ELECTRON MICROSCOPE (FIB-SEM) ATTACHED WITH ANALYTICAL AND DIGITAL FACILITIES

The minimum requirements of Branded FIB-SEM attached with latest analytical and digital attachments (All operations and functions should be fully PC controlled with software compatible to the Windows latest version) are given below. The quoted system specifications should be equal or better.

Specifications (Equivalent or Better)

1. Should have a Field Emission Gun Scanning Electron Microscope (FEG-SEM), with a high brightness Schottky gun capable to provide stability of beam current better than 1% over 24h.
2. SEM accelerating voltage in the range at least 200V to 30 kV.
3. The SEM must provide an approximate resolution ≤ 1.6 nm 1 kV without beam deceleration or ≤ 1.4 nm 1 kV with beam deceleration for high resolution imaging with high surface sensitivity. The available current must be from 1 pA or less to 250nA.
4. Analytical working distance of SEM should be at least 7 mm without deterioration at longer analytical WD. Please provide Au on C images at 1 kV, 7 mm WD for evaluation.
5. System should be capable to perform fully automated alignment of SEM column. System should be equipped with the following detectors:
 - Everhart-Thornley SE detector, In-lens/in-column detector(s) of SE&BSE, Retractable backscatter detector, IR camera for live viewing samples/chamber, Integrated beam current monitor. Simultaneously collect & display SE and BSE signals by the detectors in the lens and in the column.
6. Retractable backscatter detector should have at least 4 concentric rings. It also should be sensitive for the BSE signal at low accelerating/landing voltages down to 0.5 kV or lower. Automatic shutdown of IR source illumination in BSE mode is required to allow the light sensitive BSE to work correctly.
7. Sample overview optical camera should be best (minimum 6 Mpix), integrated in user interface and allow convenient navigation over the sample. The collected images should be automatically calibrated to the stage locations so the image can be used for navigation in x and y directions.
8. System must be equipped with a Ga FIB capable of approx. 3.0 nm resolution at 30 kV, for 1.2pA current
9. The FIB should be capable of delivering at least 65 nA in a tight, perfectly round spot, and a high beam current density at 30 kV.
10. The FIB must guarantee accurate beam deflection, even at small dwell times, for precise high-speed patterning. The FIB must be capable to perform milling with approx. resolution 64k x 64k provided by pattern generator that is necessary for accurate and high-performance micro and nano patterning.

11. The FIB should operate in the range from 500 V to 30 kV acceleration voltage or larger. Deposition of platinum should be included in the system based on injection of gas and using ion beam or electron beam.
12. The microscope stage should have the following minimum specifications: Fully motorized high precision 5 axis motorized stage, x,y = 110 mm, z = 65 mm, Tilt = -15° to +90°, Rotation = 360° continuous, Sample weight up to 1.5 kg with available X and Y movements.
13. The sample holder(s) should be provided that allows mounting of at least 15 pin stubs in horizontal and pre-tilted positions, as well as loading of TEM grids. A cross-sectional sample clamp holder is required.
14. EDS detector should be solid state Peltier-cooled with 30mm² surface area, energy resolution 129 eV, sensitive up to beryllium.
15. EDS analysis software should have capabilities for quantitative calculations, background subtraction, peak deconvolution, drift compensation for polished and unpolished bulk samples.
16. The system should come with a fully integrated nanomanipulator for lifting out lamella prepared for TEM. Spare needles should be included in supply.
17. Microscope must have adjustments for image shift and to yield better image quality in case of charging and drifting. Microscope should have capability for charge neutralization during FIB milling of insulating samples using electron beam.
18. It should be possible to obtain images at up to 6144 x 4096 pixel resolution.
19. Plasma cleaner for a gentle cleaning of samples from carbon contamination using oxygen plasma should be included.
20. Vacuum/sample chamber should have at multiple configurable ports for standard and additional equipment.
21. The FIB-SEM must be supplied with a USB Manual User Interface (MUI) allowing adjustments of focus, contrast and brightness and stigmation.
22. The FIB-SEM system must be capable for complete cycle of TEM sample preparation including transfer of lamella from bulk sample to a grid holder by manipulator, thinning and polishing at low-kV (down to 0.5 kV), and final control of lamella quality. All these operations should be done in microscope chamber without breaking vacuum.
23. TEM sample preparation process should be automated to a high level with preparation time less than 1 hour. The process should be suitable for usage by non-expert users with relatively small experience. Please provide a movie or PDF document with images describing the automation and user procedure.
24. TEM grid holder with 3-6 grid positions should be provided.
25. Software user interface should be friendly, advanced and support customizable view. The system should be supplied with the additional (the second) PC capable for data storage and available for installation of software by user.
26. The FIB-SEM system must have uninterruptible power supply and be able to provide backup time of at least 6 hours.
27. On site technical trainings for operation on microscope should be provided: At least 3 days at the local site, Introduction FIB-SEM course at the manufacturer site, Advanced FIB-SEM course at the manufacturer site.

28. Should have sputter coating unit/units for C, Gold, Platinum etc. including targets for sample preparation.
29. Enabled with a Remote diagnostic support and online help mechanism
30. After sale service should be easily available in Pakistan.
31. Companies who have already supplied similar equipment with good technical/after sale-service repute will be given preference.
32. A minimum warranty of 5 years is required.
33. Replaceable accessories for the next five years.
34. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Quote above as a Main Unit. Following items must be quoted separately.

35. Optional Attachments
36. For in-situ measurements, tensile, heating, and cooling stages upto 500 °C
37. Electron back scattered diffraction (EBSD), WDS, Raman Attachments.

Estimated Bid Price PKR 80.0 Million

Technical Specifications

HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPE (HR-TEM) ATTACHED WITH ANALYTICAL AND DIGITAL FACILITIES

The minimum requirement of Branded HR-TEM attached with latest analytical and digital attachments (All operations and functions should be fully PC controlled with software compatible to the Windows latest version) are given below. The quoted system specifications should be equal or better.

Specifications (Equivalent or Better)

1. Operating Voltage 60-300 KV, fast, multichannel, high resolution TEM imaging and precise compositional analysis (energy dispersive x-ray spectroscopy).
2. XFEG source: offers reduced brightness of 7.5×10^7 A/m².sr.V, equivalent to the one of a Cold FEG source, but offering less than 1.5% absolute stability over a day, and showing more than 50 nA on the sample. Energy Resolution is shown to be better than 0.2eV over 1 sec acquisition time at 300kV, and better than 0.13 over 1 sec at 60kV.
3. Integrated Differential Phase Contrast: Dedicated 4-segment STEM detector, TEM 60-300 should capable of generating Differential Phase Contrast, for imaging of Electrical and /or magnetic fields, by simultaneously acquiring the 4 different segments and differentiating them two by two (=> X and Y direction), and when integrated over the full collection angle of the ADF detector, can offer unrivaled imaging of the local potential, and thus highlight atomic column positions of both light and heavy elements. In this way it shows much better S/N ratio than any other technique like ABF, and higher sensitivity for beam sensitive samples like soft materials and other Zeolites.
4. TEM with unique combination of constant power lens technology, 3-lens condenser system, and > 5mm pole piece gap to allow for more space to run tomography or in-situ experiments, and still allows to easily shoot respectively spatial resolution of less than 60pm in Cs Probe Corrected STEM and information limit of less than 60pm in Cs Image Corrected TEM.
5. System Enclosure: A standard feature of TEM which offers acoustic shielding, remote operation and enhanced control of thermal stability around the system. The result is less stringent environmental requirements on the operator control room which offers the ability to conduct experiments in the control room with multiple investigators in normal office conditions.

6. STEM: should be advanced and fully automated way to fine tune low order aberrations in the STEM, like focus, both 2-fold and 3-fold astigmatism, and also coma, combination of a dedicated script, and the help of the Probe corrector software. STEM+ uses fast low dose-rate STEM imaging to measure aberrations prior to full and very reproducible correction, and gives fast access to top quality HRSTEM data.
7. Super-X EDS detector: made of four symmetrically positioned windowless SDD detectors of 30mm² each, i.e. total 120mm² active area, protected by pneumatic shutters when not in-use. The fixed, unique, “in-column” design mitigates the need for detector insertion and retraction which leads to unwanted beam displacements and optical aberrations. 0.7srad effective collection angle at 0° tilt, unique and fully automated, quantifiable 3D EDX mapping capability and high sensitivity to light elements, down to Boron. It shows unrivaled Fiori number (peak to background ration on NiK α peak) of >4000 and easy access to sub-atomic chemical mapping on large areas (up to 2kx2k). System peaks are shown to be less than 1% (Fe, Co, Si etc.).
8. Include on site installation and training of our technical team.
9. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours)
10. After sale service should be easily available in Pakistan.
11. Companies who have already supplied similar equipment with good technical/after sale-service repute will be given preference.
12. A minimum warranty of 5 years is required
13. Replaceable accessories for the next five years
14. Reference from within Pakistan from a similar offered TEM user is preferable
15. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Quote above as a Main Unit. Following items must be quoted separately.

Optional Attachments

1. For in-situ measurements, tensile, heating, and cooling stages up to 500 °C
2. Electron Energy Loss Spectroscopy (EELS) package.

Estimated Bid Price PKR 200 Million

Technical Specifications

SCANNING ELECTRON MICROSCOPE (E-SEM) ATTACHED WITH ANALYTICAL AND DIGITAL FACILITIES

The minimum requirements of Branded SEM attached with latest analytical and digital attachments (All operations and functions should be fully PC controlled with software compatible to the Windows latest version) are given below. The quoted system specifications should be equal or better.

Specifications (Equivalent or Better)

1. Source: Tungsten thermal emission SEM column with dual-anode source emission geometry. The filament should be fully automatic switched to keep constant emission over the full high-tension range.
2. Voltage 200 V to 30 kV, Beam Current Up to 2 μ A.
3. The tungsten electron gun should have a multiple bias setting to improve low kV imaging.
4. High-vacuum mode ($<6 \times 10^{-4}$ Pa) for imaging and microanalysis of conductive and/or conventionally prepared specimens.
5. Low-vacuum mode (10 to 130 Pa) for imaging and microanalysis of non-conductive specimens without preparation.
6. Environment vacuum mode (ESEM) (10 to 2600 Pa) for high-vacuum incompatible specimens.
7. Through lens differential pumping should be provided to keep the system clean in low vacuum operation.
8. Secondary electron image resolutions must meet the following minimum resolution at 30kV: 3 nm or better in high vacuum mod, 3 nm or better in low vacuum mode and 3 nm or better in environmental vacuum mode.
9. System should be equipped with the following detectors: Everhart-Thornley SED, Large Field Gaseous SED (for low vacuum up to 133Pa), Gaseous SED (for very low vacuum up to 2600Pa), BSE, IR-CCD, EDS.
10. The system should be able to image fully hydrated or wet specimens with secondary electrons without any complications.
11. Stage movement should have fully computerized with following minimum specifications: 50x50 mm for X and Y stage movement, Z range at least 25 mm, 360 degree rotation in continuous motion, Tilt range: -15° - 75° .
12. EDS detector should be solid state Peltier-cooled with 10mm² surface area, energy resolution 129 eV, sensitive to up to beryllium.
13. Single or four-quadrant frame display of images from any combination of detectors: Secondary Electron (SE), Backscattered Secondary Electron (BSE), mixed signals, CCD. It should support observation of live images, line averaged, line integrated, frozen and frame-averaged digital images.

14. Microscope must also enable drift compensated frame integration to overlay frames with an offset to adjust for any sample or system instability (such as slight charge drift) to yield better images in case of charging or shifting sample. Scan settings presets and column presets should be available in user interface to facilitate efficient and convenient operation.
15. The vacuum pumping system should be able to achieve high vacuum within 180 seconds or better.
16. Software user interface should be friendly, advanced and support customizable view. The system should be supplied with the additional (the second) PC capable for data storage and available for installation of software by user.
17. Free installation and on site technical trainings for operation on microscope should be provided: At least 3 days at the local site.
18. Should have sputter coating unit/units for Carbon, Gold, Platinum etc. including targets for sample preparation.
19. Replaceable accessories for the next five years. The SEM should come with spare W cathodes, basic required instruments.
20. Enabled with a Remote diagnostic support and online help mechanism.
21. The SEM system must have uninterruptible power supply and be able to provide backup time of at least 3 hours.
22. After sale service should be easily available in Pakistan.
23. Companies who have already supplied similar equipment with good technical/after sale-service repute will be given preference.
24. A minimum warranty of 5 years is required.
25. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Quote above as a Main Unit. Following items must be quoted separately.

26. Optional Attachments
27. For in-situ measurements, tensile, heating, and cooling stages upto 500 °C
28. Electron back scattered diffraction (EBSD), WDS, Raman Attachments.

Estimated Bid Price PKR 20.0 Million

TECHNICAL SPECIFICATIONS**OPTICAL MICROSCOPE WITH IMAGE ANALYSIS FACILITIES****Specifications (Equivalent or Better)**

1. Optical Microscope with Reflected and Transmitted Light modes
2. LED illumination for both Reflection and Transmission modes
3. Bright field, dark field, simple and cross polarization
4. Fixed Stage manually controlled, with centering adjustment
5. Manual, Coarse and Fine coaxial handle.
6. Manual operation: 6x for BF/DIC, 5x for BF/DF/DIC, 5x for BF with centering
Motorized operation: 6x for BF/DIC, 5x for BF/DF/DIC
7. Attachment for conosopic and orthoscopic observation
8. High-quality polarization direction is rotatable
9. Coded reflected led light for bf/df/pol
10. LED transmitted light, Six position revolving nosepiece, Rotatable stage
11. Mechanical stage, Swing-out condenser for pol, Polarizer, Filter casset.
12. Green filter
13. Eyepiece 10x fn22, focusable,5x, 10x, 20x, 50x, 100x
14. Digital camera & software, 3.1 mp digital camera with 0.5x c-mount adapter
15. Software, Olympus stream essentials 2.2
16. Free installation and on site technical trainings for operation on microscope should be provided.
17. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours)
18. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Quantity: 03 (three)**Estimated Total Bid Price PKR 10.0 Million**

Technical Specifications**X-Ray Diffractometer (XRD)**

The minimum requirements of Branded X-Ray Diffractometer (XRD) attached with latest analytical and digital attachments (All operations and functions should be fully PC controlled with software compatible to the Windows latest version) are given below. The quoted system specifications should be equal or better.

Applications

X-ray diffractometer with hardware and application software packages for:

1. Phase identification and quantitative phase analysis.
2. Residual stress analysis.
3. X-ray Reflectometry (XRR).
4. Texture analysis.
5. Should have capability to demonstrate the application such as grazing incidence diffraction (GID) and Small angle X-ray scattering (SAXS).

Specifications (Equivalent or Better)

1. Alignment-free switching of all beam path components incl. X-ray tube, all optical components, non-ambient sample holders, stage and all detectors.
2. The system should be true plug & play functionality by fully automatic, real-time component recognition and configuration as well as conflict detection for all beam bath components incl. X-ray tube, all optical components, all ambient and non-ambient sample holders, and all detectors.
3. Failure-safe operation via automatic, real-time validation of replaced components.
4. Fully automatic, motorized, software controlled switching between Bragg-Brentano and parallel beam (Göbel mirror) geometry without the need to touch the instrument hardware.
5. Simultaneous variable counting time and variable step-size support.
6. The system must have all safety and interlocks for operator safety.
7. The system must display an up-to-date CE marking, accompanied by a correct EC Declaration of Conformity as well as all required documentation.
8. The system must be fully CE compliant, including but not limited to:
 - i). Machinery Directive (2006/42/EC), Electrical Equipment (2006/95/EC)
 - ii). Electromagnetic compatibility (2004/108/EC), with standard AC 220V/50Hz
9. At installation, the instrument must pass a documented acceptance test based on an established instrument verification procedure,
 - i). Instrument alignment must be equal or better than $\pm 0.01^\circ$ 2Theta using standard reference material NIST SRM 1976a or its successor
10. 3KW x-ray generator with Stand-by mode shall not exceed 100W (20kV, 5mA) to maximize tube life time.

11. The kV and mA settings must be continuously adjustable via software with automatic tube startup tube conditioning
12. XRD Must be compatible with ceramic, glass tubes, and 3rd party tubes
13. The sealed X-ray tube shall be metal-ceramic type.
14. X-ray tube must be able to switch between line and point focus, without dis-connection and removal.
15. The system shall have automatic focus direction recognition of x-ray tube.
16. THETA-THETA goniometer, maintenance free drive mechanism / gearings, with variable measurement circle diameter, with predefined positions at 500 mm, 560 mm and 600 mm as well as any intermediate setting (depending on accessories) with 10cm central diameter opening in the center for long samples or optional attachments.
17. The goniometer shall have a minimum angular measurement range of $-110^\circ < 2\theta \leq 168^\circ$ (depends on accessories)
18. Angle positioning: Stepper motors with optical encoders for optimum scanning speed and positioning precision.
19. Minimum angular speed: 20°/s, minimum step size shall be 0.0001°
20. The reproducibility shall be $\pm 0.0001^\circ$
21. Switching between (a) motorized slit for powder diffraction, and (b) Göbel mirror for grazing incidence diffraction or Reflectometry shall be software-controlled.
22. Exchange of all optics shall be tool-free and alignment free using any snap-lock mechanism.
23. The system must have the following sample stages:
 - i). Motorized, fully software controlled, Eulerian cradle with Motorized, fully software controlled XYZ-stage
 - ii). Standard sample stage
24. All sample stages can be ex-changed without re-alignment.
25. Detector with Silicon-Strip technology, with all functional strips, detector shall be maintenance-free, and not required external cooling or purging gas required,
Guarantee for No dead strips, no dead areas etc.
 - i). Detector window up to $\sim 3^\circ 2\theta$ (depends on instrument radius)
 - ii). For Cr, Co, Cu, Mo and Ag radiation. For high-energy radiation (Mo, Ag) a specialized (500 micron) sensor shall be offered to improve the detector efficiency. 0D / 1D operation, selectable by software
 - iii). Operation in $0^\circ / 90^\circ$ mode (in 90° mode the detector is rotated by 90° for highest dynamic range).
26. Complete and full functional with all software, hardware, computer with PDF-2 files
27. The measurement software shall have a graphical instrument representation for real-time display of the actual instrument configuration based on component recognition, real-time validation and conflict detection, and measurement planning (definition of instrument parameters such as slit settings, selection of optical components, and selection of diffractometer geometry.
 - i). Variable counting time and variable step-size support.
28. Enabled with a Remote diagnostic support and online help mechanism
29. Include the latest Intel core-i7 or better PC with monitor.
30. Include on site installation and training of our technical team.

31. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours)
32. After sale service should be easily available in Pakistan.
33. Companies who have already supplied similar equipment with good technical/after sale-service repute will be given preference.
34. A minimum warranty of 5 years is required
35. Replaceable accessories for the next five years
36. Reference from within Pakistan from a similar offered XRD user is preferable.
37. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 20.0 Million

Technical Specifications
**ION BEAM MILLING MACHINE FOR TRANSMISSION ELECTRON
MICROSCOPE SAMPLE PREPARATION**

(All operations and functions should be fully PC controlled with software compatible to the Windows latest version)

Specifications (Equivalent or Better)

1. Should have two ion guns with rare earth magnets or other materials.
2. Milling angle should be adjustable to equal or better than $+10^{\circ}$ to -10° .
3. Ion Beam Energy should be 100eV to 6.0keV or equivalent.
4. Ion beam diameter should be controlled and adjustable (minimum 350 μm FWHM at 5keV).
5. Beam alignment should be controlled and adjustable.
6. Specimen size should be 3mm or 2.3mm with mounting facility.
7. The vacuum system should be quick, operating automatically and have lowest noise and clean (oil free) without contamination.
8. Base pressure should be 5×10^{-6} torr and 8×10^{-5} torr operating pressure or better.
9. Power voltage should be 220-240VAC with frequency of 50/60Hz.
10. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours).
11. Free installation and on site technical trainings for operation of Ion Beam Milling Machine.
12. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 8.0 Million

Technical Specifications
**TWIN JET ELECTROLYTIC POLISHER FOR TRANSMISSION
ELECTRON MICROSCOPE SAMPLE PREPARATION**

Specifications (Equivalent or Better)

1. Specimen size should be 3mm or 2.3mm with mounting facility.
2. Polishing range should be 0 to 120 V DC; 0 to 100 mA or equal.
3. Power voltage should be 220-240VAC with frequency of 50/60Hz.
4. Standard recipes of etching agents should be provided.
5. Specimen punch/dimple to prepare disk samples.
6. An attachment for low temperature sample polishing.
7. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours).
8. Free installation and on site technical trainings for twin jet electrolytic polisher.
9. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 8.0 Million

Technical Specifications**NANO INDENTER/ATOMIC FORCE MICROSCOPE (AFM)**

(All operations and functions should be fully PC controlled with software compatible to the Windows latest version)

Specifications (Equivalent or Better)

1. Applications: Metals, Alloys, Polymers, Bio-Materials, Thin films, Ceramics/glasses, Nano-structures.
2. Max Load = 5 N.
3. Tips = Berkovich.
Cube Corner and Flat punch (optional).
4. Wear Scanning.
5. Standard stage (without piezo-transducer).
6. Fast data acquisition rate
7. Optical Microscope:
Resolution = 1 micron
Objective = upto 40x
8. Vibration controlled
9. Acoustic and thermal isolation.
10. In-situ SPM/AFM imaging (optional).
11. Nano DMA (optional).
12. Include the latest Intel core-i7 or better PC with monitor.
13. Include Installation and training of at least two persons from principal company.
14. Replaceable accessories for the next five years.
15. Should be supplied with a Compatible UPS (Backup min. 06 hours)
16. After sale service should be easily available.
17. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 20.0 Million

Technical Specifications**CHEMICAL VAPOUR DEPOSITION (CVD) EQUIPMENT**

(All operations and functions should be fully PC controlled with software compatible to the Windows latest version)

Specifications (Equivalent or Better)

1. Chamber pressure 10^{-6} Pa.
2. Substrate heating temperature: upto 1000 °C
3. Working gas lines at least 3
4. RF power supply (13.56MHz/500W) and matching box.
5. Top flange can be lifted by motor.
6. Substrate change is easy.
7. Vacuum pumps are TMP and rotary pump.
8. Full range vacuum gauge.
9. Touch panel is used for system control.
10. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours).
11. Include free Installation and technical training from principal company.
12. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 13.0 Million

Technical Specifications**THERMAL EVAPORATOR WITH GLOVE BOX**

(All operations and functions should be fully PC controlled with software compatible to the Windows latest version)

Specifications (Equivalent or Better)

1. The system consists of one thermal evaporator High Vacuum (HV) system and one glove box.
2. Metal or organic film growth is done in the HV system, while the glove box is connected to the HV system to avoid sample exposure to atmosphere.
3. Sample linear and azimuthal rotation. Rotation is motor controlled.
4. Sample temperature upto 1000 °C or more.
5. Evaporator boats nos. 3-12
6. Quartz crystal microbalance for film thickness monitor.
7. TMP and rotary pump, vacuum gauge.
8. Touch panel operation.
9. Vacuum 10^{-6} Pa.
10. Should be supplied with a Compatible UPS (Backup time of Min. 06 hours).
11. Free installation and on site technical trainings for operation of Thermal Evaporator with Glove Box.
12. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment.

Estimated Bid Price PKR 10.0 Million

Technical Specifications**METALLOGRAPHIC SAMPLE PREPARATION EQUIPMENT**

1. **Precision Cutting**
2. **Cutting**
3. **Mounting**
4. **Grinding and Polishing**

1. Low Speed Precision Saw

- | | | |
|-------|--|--|
| i. | Voltage | 1 phase, 230 V, 50 Hz. AC |
| ii. | Power | 100 W DC Motor (Including installed Fuse) |
| iii. | Disc speed: | Variable (0 to 1000 rpm) |
| iv. | Speed increment: | Maximum 5 rpm |
| v. | Cutting capacity: | Max. 50 mm thickness |
| vi. | Cutting method: | Gravity feed |
| vii. | Optical shut-off sensor with adjustable stop to control depth of cut | |
| viii. | Cutting wheels of standard size (Dia): | 6" (150 mm) |
| ix. | Cutting wheel materials: | Sintered diamond, resin bonded or metal bonded diamond |
| x. | Specimen Holder: | Regular and Irregular specimen holder included
Counter-balanced holder with set of 3 weights.
Micrometer for lateral movement 0-25 mm.
Standard specimen holder provided. |
| xi. | Nature friendly and non-corrosive coolant | |
| xii. | Complete unit with allied accessories | |
| xiii. | Units with equivalent or better specs will also considered. | |
| xiv. | All the operational/technical instructions manuals and literature should be in English and provided along with the equipment | |

Estimated Bid Price PKR 0.5 Million

2. Abrasive Cut off Machine

Abrasive Cutting Machine, with hand wheel driven chop cutting and table-feed cutting systems, manual positioning of the specimen in X and Y axis (X-axis for plane parallel cutting is optional), manual positioning of the cutting wheel in Z-axis, with:

- i. Compact cutting motor,
- ii. Upto 3000 rpm cutting speed, with electronic brake system,
- iii. cutting capacity upto 110 mm solid stock, with cut-off wheels upto ϕ 300mm,
- iv. twin T-slotted clamping table made of stainless steel, bottom part as rugged alloy base casting,
- v. standard set of cutting consumables composed of;

- a). An assortment of 20 cut-off wheels with 300 mm dia.
- b). cooling fluid.
- vi. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment

Estimated Bid Price PKR 0.5 Million

3. Mounting Press

- i. Programmable Automatic Mounting Press with two cylinders,
- ii. touch screen control with program based mounting sequences,
- iii. Electro hydraulic pressure (requires no air),
- iv. Pressure upto 300 bar,
- v. Temperature upto 200 C,
- vi. Operation time upto 100 minutes,
- vii. Short cycle time,
- viii. Thermostatically controlled heating
- ix. Selectable mould sizes from 25 mm to 50 mm,
- x. Includes a standard set of mounting consumables composed of 3 different hot mounting compounds; 1 kg of each and a total of 3 kg.
- xi. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment

Estimated Bid Price PKR 0.5 Million

4. Grinding and polishing machines

- i. Double wheel, suitable for approx. 200 mm and approx. 250 mm wheel size
- ii. Programmable Automatic control unit. Base Unit with large approx. 0.75HP Motor
- iii. Standard interface for automatic specimen mover
- iv. Variable wheel speed 600 rpm, V-belt drive, Complementary or Contra rotational direction, Soft Start and Stop function, Retractable water hose, with water supply and drain tubes.
- v. Automatic Head, programmable sample preparation parameters, central and/or individual force application, steel mounting column, with variable specimen holder speed approx. 50 rpm, DC motor,
- vi. Complete and ready for operation. Without Specimen Holders.
- vii. 230 V, 1-phase, 50 Hz. Aluminium wheel and splash guard,
- viii. Includes the following standard set of consumables; Special Magnetic Foil, Thin Metal Plate, Magneto grinding, Variety of polishing cloths and Diamond suspensions, plus lubricant
- ix. All the operational/technical instructions manuals and literature should be in English and provided along with the equipment

Quantity: 04 (Four)

Estimated Total Bid Price PKR 2.0 Million

A. Pratih