राष्ट्रीय प्रौद्योगिकी संस्थान, मिजोरम

NATIONAL INSTITUTE OF TECHNOLOGY, MIZORAM

(An Institute of National Importance under Ministry of HRD, Govt. of India)

CHALTLANG, AIZAWL: MIZORAM – 796012,

Phone No. 0389- 2341236/ 2341699
Fax: 0389-2341774
Web: www.nitmz.ac.in
Email: nit_mizoram@nitmz.ac.in

Ref. No.: NIT-MZ/TENDER/01-A/2014
Date: 29th January 2014

NOTICE INVITING TENDER FOR SUPPLY & INSTALATION OF LABORATORY EQUIPMENTS FOR MECHANICAL ENGINEERING DEPARTMENT

Strength of material

Last date for receiving Tender documents: **25th February 2014 before 3:00 PM**
Date/Time for Opening of Tech. Bids**:** **25th February 2014 at 3.30 PM**

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Ref. No.: NIT-MZ/TENDER/02-A/2013
Date: 20th May 2013

NOTICE INVITING TENDER (NIT)

National Institute of Technology-Mizoram is one of the ten new NITs established by Ministry of Human Recourse Development, Government of India, New Delhi in the year 2010 at Aizawl, Mizoram to impart education, training and research in Science, Technology and Management leading to award of B. Tech., M. Tech., MBA and Ph.D degrees. This institute if fully financed and governed by Ministry of Human Recourse Development, Government of India.

Sealed Tenders are invited from eligible Manufacturers/Developers or their Authorized Dealers for supply & Installation of Machines as per details at **ANNEXURE-IV**, **in Two Bids** to reach the undersigned on or before **25th February 2014 before 3:00 PM.** Date/Time for Opening of Tech. Bids**: 25th February 2014 at 3.30 PM**. After evaluation of Technical Bids, Financial Bids of the successful bidders will be opened on later date which will be notified in the Institute website. Venue of bid opening: **NIT Mizoram, Aizawl**.

Sl. No.	Reference No.	Items	Qty	EMD (Rs.)in the form of DD only. (Refundable)	Tender Document Fee (Rs.) in the form of DD only. (Non-Refundable)
01.		**Supply & Installation of Equipments for Strength of Material Lab on turnkey basis to be installed at NIT, Mizoram, Aizawl**	**One Package**	**@2%**	**1,000.00**

Note: Demand Draft must be in favor of "**Director, NIT Mizoram**" Payable at **Aizawl**.

General Instructions for the Bidders:

01. Quotations will have to be submitted in TWO Bids **i.e. Technical Bid and Financial Bid, in hard copy as well as in soft copy (soft copy must be in MS word 2007 provided in separate CDs for Technical Bid and Financial Bid). Both hard copy and soft copy of Technical Bid should be in one sealed envelope specifically mentioning "Technical Bid" on the cover of the envelope similarly for Financial Bid also, both hard copy and soft copy of must be in one sealed envelope specifically mentioning "Financial Bid" on the cover of the envelope.** Further these two sealed Bids must be kept inside one big sealed envelope before submitting it.
    The address of the firm submitting the quotation and the Officer to whom the quotation is addressed must appear distinctly on sealed covers. Further, on sealed cover, the following are to be written:

    QUOTATION FOR SUPPLY & INSTALLATION OF "**EQUIPMENT FOR STRENGTH OF MATERIAL LABORATORY OF MECHANICAL ENGINEERING DEPARTMENT AT NIT MIZORAM".**

02. **Submission of Compliance Certificate:** Duly filled and signed Compliance Certificates (as per formats at **Annexure I (A & B**) are must with the Technical bid.

03. **Bid not transferable:** The bid documents are not transferable and the seal and signature of the authorized official of the firm must appear on all the papers and envelopes submitted.

QUALIFICATION REQUIREMENTS

01. The Bidder should be a Original Equipment Manufacturer (OEM)Or a firm of reputation having sufficient expertise and experience in the subject tender with sound warranty / service support capability and authorization from Manufacturer/Distributor.

02. **The Bidder has to Quote for all the items in the Strength of Material Lab, Bidders who do not Quote for all the items are subject to be disqualified.**

TERMS & CONDITIONS:

01. **Rates:** Rates quoted in the **Price Bid** should be **on DOOR DELIVERY NIT Mizoram basis,** as per details below:

Sl. No.	Particulars	Rate
I	Basic Price (per unit) including Packing, Forwarding, Freight, Insurance, Installation & demonstration charges inclusive	
II	Taxes(pl. give break up)	
III	Grand Total for the item on door delivery at NIT Mizoram	

Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.

02. **Validity of Quotation:** Quoted rates must be valid for **90 days** from the date of quotation.

03. **Warranty:** The quoted equipment and components must be warranted for a minimum of one Year or period specified against the item from date of Installation.

04. **Literature a must**: All the quotations must be supported by the printed technical leaflet/literature and the specifications mentioned in the quotation must be reflected/ supported by such printed technical leaflet/literature. The model and specifications quoted should **invariably be highlighted** in the leaflet/literature for easy reference.

05. **After Sales Service:** Vendors should clearly state the available nearest after sales service facilities in the region, without which their offers will be rejected.

06. **Dealership Certificate:** Dealers or Agents quoting on behalf of Manufacturer must enclose valid dealership certificate.

07. **Earnest Money Deposit:**

Refundable earnest money deposit (EMD) of @2% of the Quoted Value through demand draft drawn in favor of "The Director, National Institute of Technology Mizoram", payable at Aizawl, will have to accompany the technical Bid. The EMD of unsuccessful bidders shall be returned after award of contract. EMD of the successful bidder will be released on submission of the Performance Guarantee. Offers received without Earnest Money or valid Certificate shall be summarily rejected.

08. **Performance Bank Guarantee (PBG):** In case of items with order value of Rupees five lakhs (INR 5,00,000/-) and above, the successful bidder shall furnish an unconditional PBG (as per format at **Annexure II**) for 5% of the Purchase Order value from a scheduled Bank of India, after receiving the purchase order**.** Where the PBG is obtained by a foreign bank, it shall be got confirmed by a Schedule Indian bank and shall be governed by Indian Laws and be subject to the jurisdiction of courts at Aizawl. The PBG shall guarantee that,

(a) The Vendor guarantees satisfactory operation of the Equipment & components against poor workmanship, bad quality of materials used, faulty designs and poor performance.
(b) The Vendor shall, at his own cost, rectify the defects/replace the items supplied, for defects identified during the period of guarantee.
(c) This guarantee shall be operative from the date of installation till 60 days after the warranty period.

09. **Delivery:**

a) Time Limit: Maximum within 12 Weeks from the date of issue of this purchase order.

b) Safe Delivery: All aspects of safe delivery shall be the exclusive responsibility of the vendor. At the destination site, the package will be opened only in the presence of NIT user/representative and vendor's representative. The intact condition of the package and the seal/indicators for not being tempered with shall form the basis for certifying the receipt in good condition.

c) Insurance: The supplier is to establish 'All Risk Transit Insurance' coverage till door delivery at NIT Mizoram.

d) Part Delivery: Acceptance of part delivery shall be a prerogative of the institute.

e) Penalty for delay in delivery: The date of delivery should be strictly adhered to otherwise the Director, NIT Mizoram reserves the right not to accept delivery in part or full.

10. **Genuine Pricing**: Vendor is to ensure that quoted price for the particular item is not more than the price quoted to any other customer in India, particularly to IITs/NITs and other Government Organization. Copy of the latest price list for the quoted item, applicable in India, must be enclosed with the offer.

11. **Conditional tenders not acceptable:** All the terms and conditions mentioned herein must be strictly adhered to by all the vendors. Conditional tenders shall not be accepted on any ground and shall be rejected straightway. Conditions mentioned in the tender bids submitted by vendors will not be binding on NIT Mizoram.

12. **Road Permit:** NIT, Mizoram will provide Road Permit to the Vendors of outside Mizoram.

13. **VAT deduction at source:** In case of supply within Mizoram, VAT deduction at source, as per Order/ notification of the Govt. of Mizoram will be applicable.

14. **Late and delayed tender**: Late and delayed tender will not be considered. In case any unscheduled holiday occurs on the prescribed closing/opening date the next working day shall be the prescribed date of closing/opening.

15. **Payment**: 100% payment within 30(Thirty) days after receipt of the material in full, satisfactory installation, training and acceptance.

16. **Payment for Imported Goods:** By an irrevocable letter of Credit at CIF/CIP Kolkata value negotiable through any overseas branch of State Bank of India/any Schedule Bank of India.

Note: Please note LoC will not be opened unless and until Letter of Acknowledgement in original is received at NIT, Aizawl, Mizoram, directly from the principal (Even in case of firms having subsidiary office in India).

17. ADDITIONAL TERM FOR IMPORTED GOODS

Following term besides the fore mentioned terms will be applicable in case of foreign purchases:

Rates: Prices quoted must be for destination including freight and insurance charges inclusive of free delivery up to the door of department/centre NIT, Mizoram premises, as per details below:

Sl. No.	Particulars	Rate
I	Basic Price (per unit) including Packing, Forwarding, Freight, Insurance, Installation & demonstration charges inclusive	
II	Custom Duty (Approximate)	
III	Grand Total for the item on door delivery at NIT Mizoram	

18. **Free Maintenance & Service for 20 Years**: An agreement is to be executed between the Institute & the **Manufacturer/Distributor/Dealer** for providing **Free Maintenance & Service for 20 Years** after expiry of the Warranty Period of the equipment by the Manufacturer/Distributor/Dealer (Preferably from the Manufacturer) within 30 Days from the day of Complain. The cost of the Spare parts required for the service and maintenance will be paid by the Institute along with the To & Fro charges (The cheapest mode of Travel).

18. **Enquiry during the course of evaluation not allowed**: No enquiry from the bidder(s) shall be entertained during the course of evaluation of the tender till final

decision is conveyed to the successful bidder(s). However, the Purchase Committee or its authorized representative may make enquiries/seek clarification from the bidders. In such a case, the bidder must extend full co-operation. The bidders may also be asked to arrange demonstration of the offered items, in a short period of notice.

19. The acceptance of the quotation will rest solely with the Director, NIT Mizoram, who in the interest of the Institute is not bound to accept the lowest quotation and reserves the right to himself to reject or partially accept any or all the quotations received without assigning any reasons.

20. **Force Majeure**:
If the performance of the obligation of either party is rendered commercially impossible by any of the events hereafter mentioned that party shall be under no obligation to perform the agreement under order after giving notice of 15 days from the date of such an event in writing to the other party, and the events referred to are as follows:
    i. Any law, statute or ordinance, order action or regulations of the Government of India,
    ii. Any kind of natural disaster, and
    iii. Strikes, acts of the Public enemy, war, insurrections, riots, lockouts, sabotage.

21. **Applicable Law**:
(a) The contract shall be governed by the laws and procedures established by Govt. of India and subject to exclusive jurisdiction of Competent Court and Forum in Aizawl only.
(b) Any dispute arising out of this purchase shall be referred to the Director NIT Mizoram, and if either of the parties hereto is dissatisfied with the decision, the dispute shall be referred to the decision of an Arbitrator to be appointed by the Director of the Institute. The decision of such Arbitrator shall be final and binding on both the parties.

22. **Training:** The vendor will provide free training at NIT Mizoram after Successful installation of the Machines/equipments.

Sd/

Encl.: **ANNEXURE-I, ANNEXURE-II, ANNEXURE-III & ANNEXURE-IV**

Annexure -I

A. COMPLIANCE CERTIFICATE FOR NIT TERMS
(To be enclosed in the Technical bid)

Sl. No.	NIT Terms and Conditions	Yes/No
01	**Rate** quoted as per instruction	
02	**AMC rate** after warranty provided	
03	**Validity** of quoted rate for 90 days agreed	
04	**EMD** submitted (appropriate certificate enclosed)	
05	**PBG** term agreed	
06	**Payment** term agreed	
07	**Delivery terms** agreed	
08	**Warranty period** agreed	
09	**Literature:** Printed Literature provided	
10	**Dealership** / distributorship certificate (in case of dealers/agents) provided	
11	**Sales Service**: address of after Sales Service centre in India (for imported goods)/ in the region provided	
12	**Manufacturer** certificate provided	
14	**Applicable law** terms agreed	

Signature with Seal:…….

Vendor: M/s……

B. <u>COMPLIANCE CERTIFICATE FOR SPECIFICATIONS</u>
(One for each item must to be enclosed in the Technical bid)

Item Sl. No.			
Specifications as per Annexure-IV		**Quoted Item Specs.***	**Complied (Yes/No)**
Parameter	**Specification**		

Signature with Seal:.....

Vendor: M/s.....

*** Vendor must quote the parameter specification of the quoted product in this column and not just copy the specification from the tender call document. Failure to do so will lead to rejection of the tender.**

Annexure -II

PERFORMANCE BANK GUARANTEE

To:

The Director
National Institute of Technology Mizoram

WHEREAS..... (Name of Supplier)

Hereinafter called "the Supplier" has undertaken, in pursuance of Contract No..... dated ..... 20... to supply..... ..... (Description of Goods and Services) hereinafter called "the order".

AND WHEREAS it has been stipulated by you in the said order that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with the Supplier's performance obligations in accordance with the order.

AND WHEREAS we have agreed to give the Supplier a Guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of..... ..... (Amount of the Guarantee in Words and Figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the order and without cavil or argument, any sum or sums within the limit of ..... (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the .....day of.....20.....

Signature and Seal of Guarantors

.....

Date.....20....

Address:.....

.....

All correspondence with reference to this guarantee shall be made at the following address: **National Institute of Technology Mizoram, Chaltlang, Aizawl, Mizoram, India: 796012**

A**nnexure -III**

MANUFACTURERS' AUTHORIZATION FORM

No. Dated _____

The Director
National Institute of Technology
Aizawl-796012, Mizoram

Dear Sir:

We…… who are established and reputable manufacturers of ……having factories at----------(address of factory) do hereby certify that ……(Name of the Authorized Dealer)is our authorized dealer to quote against your tender enquiry no **…… ,Last Date of Submission is:**

No other Company other than …… (Name of the Authorized Dealer) is authorized to quote of our products against this Tender Enquiry No…….

Yours faithfully,

(Name)

(Name of manufacturers)

Annexure –IV

TECHNICAL SPECIFICATION FOR STRENGTH OF MATERIALS LABORATORY

SL. NO.	TECHNICAL SPECIFICATION	QTY
01.	**DIGITAL BRINELL HARDNESS TESTING MACHINE** **1.** Type of Machine should be Digital Electronic Brinell Hardness Testing machine with testing range 8-650HBW **2.** Test Force (Kgf) shoild be 62.5; 100; 125; 187.5; 250; 500; 750; 1000; 1500; 3000 **3.** Accuracy of Displayed Hardness Value Hardness Range (HBW) Maximum Tolerance% Repetition% =/< 125 +/-3 =/<3.5 =/<125 =/<225 +/- 2.5 =/<3.0 > 225 +/-2.0 =/<2.5 **4.** Maximum Height of specimen (mm) should be 225 **5.** Throat Depth (mm) should be 135 **6.** Magnification of microscope should be 15X **7.** Minimum Reading grade of the drum wheel of the microscope (mm) should be 0.0025 **8.** Power should be AC 220V/50-60Hz **9.** Standard Accessories with the machine should be - (i) Large, Small and Vee Shaped Tables of each category (ii) Indenter of diameter 2.5mm, 5mm and 10mm each (iii) Microscope of 15X magnification (iv) 4. Standard Hardness Test Block HBW750/5 (150-250); HBW 3000/10 (150-250	**01(One)** **No**
02	**DIGITAL ROCKWELL CUM ROCKWELL SUPERFICIAL HARDNESS TESTING MACHINE** **1.** Type of Machine should be Digital Rockwell cum Rockwell superficial Hardness Testing machine **2.** Major Load (Kgf) should be 15, 30, 45, 60, 100,150 **3.** Minor Load (kgf) should be 3, 10 **4.** Maximum Height (mm) should be 295 **5.** Depth of Throat (mm) should be 148 **6.** Scales should be Rockwell A,B,C,D,E,F,G,H,K,M,P,R,S,L,V,15N,30N,45N,15T,30T,45T in Nos. 1 to21 resp. **7.** Standard Accessories with the machine should be-	**01(One)** **No**

	(i) Testing Table of 50mm diametre-1unit (ii) Testing table of 40 mm diameter with V groove for round jobs 6-45mm-1 unit (iii) Diamond Indentor- Rockwell- 1 unit (iv) Steel ball indentor 1/16" with 5 spare balls- 1unit (v) Test BLOCK ROCKWELL B and C - 1 unit for each scale (vi) Test Block HR 30N - 1unit (vii) Allen spanners- 5 nos. (viii) Screw Driver- 1 no. (ix) Clamping Device - 1no. (x) Wooden box for standard accessories- 1no. (xi) Telescopic sleeves for elevating screw protection- 1 set (xii) Spare Fuse 1amp-1 no. (xiii) Power Cable- 1 no. (xiv) Machine Cover-1 no. **8.** Instruction Manual - 1no.	
03.	**DIGITAL VICKERS HARDNESS TESTING MACHINE** **1.** Test load :should be 1, 5,10, 20, 30, 50 kgf **2.** Optical Magnification should be 70X **3.** Optical Measuring range (mm) should be 0.1 to 1.0 **4.** Max. Test Height should be 200 mm **5.** Scale Least count (mm) should be 0.001mm **6.** Throat depth (mm) should be 135mm **7.** Power supply should be 220 V AC, 50 HZ, 1 phase **8.** Standard Accessories with the machine should be- (i) Standard text block - 1 no (ii) Diamond Penetrator – 1no (iii) Weights - 1 set (iv) Vee type anvil (small & big) – 1 on each (v) Spanners - 1 set (vi) Electronic cord – 1 no (vii) Instruction & operational manual – 1no	**01(One)** **No**
04.	**DIGITAL TORSION TESTING MACHINE** **1.** The machine should be suitable for Torsion and Twist tests on various metal rods & flats. **2.** Torque should measure by Torque cell & Angle of twist measure by Rotary encoder. **3.** Geared motor should apply the torque to specimen through gear box. **4.** Provision should be for display of Torque & Angle of twist on LCD on Data	**01(One)** **No**

	Acquisition system. **5.** Torque resolution should be 0.1% of machine capacity for entire range. **6.** Angle of twist resolution should be 0.1 Degree. **7.** Accuracy of Torque measurement should be ± 1% in the range from 4% to 100% of machine capacity. **8.** Provision to conduct test slowly by a handle which facilitates finding Modulus of rigidity "G". **9.** Facility for connecting the DAS Panel to Computer. Special comprehensive software for torsion test should be provided. **10.** Software Provision should be there for Torque Vs Angle of Twist graph & also to calculate various parameters like Torsional shear strength, Modulus of Rigidity, etc. **Description** **Values** Max. torque capacity : 1000 Nm Torque Resolution : 0.1 Nm Angle of Twist : 0.1 Degree Torsion Speed : 1.5 reverse RPM Clearance between Grips : 0-600 mm Grips for flat Specimens width mm : 10-18,18-26,26-34 mm Grip width : 5-15,50 mm Motor (400-440 V, 3 Phases & 50 Hz.) : 1 HP	
05.	**UNIVERSAL TESTING MACHINE , 600KN(60T)** **1.** Front Open Crossheads: The machine should have front open crossheads which is an important feature to facilitate insertion of tensile specimen from front. This is extremely useful especially for heavy specimens and bigger capacity machines. This facility is essential because the jaws and the inserts can be easily removed by just pulling from the front. **2.** Hydraulic grips: It is essential for hydraulic operation of jaws (closing and opening). In the hydraulic griping method, separate double acting hydraulic cylinders are to be provided to operate the jaws and the cylinder operation just by pressing a push button. A power pack with oil tank, pump, oil filler cum breather, oil level indicator, filter, relief valve are to be provided along with an electric motor to drive the hydraulic pump.	**01(One)** **No**

	3. Electronic Extensometer: It is also an essential feature for the UTM with the following specifications. Gauge length: 50mm & 25mm, elongation of 0-2 mm, resolution 0.001mm, diameter of specimen to be used with extensometer 1-20mm, thickness of specimen measured by extensometer 20mm etc. **4.** Type of Machine should be Computerized Digital Load ,cell based machine (i) Measuring capacity (kN) should be 600 (ii) Measuring Range (kN) should be 0 - 600 (iii) Least Count (N) should be 20000 counts of full scale of load (iv) Load Range in kN with accuracy should be 12 - 600 of Measurement ± 1% (v) Resolution of piston movement should be 0.01mm (vi) Maximum tensile clearance 70-810 mm at fully descended piston position (vii) Maximum clearance for compression test : 0-720 mm (viii) Distance between columns : 620mm (ix) Piston Stroke: 250 mm (x) Maximum straining speed at no load (mm/min): 0-100 (xi) Power supply : 3 Ph, 415V, 50 Hz, A.C (xii) Total Load : 2.2 KW **5.** Tensile Test Jaws should be - (i) For round specimen dia : 13 – 26 mm (ii) For round specimen dia : 26 – 40 mm (iii) For flat specimen thickness : 0 – 15 mm (iv) For flat specimen thickness : 15– 30 mm (v) Maximum width of flat specimen : 82 mm **6.** Transverse Test should be - (i) Adjustable roller support of width : 160 mm (ii) Diameter : 50 mm (iii) With maximum adjustable clearance : 660 mm (iv) Punch tops of radius : 30 mm **7.** Compression Test should be- (i) Compression Platen of Dia - 200 mm (ii) WINDOWS 7 Based Software should be capable of Real Time Graphs **8.** Standard Accessories (i) Desktop Computer: Intel Corei3 Processor, 2 GB RAM with Windows WP Operating system, 17" LCD Monitor , Make: HP/LENOVO Along with Laser Printer & UPS - 1 Set (ii) Hydraulic OIL (Full Tank) **(iii)** Operating & Instruction Manual – 1 No. Each	
06.	**DIGITAL FATIGUE TESTING MACHINE** **1.** Maximum bending moment should be 200 Kg cm **2.** Bending moment adjustable should be 5 – 200 Kg cm **3.** Gripping dia of specimen should be 12 mm **4.** Testing dia of specimen should be 8 mm	**01(One)** **No**

	5. Rotating speed should be 4200 rpm **6.** Accuracy of applied bending moment should be ± 1% **7.** Digital counter should be No.of 8 digits **8.** Power required :0.5 HP **9.** Main supply should be 3 Phase, 440 Volts, 50 Hz, A.C **10.** Overall size should be (approx) L 1000 x W 500 x H 600 MM **11.** This machine should be light, compact and simple design used to test the fatigue strength of materials and draw S-N diagram. **12.** It should be Table Top model and there should be no need of foundation. **13.** This is should be rotating beam type machine in which load is applied in reversed bending fashion. **14.** The standard 8 mm dia specimen should be held in special holders at its ends and loaded such that it experiences a uniform bending moment. **15.** The specimen should be rotated at 4200 rpm by a motor. A complete cycle of reversed stresses in all fibers of the specimen should be produced during each revolution. **16.** The bending moment should be applied with a lever system and can be easily changed by moving a weight over the lever. **17.** Total number of revolutions at which the specimen fails should be recorded by a Digital counter. **18.** An interlocking system should puts off the motor at specimen failure. **19.** Machine should meet requirements of IS 5075-1969	
07.	**DIGITAL IMPACT TESTING MACHINE** **1.** The equipment should be suitable for Charpy & Izod Impact tests on various materials. Works on Pendulum principle. **2.** Rigid designs of machine frame & other parts should assure minimum energy absorption during fracture which results in improved test accuracies. **3.** The highly stressed & wearing parts like support blocks & strikers should be of special alloy steels duly heat treated. **4.** Safety guard for the operator should be provided. **5.** Initial potential energy should- for Charpy is 300 Joules & for Izod is 170 Joules with a resolution of 0.5 Joules **6.** Pendulum drop angle for Charpy should be 140° & for Izod is 90°. **7.** ASTM Impact Testing machine should also supply, which conforms to E-23 ASTM standard.	**01(One) No**

	8. Accuracy should conform to IS:3766-2003, IS:1598-1977, IS:1757-1999, IS:1499-2003, BS:131-Part-I,II,III,IV & BS EN-10045-1993 (for Charpy). **9.** Optional Accessories should be- (i) Caliper gauge for checking V notch for Izod & Charpy. (ii) Templates for checking 10 x 10 mm cross section of Izod / Charpy test specimen. (iii) Depth notch gauge including V & U notch gauges for checking depth below V/U notch, angle and radius. (iv) Izod support for 0.450" dia Izod round specimen. (v) Self centering tong for quick and accurate setting of Charpy test specimen. (vi) V' notch milling cutter.	
08.	**THERMAL IMAGE CAMERA WITH SUPER RESOLUTION FACILITY TO DETERMINE THE TEMPERATURE DISTRIBUTION FOR ANALYSIS OF THERMAL STRESS** **1.** The equipment Should Include Thermal Imaging Camera with minimum of the following specifications (i) Temperature range : -20 °C to +100 °C / 0 °C to +350 °C (switchable) **2.** High temperature measurement– optional : +350 °C to +1200 °C. **3.** Accuracy should be ±2 °C or 2% (whichever is greater) **4.** Analysis functions should be – (i) up to 3 measurement points, Hot/Cold Spot Recognition, (ii) Area measurement (Min/Max & average),Isotherm and alarm values (iii) Emissivity correction : 0.1 to 1.0 (0.01 increments) **5.** Spectral band should be 8 µm to 14 µm **6.** Detector should be 320 x 240 pixels Focal Plane Array, **7.** Digital display should be 4.3" LCD touch Screen, large high-resolution digital display. Display should be rotatable to capture image at any angle **8.** Palettes should be minimum 7 colour palettes should be available **9.** Thermal sensitivity (NETD) should b e ≤0.03 °C at 30 °C **10.** Focus should be with Auto/Manual **11.** With Inbuilt Visual light Camera : Minimum 3MP **12.** Image Storage should have the capability to store minimum 1000 Images **13.** Voice Annotation should be Possible for minimum 30 sec. Per image **14.** LENS should be Standard Lens . **15.** Field of view (FOV) should be 30° horizontal x 23° vertical	**01(One)** **No**

	16. Spatial resolution (IFOV) should be 1.7 mrad **17.** Min focus distance should be 0.1 m . **18.** Optional Telephoto Lens should be - (i) Field of view (FOV) : 11° horizontal x 9° vertical (ii) Spatial resolution (IFOV): 0.6mrad (iii) Min focus distance : 0.5 m (iv) Software :Full analysis and reporting software should be included . Software should be license free .The Software shall have minimum of the following features ➢ Complete Analysis of the Thermal Imager ➢ Capability to add comments & remarks in the Image ➢ Add visual images in the Reports ➢ Overlay Thermal Imager over Visual Image ➢ Set the transparency level to regulate the intensity of the infrared or the real image component in the overlay. ➢ Mark Critical temperature ranges by inserting infrared limits to directly emphasize problems in the visual image ➢ Generate Reports automatically **19.** Battery type should be internal rechargeable, **20.** Battery operating time should be 4 hours continuous operation **21.** Battery charging AC Adapter should be provided. **22.** Storage temperature should be 10 °C to +50 °C **23.** Relative humidity should be 20% to 80%, non-condensing **24.** Water and dust resistant should be IP54 **25.** Weight (including batteries) should be Less Than 2 Kgs **26.** Accessories should be included with minimum following - (i) Carrying Case for Thermal Imager (ii) Lens Protection Glass to Prevent Thermal Imager Lens from Damage **27.** The equipment should be guaranteed for trouble free performance and against any defects in material; workmanship; design and for any abnormal behavior for period of not less than 18 months from the date of supply.	
09.	**STRAIN GAUGES APPARATUS FOR DETERMINING THE GAUGE FACTOR** **1.** Bending bar made of steel should be 660 x 25 x 12mm **2.** Strain gauge application (i) full bridge, 350 Ohm (ii) 2 strain gauge on the top and underside of the bar respectively	**01(One)** **No**

	3. Dial gauge should be 0...20mm, graduation: 0.01mm **4.** Adapter cable with 4 laboratory plug connectors, 4mm **5.** Investigation of deflection and strain should determine gauge factor **6.** Bending bar with 2 strain gauge on the compression side and tension side respectively **7.** Strain gauge configured as full bridge **8.** 2-point ball bearing mounting of bar permits purely bending load application **9.** Mechanical load application device with spindle , handwheel and cross-arm **10.** Dial gauge with adjustable dial for direct measurement of deflection **11.** Adapter cable for connection to voltage source and to a measuring instrument **12.** It should have the scope to determine the fundamentals of measurement using strain gauges **13.** It should have the scope to determine the measurement of deflection using a dial gauge **14.** It should have the scope for determination of gauge factor of strain gauges	
10.	**PHOTOELASTIC EXPERIMENTS APPARATUS WITH A TRANSMISSION POLARISCOPE** **1.** Light source (i) lamp box with white diffuser **2**. For white light- (i) fluorescent tube TL-E32W/33 (colour:33) (ii) incandescent lamp, candle bulb, matt inner E14, 235V, 25W **3**. For monochromatic light(colour yellow) (i) sodium vapour lamp SOX 35, 35W **4.** Filter, enclosed in glass, diameter: d=425mm (i) 2 polarisation filters (dark olive) (ii) 2 quarter wave filters (colourless) **5.** Representation of mechanical distribution of stress in photoelastic experiments **6.** Plane polarisation filters as polariser and analyser **7.** Quarter wave filters to generate circular polarised light **8.** All filters with 360^0 angle scale and marking of main optical axis **9.** White light generated using a fluorescent tube and two incandescent lamps **10**. Monochromatic light(colour yellow) generated using a sodium vapour lamp **11**. Filters roller bearing mounted and rotating **12**. Frame cross-arms height-adjustable **13**. Generation of compression or tension forces by means of a threaded spindle	**01(One)** **No**

	14. Complete models in polycarbonate(PC) for demonstration purpose available as accessories. **15.** It should have the scope to determine the generation of planar stress states in various models under load (i) bending, tensile load, compressive load **16.** It should have the scope for investigation of diffusion of stresses with plane or circular polarised light **17.** It should have the scope to **f**or Interpretation of photoelastic fringe patterns (i) stress concentrations, zero points, neutral fibers, areas of constant stress, stress gradients **18.** It should have the scope for determination of occurring stresses and strains graphically and arithmetically	
11.	**STRAIN GAUGE APPLICATION SET** **1.** Strain gauge should be 350 Ohm (i) 10 gauges, single measuring grids, for steel (ii) 10 gauges, parallel measuring grids, for steel (iii) 10 gauges, 90^0 measuring grids, for steel (iv) 10 gauges, 45^0 measuring grids, for steel (v) 10 gauges, single measuring grids, for aluminium **2.** Soldering bit should be 16W **3.** Ribbon cable should be 6x0.14mm^2 **4.** Magnifying glass should be 6-times magnification **5.** Complete set of components for application of strain gauges **6.** Strain gauges with single measuring grids, parallel measuring grids and measuring grids at $90^0/45^0$ **7.** Strain gauges for steel and aluminium components **8.** All necessary tools, adhesives and other aids included in the set **9.** Carrying case should be Lockable **10.** Learning package should include with text book, exercise script and video **11.** Cable and connectors should be provided to connect the applied strain gauge to the measurement amplifier. **12.** It should have the scope to determine fundamentals of electrical resistance strain gauges **13.** It should have the scope to determine preparation of the measuring point **14.** It should have the scope to determine selection of a suitable strain gauge **15.** It should have the scope to determine attaching, wiring up and configuring strain gauges on mechanically stressed components. **16.** It should have the scope to determine protection of the strain gauge measuring point against external influences **17.** It should have the scope to determine interpretation of measured	**01(One)** **No**

	values(theoretical)	
12.	**STRAIN GAUGE TRAINING SYSTEM** **1.** Tension bar should be- (i) measuring length:50mm (ii) cross-section: 2x 10mm **2.** Bending bar should be- (i) length: 385mm (ii) cross-section:5x20mm **3.** Torsion bar should be- (i) length:500mm (ii) d=10mm **4.** Set of weights for small should be 10 x 0.5N,1x 1N(hanger) **5.** Set of weights for large should be 1x 5N, 2x 10N, 1x 20N, 1x 5N (hanger) **6.** Strain gauge measuring point should be full bridge, 350Ω **7.** Amplifier should be with- (i) measuring range : +/-2mV/V (ii) resolution: 1µ V/V (iii) zero balancing adjustment range: +/-1mV (iv) supply voltage : 10VDC **8.** Frame opening W x H: 480x450mm **9.** Experimental unit investigating the fundamentals of strain gauge measurement **10.** Tension, bending and torsion tests each with strain gauge measuring points in full bridge circuit **11.** Strain gauge application areas should be protected by Plexiglas cover **12.** Steel test bodies **13.** Determination of modulus of elasticity on various materials using measuring objects tension rods (Brass, Copper, Aluminium) **14.** Measuring amplifier with 4-digit digital display **15.** Frame to house the measuring objects **16.** Box to house the components **17.** It should have the scope to determine the fundamentals of measuring with strain gauges **18.** It should have the scope to determine the strain gauge types and application techniques **19.** It should have the scope to determine the calculation of mechanical deformation under tension, bending and torsion **20.** It should have the scope to determine the correlation between mechanical strain and electrical resistance in a strain gauge **21.** It should have the scope to determine with Tension Rods(Brass, Copper, Aluminium) **22.** It should have the scope for determination of the modulus of elasticity for various materials from the measurement data of a tensile test	**01(One)** **No**