

**National Institute of Technology, Manipur
Takyelpat, Imphal-795001
Manipur**

Tel:- 0385-2058566 (o)

Ref: NITM.1/(153-Estt)/LabEquip/Civil/Tender/2015-3532

Date: 03-06-2015

**NOTICE INVITING TENDER (NIT)
FOR SUPPLY & INSTALLATION OF EQUIPMENTS FOR VARIOUS LABS OF
CIVIL ENGINEERING DEPARTMENT AT NIT MANIPUR IMPHAL**

The Director, NIT Manipur invites quotation for supply & Installation of Equipment as per details at ANNEXURE-IV-VI, in **Two Bids** to reach the undersigned on or before 30th June 2015.

Sl No.	Specifications at Annexure	Items	Qty	EMD (Rs.) in the form of DD	Tender Document Fee (Rs.) in the form of DD only.
01.	IV	Supply & Installation of Equipment for Advance Surveying /GIS Lab to be installed at NIT, Manipur, Langol, Imphal	One	@2%	1,000.00
02	V	Supply & Installation of Equipment for Hydraulics & Water Technology Lab, to be installed at NIT, Manipur, Langol, Imphal	One Package	@2%	1,000.00
03	VI	Supply & Installation of Equipment for Materials Testing Lab- I to be installed at NIT, Manipur, Langol, Imphal	One Package	@2%	1,000.00
04	VII	Supply & Installation of Equipment for Materials Testing LAB -II to be installed at NIT, Manipur, Langol, Imphal	As mentioned in Annexure VII	@2%	1,000.00
05	VIII	Supply & Installation of Equipment for <u>STRUCTURE ENGINEERING LAB-I</u> to be installed at NIT, Manipur, Langol, Imphal	One	@2%	1,000.00
06	IX	Supply & Installation of Equipment for Environmental Engineering	As mentioned in	@2%	1,000.00

		Laboratory to be installed at NIT, Manipur, Langol, Imphal	Annexure IX		
07	X	Supply & Installation of Equipment for Transportation Engineering Laboratory to be installed at NIT, Manipur, Langol, Imphal	As mentioned in Annexure X	@2%	1,000.00

- 1). Last date & Time for Submission: 30-06-2015 (14.00 HRS)
 (2). Date/Time for Opening of Tech. Bids: 03-07-2015 (14.30 HRS)

After evaluation of technical bids, financial bids of the successful bidders will be opened on a later date which will be notified in the Institute website
 Venue of Bid Opening at NIT, MANIPUR, Langol, IMPHAL

BID INSTRUCTIONS:

01. Quotations will have to be submitted in TWO Bids. 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 EQUIPMENTS FOR
.....LAB OF CIVIL ENGINEERING
DEPARTMENT AT NIT MANIPUR, LANGOL, IMPHAL,NIQ REF NO.
....., DATE:
- 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’s must appear on all the papers and envelopes submitted.

QUALIFICATION REQUIREMENTS

1. The Bidder should be a firm of reputation having sufficient expertise and experience in the subject tender with sound warranty / service support capability and authorization from Manufacturer/Distributor.
2. **The Bidder has to quote for all the items of a Lab, Bidders who do not quote for all the items are subject to be disqualified for that particular Lab."**

NIT TERMS & CONDITIONS:

01. **Rates:** Rates quoted in the **Price Bid** should be **FOR NIT Manipur basis**, as per details below:

Sl. No.	Particulars	Rate
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I	Basic Price (per unit)	
	Total	
	Taxes(pl. give break up)	
	Total(per unit)	
	Grand Total for the item	
	Transportation charge up to NIT Manipur premises (if applicable)	
	Grand total on door delivery at NIT Manipur	

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 1(One) Year or period specified against the item.
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/Distributor must enclose valid dealership certificate.
07. **Earnest Money:**
Refundable earnest money deposit (EMD) @2% of the Quoted Value through demand draft drawn in favour of “*Director, National Institute of Technology Manipur*”, payable at Imphal, 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 Bank Guarantee. Offers received without Earnest Money or valid Certificate shall be summarily rejected.
08. **Performance Bank Guarantee (PBG):** All successful bidders 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 Imphal. 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 the 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 tampered 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 Manipur.
- 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 Manipur 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.
- 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 Manipur.
- 12. Road Permit:** NIT, Manipur will provide Road Permit to the Vendors of outside Manipur.
- 13. VAT deduction at source:** In case of supply within Manipur, VAT deduction at source, as per Order/ notification of the Govt. of Manipur 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:**
(a) 95 % payment within 30(thirty) days from date of delivery, satisfactory installation and acceptance and submission of PBG, wherever applicable.
- 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, Imphal, Manipur, 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, Manipur premises, as per details below:

Sl. No.	Particulars	Rate
a		
I	Basic Price (Ex work)	
II	FCA/FOB dispatch port,	
III	Total CIP/CIF Kolkata	
IV	CIP NIT Manipur Price (Freight and Insurance charge from Kolkata to NIT Manipur)	
V	Grand total on door delivery at NIT Manipur	
b		
	Installation & commissioning charge, if any	
	Custom Duty (Approximate)	
	Agency Commission (if any)	
	Annual Maintenance Contract rate (after expiry of warranty period)	

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 Manipur, 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:
- Any law, statute or ordinance, order action or regulations of the Government of India,
 - Any kind of natural disaster, and
 - 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 Imphal / India only.
- (b) Any dispute arising out of this purchase shall be referred to the Director NIT Manipur, and if either of the parties hereto is dissatisfied with the decision, the dispute shall be referred to the decision of an Arbitrator, who should be acceptable to both the parties, to be appointed by the Director of the Institute. The decision of such Arbitrator shall be final and binding on both the parties.

Sd/-
Registrar, NIT Manipur

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

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	Applicable law terms agreed	

Signature with Seal:.....

Vendor: M/s.....

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

Item Sl. No.			
Specifications as per Annexure-IV-X		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
Imphal-795001, Manipur

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 theday of.....20.....

Signature and Seal of Guarantors

.....
.....
.....

Date.....20....

Address:.....

.....
.....

All correspondence with reference to this guarantee shall be made at the following address:

The Director, National Institute of Technology ,Imphal-795001, Manipur

Annexure -III

**MANUFACTURERS'/ DISTRIBUTOR'S AUTHORIZATION FORM
(In the letter head of the manufacturer)**

No.

Dated _____

The Director
National Institute of Technology
Imphal-795001, Manipur

Dear Sir:

We..... who are established and
reputable Manufacturers/distributors of

.....having factories/office at---

(address of factory/office) do hereby certify
that.....

.....(Name of the Authorised Dealer)is our authorized
dealer to quote against your tender enquiry no

..... ,**Last Date of Submission is:**

Yours faithfully,
(Name)
(Name of Manufacturer/Distributor)

Annexure IV

Advance Surveying /GIS Lab

Sl	Instrument Name	Quantity
1	<p>ECHO SOUNDER</p> <p><u>Specification:</u></p> <p><u>Measurements</u></p> <ol style="list-style-type: none"> 1) Frequency:200 KHz 2) Beam angle: 7 3) Depth resolution: 0.1 ft/0.01m 4) Accuracy :±1cm =0.1 D(0.1% of depth value) 5) Ping rate: 14Hz, Maximum 30Hz 6) Sound velocity: 1300-1700 m/s resolution is 1 m/s 7) Depth range: 0.3-300m/900ft 8) Draft : 0-9.9m 9) Gain control: AGC and TVG, depth and gain, a double door tracking 10) Output data format: SOUTH,SDH-130,DES025,INN455,ODOM etc <p><u>Physical</u></p> <ol style="list-style-type: none"> 1) Environmental : 300~ + 600 non conducting 2) Output power: up to 300 watts 3) Power supply: 9-15V DC, less than 25w,110 ~265 V AC(optional) 4) Dimension: 35cmx29cmx14cm 5) Weight: 7.5kg <p><u>Hardware part</u></p> <p><u>Embedded system index</u></p> <ol style="list-style-type: none"> 1) CPU frequency 1.6 Ghz 2) Internal memory 1GB 3) Memory capacity 4G high-speed CF card 4) I/O interface 5) USB 6) SOS 232 7) VGA interface <p><u>Display panel layout</u></p> <ol style="list-style-type: none"> 1) 12.1 inch color LCD 2) Touch screen 3) Embedded windows XP- OS 4) Power ON / OFF 5) Interface protection 6) Separate panel overlay for Keyboard mouse <p><u>Standard Configuration</u></p> <ol style="list-style-type: none"> 1) Echo sounder SDE 285 (1 pc) 2) Carrying case (for echo sounder)(1 pc) 3) 200 Khz transducer(1 pc) 4) Transducer pole (1 pc) 5) Carrying case for transducer(1 pc) 6) Double RS-232 communication cable(1 pc) 7) 220v External power supply cable(1 pc) 8) 220v External power supply cable Adapter(1 pc) 9) 12 vExternal power supply transfer cable(1 pc) 10) Keyboard(USB)(1 pc) 11) Mouse (USB)(1 pc) 12) Adapter cable for mouse and keyboard(1 pc) 	01

	<p>13) Pen drive(1 pc) 14) SDE-28S Software (on board) 15) PowerNav software (with dongle key)on board</p>	
2	<p>Integrated Real Time Kinetics (RTK) Global Navigation System Support (GNSS) Surveying System SPECIFICATIONS Receiver Part Measurements General Info 220 channels, by advanced Pacific Crest Maxwell 6 Custom Survey GNSS technology High precision multiple correlator for GNSS pseudo range measurements Unfiltered, unsmoothed pseudo range measurements data for low noise, low multipath error, low domain correlation and high dynamic response, Very low noise GNSS carrier phase measurements with 1mm precision in a 1Hz bandwidth Signal to Noise ratlos reported in dB-Hz Proven specific Crest low elevation tracking technology Satellite signals tracked simultaneously - GPS: L1 C/A, L2E, L2C, L5 (reserved) - GLONASS: L1 C/A, L1P, L2C/A (GLONASS M only), L2P - SBAS: L1 C/A, L5 (reserved) - Galileo: (reserved) Supports GIOVE-A: L1BOC, E5A, E5B, E5AtlBOC Supports GIOVE-B: L1CBOC, E5A, E5B, E5AtlBOC -Compass: (reserved) B1 (QPSK), B1-MBOC (6,1,1/11) B1-2 (QPSK) B2 (QPSK), B2- BOC (10, 5), B3 (QPSK), B3BOC (15, 2.5) L5 (QPSK) Code differential GNSS positioning Horizontal: 25mm+1ppm RMS Vertical: 50mm+1ppm RMS SBAS differential positioning accuracy: typical <5m 3DRMS Static and FastStatic GNSS surveying Horizontal: 3mm+1ppm RMS Vertical: 5mm+1ppm RMS Realtime kinematic surveying Horizontal: 10mm+1ppm RMS Vertical: 20mm+1ppm RMS Initialization time: typically <15s Initially reliability: typically >99.9% Hardware Physical Dimension (L*W*H): 158mm*158mm *78mm (6.2 in *6.2 in *3.1 in) Weigh: 1.35 kg (2.98 lb) with battery and radio built in Temperature Operating: -40°C +65 (-49F +140F) Storage: -55°C +85°C (-67F +185F) Humidity: 100% condensing</p>	01

<p>Water/Dustproof: Tested to Ip67 standard, protected from temporary immersion to depth of 1m (3.28 ft)</p> <p>Shock and vibration: Design to survive a 2m(6.6 ft) pole drop onto concrete</p> <p>Electrical</p> <p>Power : 12 – 15 DC external power input</p> <p>Rechargeable, 7.4 v, 10000mAh Lithium ion battery units built in receiver</p> <p>Battery life : 15 – 20 hours for built in battery (varies with temperature and working mode)</p> <p>Communication and data storage</p> <p>Standard and data storage</p> <p>Standard USB 2.0 port</p> <p>RS-232 port: Band rate upto 115200</p> <p>Fully sealed and integrated 2.4GHz communication Bluetooth port</p> <p>UHF receiving antenna port</p> <p>Fully sealed and integrated 450 – 470 MHZ receiver</p> <p>Built in GDL 2 RADIO (Default configuration)</p> <ul style="list-style-type: none"> - Transmit power :0.5W - UHF range (varies with terrain/temperature): 3 – 5 km typical/ 8 – 10 km optical standard GDL 5 RADIO (Optional) - Transmit power : 25W - UHF range (varies with terrain/temperature): 8-10 km typical/ 15-20 km optical standard mini GDL 5 RADIO (Optional) - Transmit power : 2/5W - UHF range (varies with terrain/temperature): 3-5 km typical/ 8-10 km optimal <p>Fully sealed and Integrated Internal GPRS/GSM Module</p> <p>External cellphone support for GPRS/GSM module for network RTK (CORS) operations</p> <p>Network RTK (via CORS) range (varies with temperature/ GPRS data rate): 20-50km</p> <p>Storage: Internal memory 4GB</p> <p>Recording Rate: 1Hz positioning, up to 20Hz (supported by mainboard Bd970)</p> <p>Reference outputs: CMR+, CMR+, RTCM 2.1, RTCM 2.2, RTCM 2.3, RTCM 3.0, RTCM 3.1</p> <p>Controller Part</p> <p>Platform</p> <ul style="list-style-type: none"> - PXA270 624 MHz processor - 1GB Flash ROM - 256 MB RAM <p>Operating System</p> <ul style="list-style-type: none"> - Windows CE 5(standard supply) - Windows mobile 6 Classic, Professional(Optional) <p>Wireless Communications</p> <ul style="list-style-type: none"> - Integrated Bluetooth Class II, V 2.0 + EDR <p>External Connectors</p> <ul style="list-style-type: none"> - One Tether Connection with full RS232 and USB On- The-Go(USB 1.1) functionality - One Low insertion Force(LIF) docking connector - DC Power Jack 	
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	<p>User Interface</p> <ul style="list-style-type: none"> - Color screen/ Touch Display - 3.7 in (9.398 cm) - Full VGA 480x640 Resolution - Transflective, portrait mode TFT - Sunlight readable (for outdoor use) - High- reliability adjustable LED - Backlight featuring a bright - 165 cd/m2 output - Touchscreen (standard) - Passive stylus for finger operation - Signature capture - Full Alphanumeric keyboard - Backlit, high durability hard- capped keys <p>Expansion Slots</p> <ul style="list-style-type: none"> - One SD/MMC memory card slot - End-cap USB interface supports GPS expansion module. - 100-pin expansion interface; supports PCMCIA(type II). GPRS/EDGE and other third –party expansion module developed using Psion Hardware Developer’s Kit. - One type II CF Card Slot <p>Power management</p> <ul style="list-style-type: none"> - Optional 3.7V,2700mAh standard capacity battery - Advanced smart battery with gauge - Built in charger - Rechargeable, user replaceable backup battery pack <p>Environmental</p> <ul style="list-style-type: none"> - Withstands multiple drops from 6ft (1.8 m) or 26 drops (on 12 edges , 6 corners, 8 faces) from 5 ft (1.5m) to concrete while powered on - Waterproof/ Dustproof;IP65,IEC 60529 - Operating temperature: -4°F to 122°F (-20°C to =50°C) - 5%-95% RHnon-condensing - Storage temperature : -40°F to 140°F (-0°C to +60°C) - ESD:+/-8kVdc air discharge,+/-4kVdc contacts <p>Physical</p> <ul style="list-style-type: none"> - Dimension (LxWxH) : 223x100x42 mm(8.78x3.94x1.65in) - Weight : 0.46kg(1 lb) without battery 	
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Annexure - V

TECHNICAL SPECIFICATION FOR HYDRAULICS & WATER TECHNOLOGY LAB

Sl no	Item Description	Qty (Nos.)
01.	<p><u>Experimental Flume(600 x 800mm)</u> <u>Technical Specifications:</u> The experimental section should be 16m long and overall length of 21m and must have a cross section of 600 x 800mm. The side walls of the experimental section should be made of tempered glass, which should allow excellent observation of the experiments. All components that come into contact with water should be made of corrosion-resistant materials(Stainless Steel, glass reinforced plastic). The inlet elements should be such that the flow enters the experimental section with very little turbulence. The closed water circuit should consist of a series of tanks and a powerful pump. The tanks included in the system should be arranged in such a way that they also serve as a gallery on which user can stand on .</p> <p>The experimental flume should have a motorised inclination adjustment to allow simulation os slop and to create a uniform flow at a constant discharge depth. The current slope should be read directly on a digital display.</p> <p>The centrifugal pump should be separate from the experimental section and should be mounted on its own foundation. It should be connected to the piping to the inlet element via a hose to ensure that there is no transmission of vibrations between the experimental section and the pump.The flume should allow the adjusting the volumetric flow. The pump should be fitted with with a control butterfly valve or a gate valve equipped that is operated electrically until the desired flow rate achieved. The flume should be equipped with electromagnetic flow meter to measure the flow rate.</p> <p>To protect against the overfilling of the experimental section there should be a level switch which should turn off the pump when the maximum level in the inlet or outlet element is exceeded.</p> <p>Specificaton [1] basic principles of open-channel flow [2] experimental flume with experimental section, inlet and outlet element and closed water circuit [3] length of the experimental section 16m [4] smoothly adjustable inclination of the experimental section [5] experimental section with evenly spaced threaded holes on the bottom for installing model or for pressure measurement [6] side walls of the experimental section are made of tempered glass for excellent obeservation of the experiments [7] experimental section with guide rails for the optional instrument carrier [8] all surface in contact with water are made of corrosion -resistant materials [9] flow-optimised inlet element for low- turbulence entry into the experimental section [10] closed water circuit with 5 water tanks, pump, flow meter and manual flow adjustment [11] water tanks form a gallery that can be walked on [12] models from all fields of hydraulic engineering available as accessories</p> <p>Technical Data 1. Experimental section • length: 16m</p>	01 No.

	<ul style="list-style-type: none"> • flow cross-section: WxH: 600 x 800mm • inclination adjustment: -0,75..2,1% • 3 spindal-type lifting gears <p>2. Tanks</p> <ul style="list-style-type: none"> • 1 x 2.300L • 5 x 4.300L <p>3.Pump</p> <ul style="list-style-type: none"> • power consumption: 15 KW • max. Flow rate: 440m³/h • max. Head: 17,5m • Flow rate measuring range: 20...400m³/h <p>The Accesories should the following :</p> <ol style="list-style-type: none"> 1. sluice gate 2. Ogee crested weir with weir outlets 3. Base plate for clamping of models 4. Elements for energy diddipation 5. Syphoon spillway 6. Venturiflume 7. Digital level gauge and instrument carriage 8. Radial Gate 9. Wave Generator Flap-Type 10. Sediment Trap 11. Broad Crested Wires Set of Two 12. Pitot Tube (04 nos) 13. 20 Tube Manometer 14. Sill 15. Instrument carrier (04 nos) 16. Digital level guage (10 nos) 17. Flow meter magnetometer 18. Roughened bed 19. WaterTank 20. Electrical inclination adjustment 21. Digital Velocity meter (02nos) 22. Trapezoidal Flume 	
02.	<p>Experiment Flume for Sediment Transport in River Course : It should demonstrate the important phenomena of bed-load transport in the area near the bottom at subcritical discharge. The large dimensions of the experimental section should enable the modeling of river courses with and without structure.</p> <p>Technical Specifications:</p> <ol style="list-style-type: none"> 1.Open-channel bed-load transport 2. Experimental flume with experimental section, inlet element, outlet element, closed water circuit, 1 set of models 3.Closed water circuit with water tank with sediment trap, pump, and electromagnetic flow meter 4.Eexperimental section with grooves for plate weirs to realise different flow conditions 5.Measurement of profiles along the bottom with moveable instrument carrier and point gauge 6.Inlet element with plate weir to protect against sediment flowing back 	01 No.

	<p>7. Models supplied 3 bridge piers, 2 islands, set of deflection plates (for your own model ideas)</p> <p>8 .Sediment trap with filter element for sand</p> <p>9. Experimental section, inlet and outlet element made of stainless steel</p> <p>10. Experimental flume</p> <ul style="list-style-type: none"> • stainless steel • dimensions of the experimental section: • 5000x800x250mm <p>11.Pump</p> <p>power consumption: 3,6kW</p> <ul style="list-style-type: none"> • max. head: 11,5m • max. flow rate: 74m³/h • Storage tank, content: approx. 1000L <p>12. Sediment trap filter element : Aperture size: 49mesh</p> <p>13. Flow meter - measuring range: 80m³/h</p> <p>14. The following experiment should be done with this Equipment:</p> <ul style="list-style-type: none"> • Bed-load transport in open channels • How flow velocity affects bed-load transport • Ripple formation on the river bed • Observing the formation of meanders • Fluvial obstacle marks on structures • Bridge pier with rectangular profile • Rounded-nosed bridge pier • Pointed-nosed bridge pier • Island (round or rectangular) • Bed-load transport formulae • Meyer-Peter and Müller formula • Einstein's formula 	
<p>03.</p>	<p>Water Potential Meter</p> <p>Technical specifications :</p> <p>ACCURACY: ±0.05 MPa* from 0 to -5 MPa 1% from -5 to -300 MPa</p> <p>RANGE: -0.1 to -300 MPa*</p> <p>MEASUREMENT TIME</p> <p>In precise mode:10-15 minutes for most soil samples & 20 minutes for plant tissue samples</p> <p>In fast mode: <5 minutes (reduced accuracy)</p> <p>TEMPERATURE CONTROL: 15 to 40°C (± 0.2°C)</p> <p>SENSOR TYPE</p> <p>1) Chilled-mirror dewpoint sensor</p> <p>2) Infrared temperature sensor</p> <p>OPERATING ENVIRONMENT: 5 to 40°C (41 to 104°F)</p> <p>SAMPLE CUP CAPACITY: 7 mL recommended (15 mL full)</p> <p>DATA COMMUNICATIONS:</p> <p>RS232A compatible 8-data bit ASCII code 9600 baud no parity 1 stop bit</p> <p>POWER: 220 VAC, 50/60 Hz</p> <p>DISPLAY: 20 x 2 alphanumeric dot-matrix LCD with backlighting</p> <p>COMPATIBLE STANDARDS: ASTM D6836-07</p>	<p>01 No.</p>

<p>04.</p>	<p>Laboratory setup for Automatic Soil Retention Curve and Measurement of Unsaturated Hydraulic Conductivity Technical specifications: Set inclusive of laboratory balance, resolution 0.1 g. Laboratory setup for determination of the soil retention curve and the unsaturated hydraulic conductivity 0 ... 80 kPa. Incl. sensor unit, USB-converter, software, link cable, auger set, saturation bowl, refill adaptor, 2 sealing discs, complete refill kit incl. vacuum syringes, 1 sampling ring, tools. soil sample rings and hammering grip Sensor unit MEASURING RANGE FOR EACH TENSIO METER: +20 hPa to -1200 hPa / -2500 hPa RESOLUTION: 0.01 hPa ACCURACY: 1.5 hPa (0 hPa to 800 hPa) CASE/DIMENSIONS W/OUT SOIL SAMPLE RING: PA66GFK, h = 60 mm, 80 mm INTERFACE: RS485 Laboratory scale MEASURING RANGE: 0 to 2.5 kg RESOLUTION: 0.01 g ACCURACY: 0.1 g INTERFACE: RS232</p>	<p>01 No.</p>
<p>05.</p>	<p>Water Hammer Apparatus & Surge Chamber It should be used to generate and visualize water hammer in pipes and to demonstrate how a surge chamber works Technical specifications:</p> <ol style="list-style-type: none"> 1. Functioning of a surge chamber 2. Pipe section with ball valve and surge chamber 3. Surge chamber designed as transparent PMMA tank 4. Pressure sensor behind the water chamber for measuring the pressure wave 5. Pipe section with solenoid valve and two pressure sensors for measuring water hammer 6. Volumetric flow measurement via supply unit 7. Software for data acquisition via USB under Windows Vista or Windows 7 8. Pipe section for pressure oscillations <ul style="list-style-type: none"> • copper • length: 5875mm, inner diameter: 26mm • ball valve • surge chamber, PMMA 9. Height: 825mm 10. Inner diameter: 50mm 11. Pipe section for water hammer <ul style="list-style-type: none"> • Copper • Length: 5875mm, inner diameter: 26mm • Distance between sensors: 3000mm • Solenoid valve, closing time: 20...30ms 12. Tank: 50L 13. Supply unit : Pump <ul style="list-style-type: none"> • power consumption: 550W • max. flow rate: 230L/min • max. head: 11m 14. Tank: 1x 180L, 1x 40L 	<p>01 No.</p>

	<p>15. Measuring ranges</p> <ul style="list-style-type: none"> • pressure (pipe section): 2x 0...16bar abs. • pressure (surge chamber): 0...0,3bar <p>16. The following experiment should be done with this Equipment:</p> <ul style="list-style-type: none"> • Transient flow conditions in pipe systems by means of experimentation • demonstrating water hammer in pipes • determining the sound velocity in water • understanding how a surge chamber works • natural frequency in the surge chamber 	
06.	<p>Volumetric soil water content sensor & dielectric water potential sensor with Data logger and Software Should Consists of</p> <p>A) Volumetric soil water content sensor (Qty: 5) Technical specifications: ACCURACY Mineral Soil: $\pm 3\%$ VWC, most mineral soils, up to 8 dS/m $\pm 1-2\%$ VWC with soil specific calibration Rockwool: $\pm 3\%$ VWC, 0.5 to 8 dS/m Potting Soil: $\pm 3\%$ VWC, 3 to 14 dS/m RESOLUTION 0.1% VWC (mineral soil) 0.25% VWC (rockwool) RANGE: calibration dependant; up to 0-100% VWC with polynomial equation DIMENSIONS : 8.9 x 1.8 x 0.7 cm CABLE LENGTH : 5 m, custom cable lengths available upon request MEASUREMENT TIME : 10 ms POWER : 2.5 - 3.6 V DC @ 10 mA. Output proportional to input voltage. 2.5 V and 3 V excitations supported with calibration equations OUTPUT : Voltage, correlated linearly (soil) or polynomially (growing media) with VWC TEMPERATURE: -40°C to +50°C CONNECTOR TYPES: 3.5 mm "stereo" plug or stripped and tinned lead wires (3)</p> <p>B) Dielectric water potential sensor (Qty: 5) ACCURACY Soil Water Potential: $\pm 25\%$ of reading from -10 kPa to -100 kPa, see user manual for more details on accuracy Soil Temperature: $\pm 1^\circ\text{C}$ RESOLUTION Soil Water Potential: 0.1 kPa Soil Temperature: 0.1°C RANGE Soil Water Potential: -10 to -500 kPa (pF 2.01 to pF 3.71) Soil Temperature: -40° to 60°C* *Sensors can be used at higher temperatures under some conditions. Contact Decagon for more details. MEASUREMENT SPEED: 150 ms (milliseconds) EQUILIBRATION TIME : 10 min to 1 hr depending on soil water potential SENSOR TYPE: Frequency domain with calibrated ceramic discs, thermistor OUTPUT : RS232 (TTL) with 3.6 volt levels or SDI-12 communication protocol OPERATING ENVIRONMENT: -40° to 60°C* POWER: 3.6 - 15 VDC, 0.03 mA quiescent, 10 mA max during 150 ms measurement CABLE LENGTH: 5 m, custom cable lengths available</p>	01 No.

<p>CABLE CONNECTOR TYPES: 3.5 mm "stereo" plug or stripped and tinned lead wires (3)</p> <p>SENSOR DIMENSIONS: 9.6 cm (l) x 3.5 cm (w) x 1.5 cm (d)</p> <p>C) Data logger with graphing software (single user) (Qty: 2)</p> <p>INPUT CHANNELS:5 channels, each supporting 12-bit analog, 32-bit digital, or pulse, compatible with any Decagon Devices sensor</p> <p>DATA STORAGE:1 MB (36,000 scans of all 5 ports)</p> <p>SENSOR TYPES: EC-5, 10HS, 5TM, 5TE, EC-TM, MPS-1, PAR, Total Solar Radiation, LWS, Temp, Temp/RH, precipitation, wind speed</p> <p>OPERATING ENVIRONMENT:-40° to 60°C, up to 100% RH</p> <p>POWER REQUIREMENTS:5 AA alkaline or lithium batteries, (typically good for 8 - 12 months)</p> <p>CASE MATERIAL: Weatherproof, UV- and impact-resistant IP55, NEMA 3R</p> <p>INTERFACE CABLE:Serial</p>	
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Annexure VI

TECHNICAL SPECIFICATION FOR MATERIALS TESTING LAB-I

Sl No:	Description	Qty (Nos.)
01.	<p><u>200T SERVO HYDRAULIC AUTOMATIC UNIVERSAL TESTING MACHINE:</u></p> <p>Computer Control Hydraulic Universal Testing Machine should be suitable to test various metallic & non-metallic materials for tension, compression, bending and shearing strength. It should have to be capable of testing the characters of materials on physical & technology properties. It should be simple, easy to operate and widely used in works, laboratories for material properties research and quality control. It should be equipped with the computer & Software & printer, it can display, record, process and print the test results, and control test procedures as the set program and can draw test curves automatically in real time. The machine should comply with BS, ISO, ASTM standards for load testing and strain measurement.</p> <p>A. Standards: Load meet the below standards</p> <ol style="list-style-type: none"> 1) BS 1610 2) ASTM E4: Standard Practices for Force Verification of Testing Machines. 3) EN 10002-2: Tensile Testing Of Metallic Materials - Verification of Extensometers Used In Uniaxial Testing. 4) ISO75000-1: Verification of Tension/Compression Testing Machines and 5) Strain Measurement meet the below standards <ol style="list-style-type: none"> A) BS 3846 B) ASTM E83: Standard Practices for Force Verification of Testing Machines. C) ISO 9513 <p>B. The mechanical structure Should have following properties / specifications</p> <ol style="list-style-type: none"> 1. Its of rigid four-column & two -lead screw construction & compact design. The stiffness is 1800KN/mm. 2. The machine is of dual workspace design: Upper for tension, Lower for compression or bending tests 3. The movable lower crosshead providing exceptional ease of operation of the machine . 4. The Accurate force measurement is done through precision load cell of compression/ tensile type. 5. The machine is with open front hydraulic grips of pressure more than 2MPA required for easy change of inserts and specimen loading. 6. The displacement is measured by Integrated displacement photoelectric encoder of 2000 pulse/turn. <p>C. The Control Unit Should have the following specification</p> <ol style="list-style-type: none"> 1. The machine have Constant speed load control: Control range:2 -100%of full scale load . 2. Emergency shut down button & over load protection (auto stop) function equipped and return to the specified position automatically. 3. The Control mode of operation: Auto/Manual function changeable 4. Automatic endpoints: The tester stops automatically while specimen breaks. 5. Display of testing parameters: Value and real-time curve (Load and Stroke), available to 	01

display and switch from computer. Also the elongation can be calculated.

6. Hand control box is provided for free cross head movement and clamping and unclamping of hydraulic grips.

D. Electric Power Output

The electric system of the machine is compatible with three-phase-four-wire, 50Hz , 415VAC power. Fusible cutouts and thermo relay are provided in both the main and the control circuits for over-current prevention.

E. Safety

When the testing load is over 2%-5% of Max. Load, the system will unload.

Stroke protection: When the ram arrives at the upper limited position, the motor of oil pump will stop.

F. Software

- Machine to be operated through software. Following features and provisions should be equipped with the software:
- Provision for storage & retrieval of test parameters & data.
- Sample break detection facilities.
- Provision for Auto-Zeroing of Load.
- Provision for Pre-setting of Load & Strain.
- Provision for Holding of Load at a specified value.
- Provision for calculation of test details like Load & Elongation at yield, peak load and load at break, yield stress, proof stress (0.1% & 0.2%), Ultimate strength etc.
- Facilities for display and printing the test results and graph from PC.
- Plots of Load vs. Cross-head travel, Load vs. Time, Cross-head travel vs. Time, Load vs. Extension, Stress vs. Strain should be available.
- Softwares for different tests viz. tensile, compression, shear, bend of TMT Steel Bar & Rectangular Test piece should be available.
- The program is configured for different load sensors , users could switch the sensor in if needed.
- The program is configurable to different elongation sensors (extensometer) and the users could switch the sensors if needed.
- The Program have a open framework, which supports different database modules of testing. The initialization of the program incorporates the testing method of ISO 6892 , ASTM etc. , that could be added if need.
- The program display the load value, the load peak in scaled and non scaled mode, $\pm 1\%$ of the display value (no lower than 20% of the MFS of the scale) in precision when in scaled mode, and $\pm 0.5\%$ of the MFS in precision when in non scaled mode.
- The program display the elongation value, the elongation peak in scaled and non scaled mode, $\pm 1\%$ of the display value (no lower than 20% of the MFS of the scale) in precision when in scaled mode, and $\pm 0.5\%$ of the MFS in precision when in non scaled mode.
- It automatically records load/time, elongation/time, load/elongation, load/displacement curve of specimens.
- It automatically calculate the mechanical performance of the material according to testing curve, the result could be manually calculated.
- It automatically saved the data and the curve of the test.

TECHNICAL SPECIFICATIONS:

- **Type of Machine : Computerized Load cell based Universal Testing machine**
- **Measuring capacity (kN) : 2000**
- **Measuring Range (kN) : 0 - 2000**
- **Least Count (N) :20,000 - counts of full scale of load**
- **Load Range in kN with accuracy of Measurement $\pm 1\%$: 40 - 2000**

	<ul style="list-style-type: none"> • Resolution of piston movement (mm) : 0.01 • Maximum tensile clearance at fully descended piston position (mm) : 900 • Maximum clearance for compression test (mm) : 0-800 • Distance between columns (mm) : 700 • Piston Stroke (mm) : 250 • Maximum straining speed at no load (mm/min) :0-80 • Power supply :3 Ph, 415V, 50 Hz, A.C • H.P. Total (Approx) Max : 7 <p>Tensile Test Jaws</p> <ul style="list-style-type: none"> • For round specimen dia (mm) : 26 – 40 • For round specimen dia (mm) : 40 – 60 • For round specimen dia (mm) : 60 - 70 • For flat specimen thickness (mm) : 0 – 25 • For flat specimen thickness (mm) : 25 – 50 • Maximum width of flat specimen (mm) : 82 <p>Transverse Test</p> <ul style="list-style-type: none"> • Adjustable roller support of width (mm) :205 • Diameter (mm) :50 • With maximum adjustable clearance (mm) :800 • Punch tops of radius (mm) : 50 <p>Compression Test</p> <ul style="list-style-type: none"> • Compression platen of Dia (mm) : 205 • Software for computer control operation : Windows XP/7 OS based software should be capable of real time graphs <p>a) Front Open Crossheads : This is an important feature which facilitates insertion of tensile specimen from front. This is extremely useful especially for heavy specimens and bigger capacity machines. In this type of machine the jaws and the inserts also can be easily removed by just pulling from the front. When the jaws and inserts are heavy, it is very difficult to remove them from the machine from upper or lower side. Hence this is an important feature from the point of view of easy operation.</p> <p>b) Hydraulic grips : It is a better choice to go for hydraulic operation of jaws (closing and opening). In this hydraulic gripping method, separate double acting hydraulic cylinders operate the jaws and the cylinder operation is just by pressing a push button. So the operator has to operate only push buttons, which are conveniently located on the machine, to operate the jaws. A power pack with oil tank, pump, oil filler cum breather, oil level indicator, filter, relief valve is provided alongwith an electric motor to drive the hydraulic pump.</p> <p>C) Electronic Extensometer: Gauge length: 50mm, elongation of 0-2 mm, resolution 0.001mm, Diameter of specimen to be used with extensometer is 1-20mm, thickness of specimen measured by extensometer is 20mm, maximum width of specimen is 20mm.</p> <p>D) Load cell based machine:</p> <p>E) DESKTOP COMPUTER , UPS & LASER PRINTER</p>	
02.	<p>ROTARY BENDING FATIGUE TESTING MACHINE The testing machine should be used for fatigue strength tests of metals or various industrial materials and assures easy operation.</p> <p><u>TECHNICAL SPECIFICATION:</u> Test Temperature: 10kgf-M</p>	01

	<p>Revolution Number (approx):2900R.P.M. (50Hz) 3500R.P.M. (60Hz)</p> <p>Counter:10⁷</p> <p>Length of Loading Leaver:200mm</p> <p>Loading Weights:Combined 100kg , Min. Over 2kg</p> <p>Motor:220V. 3PH, 0.4kw</p> <p>Automatic Stopper:Auto count stop</p> <p>Dimension of machine: 1300x400x1000 (W)x(D)x(H) (cm)</p> <p>Weight (approx):350kg</p> <p>Power supply:3Ø , 220VAC, 50/60HZ (optional 380V or 415V)</p>	
03.	<p>ELECTRONIC TORSION TESTING MACHINE</p> <p>Features</p> <ul style="list-style-type: none"> • Torsion Testing Machine should be designed for conducting torsion and twist on various metal wires , tubes, sheet materials. Torque measurement should be by torque transducer system. • Torque should be applied to specimen by geared motor through gear box. Autographic recorders gives the relation between torque and angle of twist • The accuracy of torque indication should be ± 1 % of the true torque <p>The electronic control panel should built using 8085 microprocessor which incorporates state of the art technology with following features-</p> <ul style="list-style-type: none"> • Front panel membrane type key board for test set up • 7 seg digital display of load displacement/extension. • Printer port interface • Serial port for communication with PC • Storage of important parameters such as peak load & maximum displacement after test. • Preload selection to take care of initial slippage • Optional real time graph & PC softwares. <p>Technical Data</p> <p>Max Torque capacity : 1000Nm</p> <p>Least Count : 0.01 Nm</p> <p>Torsion Speed :0.5 RPM</p> <p>Clearance between Grips :0-600mm</p> <p>Grips for Round Specimens : 10-18mm 18-26mm 26-34mm</p> <p>Grips for Flat Specimens : 5-15mm</p> <p>Width mm: 50 mm</p> <p>Motor : 1.0 HP (400-440V,3 Phase & 50 Hz)</p> <p>Accessories :</p> <p>1. DESKTOP COMPUTER & UPS</p>	01
04	<p>Deformation of Straight Beams</p> <p>Technical Description</p> <p>The science of the strength of materials should deals with stress and strain resulting from the application of load to a component. Many fundamental principles of the strength of materials should be illustrated well by a straight beam. The beam under investigation should</p>	

be supported in different ways. This produces statically determinate and indeterminate systems which should be placed under load by up to four sets of weights. The load application points should be movable. Three dial gauges record the resulting deformation. Three articulated supports with integral force gauges indicate the support reactions directly. The articulated supports should be height-adjustable, so as to compensate for the influence of the deadweight of the beam under investigation. A fourth bearing clamps the beam in place. Five beams of different thicknesses and made of different materials demonstrate the influence of the geometry and of the modulus of elasticity on the deformation of the beam under load.

The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete experimental set-up should be arranged in the frame.

The well-structured instructional material sets out the fundamentals and should provide a step-by-step guide through the experiments.

Learning Objectives / Experiments

- investigation of the deflection for statically determinate and statically indeterminate straight beams
 - * cantilever beam
 - * single-span beam, dual- or triple-span beam
 - * formulation of the differential equation for the elastic line
- deflection on a cantilever beam
 - * measurement of deflection at the force application point
- deflection of a dual-span beam on three supports
 - * measurement of the support reactions
 - * measurement of the deformations
- influence of the material (modulus of elasticity) and the beam cross-section (geometry) on the elastic line
 - Maxwell-Betti coefficients and law
 - application of the principle of virtual work on statically determinate and indeterminate beams
 - determination of lines of influence
 - * arithmetically
 - * qualitatively by way of force method (Müller-Breslau)

Specification

- [1] elastic lines of statically determinate and indeterminate beams under various clamping conditions
- [2] 3 steel beams with different cross-sections
- [3] 1 brass and 1 aluminium beam
- [4] 3 articulated, height-adjustable supports with force gauge
- [5] 1 support with clamp fixing
- [6] force gauges can be zeroed
- [7] 3 dial gauges to record deformations
- [8] 4 sets of weights with adjustable hooks
- [9] anodised aluminium section frame housing the experiment
- [10] storage system to house the components

Technical Data

Beam

- length: 1000mm
- cross-sections

	<p>3x20mm (steel) 4x20mm (steel) 6x20mm (steel, brass, aluminium) Frame opening: 1320x480mm Measuring ranges - force: -50..+50N, graduations: 1N - travel: 0...20mm, graduations: 0,01mm Weights - 4x 2,5N (hanger) - 4x 2,5N - 16x 5N</p>	
05	<p>Beam on 2 Shear Force & Bending Moment Diagrams Technical Description Statics observes the effect of forces on a rigid body, ignoring any possible deformations which may occur in the process. The forces should be in equilibrium. In reality, forces always produce an effect in the component, such as deformation. These effects should be investigated in the science of the strength of materials. The methods applied in strength of materials should serve to design components so that they cannot be deformed or destroyed by applied forces. The reactions should be determined from the conditions of equilibrium. To investigate the effect of the point loads in the beam, it is notionally split into two segments. Applying the method of sections, the internal forces and moments should be plotted onto the two segments and calculated by way of conditions of equilibrium. It should include a beam mounted on two supports. The beam should be cut at one point. At that point there should be a low-friction hinge with two degrees of freedom. Two force gauges determine the internal reactions to the externally applied forces at the section. The shear force should be recorded and displayed directly by a force gauge. The bending moment occurring at the section should be recorded by a second force gauge acting on a fixed lever arm. This force readout, divided by 10, gives the bending moment in Nm. Adjuster nuts on the two force gauges should be used to align the beam horizontally and balance out any deflection. In evaluating the experiment it should become clear that the shear force, as opposed to the bending moment, is mostly negligible when designing components. The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete test setup should be arranged on a frame. The well-structured instructional material sets out the fundamentals and should provide a step-by-step guide through the experiments. Learning Objectives / Experiments - Calculation of the reactions arising from the static conditions of equilibrium - Application of the method of sections to calculate the internal forces and moments * under a point load * under multiple point loads - Calculation of the shear force diagram - Calculation of the bending moment diagram - Comparison of calculated and measured values for shear force and bending moment Specification [1] Determination of shear force and bending moment on beam mounted on 2 supports [2] Measurement of shear force and bending moment in beam by low-friction hinge with 2 degrees of freedom [3] Position of hinge at 1/3 span</p>	

	<p>[4] 2 bearing supports [5] Loading of beam by 1 to 3 point loads [6] Force gauges to indicate shear force and determine bending moment [7] Bending moment determined by force measurement and lever arm [8] Adjuster nuts for horizontal alignment of beam [9] Steel rule to determine positions of point loads [10] Storage system to house the components</p> <p>Technical Data Beam - total length: 1000mm - span: 800mm Measuring ranges - bending moment via force gauge and lever arm lever arm: 100mm Force gauge: -100...+100N bending moment: -10...+10Nm - shear force: -50...+50N - steel rule: 1000mm, graduations: 1mm Set of weights - 3x 1N (hangers) - 12x 1N - 9x 5N - max. weight load per hanger: 20N</p>	
06	<p>Investigation of Simple Stability Problems</p> <p>Technical Description It should be used to investigate simple stability problems on a buckling bar under different conditions. The buckling bar should be in two parts, with a central articulated joint. A compressive load should be applied to the bar by a lever and weights. The infinitely variable loading should be determined precisely with the aid of a scale on the load application lever. Experiments should depict a variety of conditions, such as an elastic joint or an elastic clamp fixing. Two tension springs serve as the elastic joint. For the elastic clamp fixing option, a steel leaf spring should be mounted in the bottom joint. The variable length of the leaf spring means various degrees of clamping are possible. The two cases should be combined. Another experiment demonstrates the influence of additional shear forces. It involves applying a shear force to the joint in the buckling bar with a cable and a weight. In all experiments the buckling bar should be placed under load until it reaches an unstable situation. The length of the lever arm at which the buckling bar buckles is read from the scale and the buckling force should be then determined. The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete experimental set-up should be arranged in the frame. The well-structured instructional material sets out the fundamentals and should provide a step-by-step guide through the experiments.</p> <p>Learning Objectives / Experiments - Determination of the buckling force for the case of an: * elastic joint</p>	

	<p>* elastic fixed end support - Investigation of the buckling behaviour under the influence of: * of additional shear forces * of pre-deformation</p> <p>Specification [1] Investigation of the buckling load under different conditions (elastic joint, elastic fixed end) [2] Two-part buckling bar with central joint [3] Loading infinitely variable with lever and set of weights [4] Determination of loading via scale on load application lever [5] Various degrees of clamping via leaf spring with variable length on bottom support [6] Thrust pad guided friction-free inside spherical shell [7] Low-friction joints with roller bearings [8] Device to generate shear forces [9] Storage system to house the components</p> <p>Technical Data Two-part buckling bar with central joint - w x h: 20x20mm - length: 2x250mm - support: pinned-pinned (articulated-articulated)</p> <p>Elastic joint - 2 tension springs, rigidity: 2N/mm - lever arm: 50mm</p> <p>Elastic clamp fixing with steel leaf spring - length: 500mm - cross-section: 10x2mm - 2nd moment of area: 6.66mm⁴ - modulus of elasticity: 205000N/mm²</p> <p>Compressive force range: 25...120N Shear force: 0...20N Load application lever, lever ratio: 1:2 - 1:5 Set of weights - 8x 1N - 6x 5N - 2x 1N (hangers)</p>	
07	<p>Mounting Frame</p> <p>Technical Description The mounting frame should provide a clearly laid-out, user-friendly means of setting up experiments in the fields of statics, strength of materials and dynamics. It comprises four steel sections which are bolted together to form a frame. Two feet on the sides should provide stability. The frame should be quick and easy to assemble, with just a few actions needed. The frame should be used for mounting the following experiments: Forces and moments Trusses Bridges, beams, arches, cables Elastic deformations Stability</p>	

	<p>Vibration</p> <p>Specification</p> <p>[1] Frame for mounting of experiments in statics, strength of materials and dynamics</p> <p>[2] Sturdy sectional steel double frame, welded</p> <p>[3] Easy, exact mounting of all components by precision clamp fixings</p> <p>[4] Stable on laboratory desktops or workbenches</p> <p>[5] Frame supplied disassembled</p> <p>Technical Data</p> <p>Mounting frame made of steel sections</p> <ul style="list-style-type: none"> - frame opening w x h: 1250x900mm - section groove width: 40mm 	
08	<p>Deformation of Bars Under Bending or Torsion</p> <p>Technical Description</p> <p>It should investigate the influence of these factors on the deformation of a bar under bending load or torque. A set of test bars has been assembled so as to permit direct comparison of measurement results.</p> <p>The bar under investigation should be fixed to two movable support blocks and loaded down by a weight. A dial gauge records the resulting deformation. The support blocks include clamping chucks to hold the torsion bars and bearings for the bars in the bend test. The bearings offer a range of clamping options, enabling statically determinate or indeterminate bearing supports to be investigated.</p> <p>The torque should be applied by a device mounted on a support block. The point of load application to generate the bending moment should be adjustable. The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete test setup should be arranged on the frame.</p> <p>The well-structured instructional material sets out the fundamentals and should provide a step-by-step guide through the experiments.</p> <p>Learning Objectives / Experiments</p> <p>Bending tests</p> <ul style="list-style-type: none"> - determination of the modulus of elasticity - statically determinate systems * beam mounted on 2 supports; cantilever beam - statically indeterminate systems * dual-span beam - deformation of a beam dependent on * material * geometry (section width, height and length) * type of support and length of span - formulation of proportional relationships for the deformation <p>Torsion experiments</p> <ul style="list-style-type: none"> - determination of the shear modulus of various materials - angle of twist dependent on * clamping length * bar diameter - formulation of proportional relationships for the angle of twist <p>Specification</p> <p>[1] elastic deformation of bars under bending or torsion</p> <p>[2] bending tests with statically determinate and indeterminate systems</p> <p>[3] torsion tests with a statically determinate system</p>	

	<p>[4] supports in the bending test may be clamped or free</p> <p>[5] 2 adjustable blocks with clamping chuck for torsion tests and supports for bending tests</p> <p>[6] set of weights to generate the bending or torque</p> <p>[7] dial gauge with bracket</p> <p>[8] storage system to house the components</p> <p>Technical Data</p> <p>17 bars for bending tests</p> <ul style="list-style-type: none"> - material: aluminium, steel, brass, copper - height with LxW 510x20mm: h=3...10mm - width with LxH 510x5mm: w=10...30mm - length with WxH 20x4mm: l=210...510mm - LxWxH: 20x4x510mm (aluminium, steel, brass, copper) - LxWxH: 10x10x510mm (aluminium) 22 torsion bars - material: aluminium, steel, brass, copper - length with d=10mm: 50...640mm (aluminium) - dxL: 10x50mm/10x340mm (aluminium, steel, copper, brass) - diameter with L=50/340mm: d=5...12mm (steel) <p>Dial gauge: 0...10mm, graduations: 0,01mm</p> <p>Tape measure, graduations: 0,01m</p> <p>Weights</p> <ul style="list-style-type: none"> - 1x 1N (hanger) - 1x 1N, 1x 4N, 1x 5N, 1x 9N 	
09	<p>Deformation of Trusses</p> <p>Technical Description</p> <p>In this experimental unit the deformation of a single plane truss at one point should be determined using Castigliano's first theorem. The truss under investigation should be made of bars joined together by a articulated construction using node discs. The trusses should be considered as ideal trusses. The bars have special snap-lock fixtures on their ends allowing them to be fixed easily into the node discs. A load application device attached to a node disc generates an external force. The range of different bar lengths provided permits three forms of truss to be constructed. The bars should be made of PVC, so their deformations should clearly visible.</p> <p>The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete experimental set-up should be arranged in the frame .</p> <p>The well-structured instructional material sets out the fundamentals and should provides a step-by-step guide through the experiments.</p> <p>Learning Objectives / Experiments</p> <ul style="list-style-type: none"> - Elastic deformation of truss under point load - Calculation of support reaction and bar forces - Principle of work and strain energy - Application of Castigliano's first theorem to calculate the deformation at a defined point - Verification of the calculated deformation possible by the principle of virtual work - Comparison of the deformations of different trusses under the same load - Comparison of measured and calculated Deformation <p>Specification</p> <p>[1] Investigation of the deformation of statically determinate trusses</p> <p>[2] Construction of different truss forms possible</p> <p>[3] 2 supports with node discs</p>	

	<p>[4] Load application device with force measurement dial gauge mountable on different node discs</p> <p>[5] Dial gauge to record the deformation of the truss under load</p> <p>[6] Cross arm for lateral stability of truss</p> <p>[7] Storage system to house the components</p> <p>Technical Data</p> <p>Truss with 19 PVC bars</p> <ul style="list-style-type: none"> - height of truss max. 450mm - length of truss max. 900mm - bar lengths <p>2x 150mm 5x 259mm 7x 300mm 1x 397mm 3x 424mm 1x 520mm</p> <ul style="list-style-type: none"> - angle between bars: 30°, 45°, 60°, 90° - maximum bar force: 200N <p>Load application device</p> <ul style="list-style-type: none"> - measuring range: -500...+500N, graduations: 10N <p>Dial gauge</p> <ul style="list-style-type: none"> - measuring range: 0..0.10mm, graduations: 0.01mm 	
<p>10</p>	<p>Forces in Various Single Plane Trusses</p> <p>The object of the experiment should be able to measure the bar forces in a single plane truss subjected to a single external force. These experimental set-up features bars with special snap-lock closures on their ends allowing them to be fixed easily into the node disc. The range of different bar lengths should provide permits three forms of truss to be constructed. The bars should be hinged, joined together by node discs, and should subjected only to compressive or tensile stress. No moments should transmitted in the nodes; they could be regarded as frictionless. Consequently, our trusses should be considered as ideal trusses. A load application device attached to a node disc generates an external force. All the forces on the truss bars should be recorded by means of strain gauges. Computerised evaluation should be provided by measurement amplifier (16 input channels). If there are more than 16 measuring points, the measurement amplifier should be extended by a measuring point add-on unit to 32 input channels. The software is used to manage the measurement data and should provide graphical representation of the bar forces. The software features a comprehensive help function. The various elements of the experiment should be clearly laid-out and housed securely in a storage system. The complete experimental set-up should be arranged in the frame. The well-structured instructional material sets out the fundamentals and should provides a step-by-step guide through the experiments.</p> <p>Learning Objectives / Experiments</p> <ul style="list-style-type: none"> - Measurement of the bar forces in various single plane trusses - Dependency on the external force * magnitude * direction * point of application 	

	<ul style="list-style-type: none"> - Comparison of measurement results with mathematical methods * method of joints * Ritter's method of sections - Basic principle: measurement of forces using strain gauges <p>Specification</p> <ul style="list-style-type: none"> [1] Investigation of bar forces in a statically determinate truss [2] Construction of various trusses possible [3] 2 supports with node discs [4] Load application device with force gauge mountable on different node discs [5] Strain gauge to measure force on each bar [6] Measurement amplifier required [7] Software to evaluate measurement data [8] Storage system to house the components <p>Technical Data</p> <p>Bars: 19</p> <ul style="list-style-type: none"> - 2 bars 150mm - 5 bars 259mm - 7 bars 300mm - 1 bar 397mm - 3 bars 424mm - 1 bar 520mm - angle between bars: 30°, 45°, 60°, 90° - maximum bar force: 500N - strain gauge on each bar - height of truss max. 450mm - length of truss max. 900mm <p>Load application device</p> <ul style="list-style-type: none"> - 500...+500N - graduations: 10N 	
11	<p>Multi-Channel Measurement Amplifier</p> <p>Technical Description</p> <p>This is a multi-channel measurement amplifier which supplies the strain gauge bridge circuits with power and processes the received measurement signals. The unit should only be operated with a computer. The measurement amplifier includes 16 input channels and, by using a measuring point add-on unit, should be extended to a maximum of 32 input channels. The strain gauge measuring points should be connected to associated balance potentiometers either by a 68-pin multiport or 16 (6-pin) single ports. The multi-channel measurement amplifier should be operated via USB using the supplied software. The measured values should read and saved on computer (using an application such as MS Excel).</p> <p>Learning Objectives / Experiments</p> <ul style="list-style-type: none"> - amplification and display of signals from strain gauge measuring points - processing of measured values on computer - evaluation of stress and strain analysis experiments - evaluation of experiments relating to forces in trusses <p>Specification</p> <ul style="list-style-type: none"> [1] multi-channel measurement amplifier for processing of strain gauge signals [2] strain gauge connection in half or full bridge configuration [3] strain gauge connection via 6-pin single ports or 68-pin multiports [4] extension of measuring points 	

<p>[5] processing of measured values on a PC [6] connection to the PC via USB [7] integrated software [8] system requirement: Windows Vista or Windows 7</p> <p>Technical Data</p> <p>Amplifier</p> <ul style="list-style-type: none"> - number of input channels: 16 - with measuring point add-on unit: max. 32 input channels <p>DMS connection in half or full bridge configuration</p> <ul style="list-style-type: none"> - resistance: min. 350Ohm/DMS - zero balancing: 20x spindle trimmer - strain gauge supply voltage: +/-5VDC <p>Frequency range selectable via bridges</p> <ul style="list-style-type: none"> - 4Hz/500Hz (-3dB) <p>Input voltage: max. +/- 50mV</p>	
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Annexure VII

TECHNICAL SPECIFICATION FOR Materials Testing LAB -II

Sl. No	Detail Specification of Equipment	Qty (Nos.)
1	<p>Compaction Factor Apparatus, Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%). Hardness of material(platen): 50 RHC Paint quality:-Powder coating 70-80 micron thick for determination of workability determination of concrete mixes of very low workability such as those normally used with concrete, compacted by vibration. Concrete mix having maximum size of aggregate not exceeding 38 mm, can be tested for workability. Compaction Factor Apparatus is complete with hoppers and receiver assembly, Tamping Rod of 16 mm dia x 60 cm long having a Hooper and two trowels.</p>	02
2	<p>Concrete Mixer, Pan Type, Capacity 40L, Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%). Hardness of material(platen): 50 RHC,Paint quality:-Powder coating 70-80 micron thick developed is transportable on wheels. The design of mixing paddles ensure uniform & efficient mixing of cement & aggregate both in dry & wet conditions. This machine is suitable for aggregate size upto 20mm. The equipment can also be put to use for mixing of any other material in dry / wet conditions. The arrangement helps the operators to access the pan contents conveniently & emptying the mixture after completion of the operation. The drum is driven off the ribbed base. The lid with mixing paddles clears off the top of the drum to provide maximum access to the operator. Mixing Capacity : 40 ltrs.Overall Dimension : 910mm X 875 mm X 1250mm,Motor : 2 HP, 960 RPM, Portable & Compact. • Adjustable Blades. • Simple to clean & maintain. • Easy to operate. Suitable for operation on 440V, 50Hz, Three Phase, AC supply.</p>	01
3	<p>Vibrating Table, 2m x 1m for 32 moulds of 150mm cube having Proper compaction of cement concrete while casting specimens for compression testing is essential to achieve higher compressive strength. Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%). Hardness of material:50 RHC Paint quality:-Powder coating 70-80 micron thick Vibrating Table is ideally suited for this purpose. The table top is suitable to hold cube moulds and has stops along its edges to prevent moulds from sliding off the table during operation. The specially designed vibro motor for operating the vibratory. Suitable for operation on 220 V, 50 Hz, Single Phase, AC supply. Capacity 0.5 to 1 ton, the height of the table from the ground level shall be sufficient to allow for easy placing and removal of the moulds and shall not exceed 0.75 metre. frequency of vibration for the table operating at its maximum load capacity shall be between 3 000 to 6 000 cycles per minute, The vibration acceleration of the table operating at its maximum load capacity shall not be less than four times the acceleration due to gravity. minimum frequency of the table under the loaded state for determining this acceleration shall be not less than 3 000 cycles per minute. The reduction in the amplitude of the table while operating from ‘ no load ’ to ‘ full load ’ condition shall not exceed 25 percent.</p>	01
4	<p>Immersion Type Needle Vibrator, Electrically Operated, Motor-Single Phase 2 HP, Needle Dia-40mm Length (including Needle)4-5 Mtrs.</p>	01
5	<p>Mould, Cast Iron, for 50mm Cube with ISI Certification</p>	18

	Mark IS:10086, having indication marks '00' are punched with 'L' bracket. Machined flat to +/- 0.02 mm of accuracy and finished to within +/- 0.2 mm of specified dimensions. Approxwt 14kg.	
6	Mould, Cast Iron, for 150mm Cube with ISI Certification Mark IS:10086, having indication marks '00' are punched with 'L' bracket. Machined flat to +/- 0.02 mm of accuracy and finished to within +/- 0.2 mm of specified dimensions. Approxwt 14kg.	32
7	Beam Mould	04
8	100mm x 100mm x 500mm	
	100mm x 100mm x 700mm	04
	150mm x 150mm x 700mm	04
	Cylindrical Mould, Cast Iron, Split Lengthwise 150mm Dia X 300mm Cylindrical Mould, Cast Iron, Split Lengthwise 150mm dia x 300mm high with ISI certification mark IS:10086	12
9	J Ring The test method should be applicable for laboratory use in comparing the passing ability of different concrete mixture. The J-Ring apparatus should measure three parameters: flow spread, flow time and blocking step. Equipment Parts include : (a) Base plate of size 1000 mm x 1000mm (b) Slump cone (c) Straight rod of at least one side flat with flexure less than 1 mm (d) Measuring scale of 0- 600 mm (e) Spirit Level (f) Stop watch with accuracy of 0.1 sec. (Reference Standard ASTM C 1621)	01.
10	L Box The apparatus should investigate the flow rate and passing ability of SSC Equipment Parts include : (a) L Box with three smooth bars and a gate (b) Bucket Capacity of 14 liters (c) Measuring Scale of 0- 600 mm (d) Spirit Level (e) Stop watch with accuracy of 0.1 sec. (Reference Standard ASTM C 1621)	01
11	V funnel apparatus to test the plastic viscosity with the following parts (a) Bucket Capacity 14 litres (b) Spirit Level (c) Stop watch with accuracy 0.1 second for recording the flow time (Reference Standard ASTM C 1621) Longitudinal Compressometer, Digital, Ref : ASTM-C469, consists of two frames for clamping to the specimen by means of five tightening screws with hardened and tapered ends. Two spacers hold the two frames in position. An adjustable pivot rod rests on pivot screws. A spring enables the pivot rod to remain in contact with pivot screws. The ball chain is for adjusting the tension of the spring. A dial gauge, fixed to a bracket, fitted to the top frame, is used for taking deformation measurement. Supplied complete with dial gauge 0.002×5mm or Dial Gauge Digital 0.001×25 mm.	01
12	Lateral Extensometer, Digital, Ref IS:- Ref. : ASTM-C469, consists of two movable frames pivoted at one end. A dial gauge measures the lateral extension, and a removable spacer strip is for the initial setting of the dial gauge. Mounting of extensometer on the specimen is with the help of screws. Supplied complete with dial gauge 0.002×5mm or dial gauge digital 0.001×25 mm	01

13	Automatic Digital Mortar Mixer, 5 Litres nominal capacity	01																														
14	<p>Rapid Chloride Permeability Tester Device for the measurement of the electrical resistance of concrete against the penetration of chloride according to the standards such as ASTM C1202 (RCPT), AASHTO T277 and ASTM C1760 GENERAL</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Applied Voltage</td> <td>50 ± 1 V</td> </tr> <tr> <td>Range of current measurement</td> <td>0 ~ 500 mA ± 0.1 mA</td> </tr> <tr> <td>Temperature measurement range</td> <td>0 ~ 100°C</td> </tr> <tr> <td>Measurement channels</td> <td>4</td> </tr> <tr> <td>Short circuit protection system</td> <td>yes</td> </tr> <tr> <td>Measurement display on LCD</td> <td>yes</td> </tr> <tr> <td>Remaining measurement display on LCD</td> <td>Yes</td> </tr> <tr> <td>LCD display area</td> <td>65×33 mm</td> </tr> <tr> <td>Dimensions</td> <td>280x240x104 mm</td> </tr> <tr> <td>Weight</td> <td>2 Kg</td> </tr> <tr> <td colspan="2">OPERATING VALUE</td> </tr> <tr> <td>Operating temperature</td> <td>15 ~ 45 °C</td> </tr> <tr> <td>Operating humidity</td> <td>30 ~ 80%</td> </tr> <tr> <td>Operating voltage/current</td> <td>100 ~ 240 V, 50-60Hz</td> </tr> </tbody> </table>	Type	Value	Applied Voltage	50 ± 1 V	Range of current measurement	0 ~ 500 mA ± 0.1 mA	Temperature measurement range	0 ~ 100°C	Measurement channels	4	Short circuit protection system	yes	Measurement display on LCD	yes	Remaining measurement display on LCD	Yes	LCD display area	65×33 mm	Dimensions	280x240x104 mm	Weight	2 Kg	OPERATING VALUE		Operating temperature	15 ~ 45 °C	Operating humidity	30 ~ 80%	Operating voltage/current	100 ~ 240 V, 50-60Hz	01
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15	Digital Hot Air Circulating Oven Laboratory Electric Oven, with Digital Indicator Cum Controller with Safety Alarm, range 50° to 250°C +/-1°C with Air Circulating Fan, S.S. Inside Size 600 x 600 x 600mm 52,697.00 1 52,697.00	01																														
16	Thickness gauge is 2386 part1 Thickness Gauge with ISI Certification Mark IS:2386(Part I)	02																														
17	Motorised sieve shaker Sieve Shaker, Motorised, with Built-in Digital Timer	01																														
18	<p>Muffle furnace</p> <ol style="list-style-type: none"> 1) Internal Dimensions of the furnace (Depth ×Width × Height) in mm : 300×200×200(Minimum) 2) Working Temperature : 1600°C or better 3) Heating Element : Silicon Carbide (SiC) 4) Temperature Accuracy : ±2°C or better 5) Temperature Control : Through microprocessor based PID controller with minimum 30 steps 6) Furnace Insulation : Ceramic wool 7) Temperature settings & Display : Digital and double display 8) Power source : 220 V ,50Hz single phase 9) Out body and inner body : Stainless Steel 10) Accessories required <ol style="list-style-type: none"> a. Stainless Steel Tongs (15-20 Inch)- 02 No b. Furnace gloves-02 Pairs 	01																														
19	Concrete Rheometer	01																														

	<p>Specification:- Velocity controlled 0.0001 - 80 rpm, steady speed and speed ramp mode, motor torque 1200 Ncm, two measurement torque range 0 - 300 Ncm and 0..1000Ncm, Resolution 0.01 Ncm, Accuracy 0.2 Ncm, Sampling Rate 0.005s .. 1min, Vessel diameter 165mm, vessel height 175 mm, usable volume 3.0l. Maximum grain size 6 -8 mm .Online Display with 19" screen, mouse, 4 USB-ports, incl. 1 meas. beachure, 1 probe for concrete and 1 probe for mortar and paste, maximum grain size 6..16 mm, 1scraper, user manual, mouse, keyboard. The Rheometer should be controlled via an TCP/IP interface 100 MHz, Ethernet and any PC running a WEB browser based on 32 bit technology.</p> <p>Beaker for Temperature Control A double wall beaker</p> <p>Circulating Cooling and Heating Unit Unit for cooling and heating water incl. a circulating pump. Temperature range 0..65 °C, Deviation +/- 0,1 K, digital temperature control unit with digital LC2 D display, air cooling, cooling power 250 W at 20°C, heating power 1.0 kW, circulation pump rate max. 18 l/min, max. pumping height 3mWS, RS232 interface, touch-screen, main power 1.2 kW, wxdxh 280 x 380 x 500 mm, net weight 25,3 kg</p> <p>Shear Stress Controlled Drive The torque measurement with a resolution of 0.1 Ncm. The angel measurement with an resolution of 0.01°.Internal resolution 0.001°.</p> <p>Oscillation mode: max. amplitude 3.6°, max. Frequency 5 Hz.</p>	
20	<p>Mini slump cone *Top Diameter: 50 mm *Base Diameter: 100 mm *High: 151 mm Along with tamping rod and base plate</p>	02
21	<p>Cement Auto` with analog pressure Gauge & digital Controller <u>Technical specification</u></p> <ul style="list-style-type: none"> ▪ Working pressure : $21 \pm 1 \text{g/cm}^2$ at 215° C ▪ Pressure vessel: 150 mm x 500 mm approx ▪ Weight: 70 kg approx. ▪ Heater: 2000 Watts approx. ▪ Supply: 220V, 50Hz, 1 phase ▪ Panel mounted PID controller with safety certification. 	01
22	<p><i>Crack Detection Microscope</i> Specification Dimensions (l x w x h) 40 x 90 x 150 mm (in case) Magnification x 40 or more Measuring range 4 mm, 0.02 mm divs Weight 550 g</p>	01
23	<p>ADVANCE Digital Vernier Caliper- 12 Inch/300mm Graduation:Dial Reading : 0.01 mm / 0.0005"::Range:0-300 mm / 12":: Special Features:With Depth Bar::Key Features:IP54 metal case digital caliper, 1.5v battery, low power consumption, 2years battery life::No. minus zero (-0.00) display, 3M/S high</p>	03

Environmental Temperature Range	-10 °C to 50 °C (14 °F to 122 °F)	
Processing Electronics	530 MHz CPU with integrated FPU with 128 MB RAM; Proprietary Olympus Digital Pulse Processor (DPP)	
Power	Rechargeable Li-ion battery; Hot-swap maintains analyzer per during battery charge	
Data Display	32 bit Color QVGA resolution, Blanview transmissive backlit touch screen; 57 x 73 mm (2.25 x 2.9 in.)	
Data Storage	1 GB microSD (stores ~75,000 readings)	
Data Transfer	USB, Bluetooth®	
Standard Accessories	<ul style="list-style-type: none"> • Carrying Case • Li-ion Battery • Electronic User Manual and User Interface Guide and Printed Quick Start Guide • Battery Charger • Mini-USB Cable • Stainless Steel Calibration Check Reference Coin • Ten (10) Spare Windows • Integrated Wrist Strap • DELTA PC Software • Factory Authorized Training and Support 	
Optional Accessories	<ul style="list-style-type: none"> • XRF WorkStation for mobile benchtop use • Soil Foot facilitating hands-free In-situ testing • Soil Extension Pole offering ergonomic In-situ testing while standing/walking • Belt Holster 	

Annexure VIII

TECHNICAL SPECIFICATION FOR STRUCTURE ENGINEERING LAB-I

Sl No:	Description	Qty (Nos.)
01.	Concrete Test/ Rebound Hammer Technical Specifications: Hammer mass: 135 g Spring constant: 0.79 N/mm Spring extension: 75 mm (2.95") Battery life: >5000 impacts (before recharging) Concrete compressive strength: 10-100 N/mm ² (1450-14500 psi) Operating temperature: 0 to 50 °C (32 to 122 °F) Storage temperature: -10 to 70 °C (14 to 158 °F) <ul style="list-style-type: none"> • 3-year limited warranty • Impact energy = 2,207 Nm. 	01

	<ul style="list-style-type: none"> • Measuring range 10 to 70 N/mm² compressive strength (below 25 N/mm² type P is better suited) • Rebound values should be read from a dial. • Type : N • Each Basic Unit includes: <ul style="list-style-type: none"> • 1 Nos. impact device • 1 Nos. carrying case incl. grinding stone • 1 Set operating instructions 	
02.	<p>Pile Driving Analyzer/ Dynamic Pile Tester system</p> <p>The PDA should verify the bearing capacity of all types of drilled or driven deep foundations. Tests should be quick and non-destructive. Pile Driving Analyzers should acquire data from acceleration and strain sensors attached to the foundation, and process these signals as the foundation element is impacted by a pile driving hammer or other suitable drop weight. This process is called High Strain Dynamic Test, and may take the form of Dynamic Pile Monitoring or of a Dynamic Load Test.</p> <p>Dynamic Pile Monitoring should be performed during initial driving of piles and provides information on driving hammer performance, driving stresses, pile integrity and capacity at the time of testing.</p> <p>Dynamic Load Tests should be performed on drilled shafts, continuous flight auger, cast in situ or driven piles to determine their ultimate bearing capacity. The test should consist of acquiring PDA data and analyzing it with the Software.</p> <p><u>Technical Specifications:</u></p> <ol style="list-style-type: none"> 1. Physical : <ul style="list-style-type: none"> • High visibility color VGA backlit LCD display optically enhanced for outdoor viewing • High contrast touch screen doubles as keyboard • Built in VGA external monitor port • Power: built-in 6 hour duration battery, • 12 VDC car battery, or 100-240 VAC w/12 VDC converter • Fast charger recharges built-in battery in 4 hours 2. Electronic: <ul style="list-style-type: none"> • PC compatible processor, running Microsoft Windows® 7 Professional • 40 GB hard disk minimum • 2 GB DRAM minimum • Ethernet port • 2 USB ports • Analog signal conditioning filtering (frequency response) 3 KHZ (-3 dB) • 24-bit A/D converter with sampling frequency of 5.12 MHz • 8 channels with effective digitizing frequency of 40 KHZ (2500 – 40000 HZ selectable) • Resolution: 24 bit A/D • Transducer signals digitally recorded • 1K, 2K, or 4K data record sizes available • Basic unit accuracy 2% 3. Functional: <ul style="list-style-type: none"> • Built in calibration test function • Compatible with Smart (wireless) Sensors • Wireless range 100 m (328 ft) • Two channels of strain data acquisition • Two channels of acceleration data acquisition 	01

	<ul style="list-style-type: none"> • Automatic balancing of signals and signal conditioning • Digital (software) integration of acceleration • Signal conditioning for force and acceleration have similar frequency response • Internal calibration check of strain and acceleration • Signal amplification capability • Automatically triggers on any attached strain transducers • High speed internet data transmission using SiteLink Connect through broadband phone or other network device • Dial up data transmission through data capable mobile phone connected via USB <p>4. Other:</p> <ul style="list-style-type: none"> • Operates in English, SI, or Metric units • Optional external USB keyboard, mouse, memory stick, and WiFi (802.11x) available • Includes both soft side carry-on luggage case and hard transit case • Equipped for remote technical support using SiteLink Connect <p>Strain Gauges: 60mm foil type for accurate measurements. Battery Life: 8hrs+ operation on full charge</p> <p>Theodolite High speed optical theodolite with integral with laser targeting and halogen target illumination. Battery Life: 6hrs+ operation on full charge Accuracy: 0.14mm @ 5m</p>	
03.	<p>Fully integrated Rebar Detector with Data Storage</p> <ul style="list-style-type: none"> • Automatic collection of data • Real time visualization of rebars • Memory : <u>Non-volatile memory for 49'500 measured values total</u> (500 objects with 99 measurements) • Display : LCD With Backlight • Interface: Data exchange should be done easily by connecting the Rebar Detector directly to the USB-port of the PC or by reading out the integrated Micro SD memory card. • Compatibility : Windows 2000, XP, Vista, 7 <p>Cover depth measurements: 185 mm (7.28 in.) Diameter measurement up to a cover of 70 mm (2.76 in.)</p> <p>Warranty</p> <ul style="list-style-type: none"> • Standard 2-year limited warranty on electronic parts of the cover 	01
04.	<p>Digital Impact Testing Machine with Notch Broaching Machine:</p> <p>General Description: The pendulum Impact Tester should be designed for conducting Izod, Charpy test. The test method conforms to BS: 131: PART 4-1972 ,BSEN: 10045-2:1993.</p> <p>Charpy Test: The Charpy test piece should rest on alloy steel support anvils, fitted on the base of the machine rigidly held in position by Allen screws. End stopper should be provided for quickly & accurately locating the test piece centrally between the supports.</p> <p>Izod Test: The Izod test piece should be clamped vertically in IZOD support fitted on the base of the machine. The support should be provided with a machined vertical groove to suit the test piece size. The front clamp piece & the Allen screw enable clamping of the test piece size. The front clamp piece & the Allen screw enable clamping of the test piece in correct height with the help of Izod setting gauge supplied.</p>	01

Technical Specifications:	
<ul style="list-style-type: none"> ➤ Max. Capacity : 300 J/170J ➤ Minimum Scale Graduation : 0.5J ➤ Overall Size (Approx.) : 1.32m x 0.45m x 1.05 m (H) 	
<p>Depth Notch Gauge Template for checking 10 x 10mm. cross section of Izod / Charpy test specimen Caliper gauge for checking 'V' notch for Izod and Charpy 'U' Notch Width Gauge 'V' Notch Angle Gauge</p> <p>Notch Broaching machine should be suitable for ferrous & non-ferrous material for sample preparation of ' V ' & ' U ' notches for Impact Testing Machine. Notch Broaching Machine should cut correct ' U ' & ' V ' notches in Charpy or Izod specimen by means of a multi-toothed broach.</p> <p>Features:</p> <ul style="list-style-type: none"> – The machine should be a free standing unit built sturdily. – The broach should be mounted in a carrier, which is drawn by a twin lead screw mechanism through the full stroke with the help of 0.5 HP motor. – V / U notch Broaching Machine fixture to clamp the specimen. The tooling includes the vice for holding the 10mm X 10mm specimen. The tooling/fixtures include the adjustors & the end stop necessary to ensure the notch depth & position accurately as per the Standards. – The approx. weight is around 100 kg. – The machine dimension (approx.) 385mm X 385mm X 1050mm. <p>The machine will broach a notch in 10mm square material to the following</p> <p>Pendulum drop angle for Charpy : 140° Pendulum drop angle for Izop : 90° Pendulum Weight : 22 Kg Striking Velocity : Charpy-5.3 m/s, Izod-3.9m/s Distance of Pendulum centre to specimen Centre : -815 mm Accuracy : + 0.5 J</p> <p>DRO for energy absorbed by Specimen Printer Facility – To print the energy of specimen after test Selection switch for charpy or Izod Test Accuracy as per IS & BS Standards</p> <p>Safety Safety guard for protection A braking arrangement for stopping the pendulum</p> <p>Accessories & Spares: Charpy/Izod Caliper Gauge Self Centering Tong Izod Charpy Sq. Template Depth Notch Gauge 'U' Notch Width Gauge 'V' Notch Angle Gauge 'U' Notch Milling cutter 'V' Notch Milling Cutter</p> <p>Standards: * A.S.T.M. A370, E23 * B.S.131:PART I, II, III, IV . BS EN 10045-1993 * DIN 50 115 * IS 1598 1977, IS 1757 1988, IS 1499 1977</p>	

Annexure IX

Technical Specification for Environmental Engineering Laboratory

Sl.No	Description	Qty
1.	Autoclavable Wide-form crucibles , porcelain: Glazed inside and out. (a) Size: 50mL, 61mm top OD, 37mm H, Pack of 24 Nos. (b) Size: 100 mL, 76 mm top OD, 46 mm H, Pack of 24 Nos.	02 02
2	(a) pH Test Paper ; pH Range 1 to 11; 9 mm x 6 m Roll. Universal pH type. A booklet of 20 strips, 7 x 70 mm; or a single 9-mm wide roll in a convenient dispenser. Packaged as a roll measuring 9 mm x 6 m in a convenient dispenser. (b) Whole Range pH Test Paper ; pH Range 1 to 14; 9 mm x 5.5 m Roll. A booklet of 20 strips, 7 x 70 mm; or a single 9-mm wide roll in a convenient dispenser. Packaged as a roll measuring 9 mm x 5.5 m in a convenient dispenser.	02 02
3	Ashless Quantitative Filter Paper : Retains medium-fine particulates (2 to 10 μ m), trace and precious metals. Ideal for gravimetric analysis and environmental monitoring. Made of the highest quality alpha cotton cellulose with low ash content. Papers should be double acid washed in hydrochloric acid followed by hydrofluoric acid, then rinsed with ultrapure water to neutralize. Filter size: 5.5 cm; Thickness: 0.20 mm; Membrane support: Cellulose; Pore size (micron): 2 to 10; Weight (g/m ²): 103; Flow time (seconds): 300; Absorption speed (cm): 6; Wet strength (cm H ₂ O): 15; Qty/pk: 100 (i) Grade No.: 6 Ashless (a) 5.5cm Dia. (b) 7.0 cm Dia (ii) Grade No.: 7 Ashless (a) 5.5cm Dia. (b) 7.0 cm Dia	02 pkd Each
4	Industrial Nitrile Gloves : Cut Resistant, High level of cut resistance, enhanced dexterity, grip, and comfort. Breathable with a flexible, nitrile dotted palm for better grip. Ambidextrous. (a) Size: 8 (b) Size: 9	02
5	Butyl Gloves : Textured, medium, excellent chemical resistance to hazardous materials—gases, aldehydes, amines, and ketones. They are unlined to ensure an excellent grip. Gloves are 14" long with rolled cuffs that fit all hazmat suits. Thickness (mil): 14; Grip: Textured; Cuff: Rolled; Lining: Unlined; Compliance (a) Medium (b) Large (c) Extra-large	02
6	Safety Goggles : Created for aseptic and clean room environments. Should be autoclavable goggles feature UV-absorbing polycarbonate lenses and a comfortable soft body that easily fits over prescription eyewear. Color: Gray; Lens: Clear/Anti-fog; Compliance. Non-vented type	05
7	Pipette Controller-cum- Pumps with rapid release lever , green, 10 mL. Knurled wheel for precise level adjustment. Attach to pipette and dispense by depressing plunger or rotating wheel. Choose rapid-release lever models for	05

	quick and easy dispensing. All models are color-coded. High-density polyethylene construction. Max volume (mL): 10; Max volume (µL): 10000; Color: Green.	
8	Chlorine Di-Oxide Ozone colorimeter: Waterproof, water floating & pH free Calorimeter for measurement of chlorine dioxide and ozone. Ready to use and calibrated at factory. Features a custom LCD display with clear enunciators. Autoranging, diagnostic error message and troubleshooting, automatic off. Power saving mode enables to take as much 3000 reading on 4 AAA batteries. Product Type: Color/Gloss Meters; Test parameters: Multiparameter; Display: LCD; CE Compliance; Operating temperature: 0 to 50°C (32 to 122°F); Operating humidity: 0 to 90% RH, non-condensing at 30°C (86°F); Wavelengths: 525 nm; Light source: LED; Detector: Silicon Photodiode; Waterproof; Dimensions (inch): 6.25L x 2.75W x 2H	
9	Pipette Controller: Fits all pipettes from 0.1 to 100 mL. Single Lever measure and dispense. Blow-out button clears pipette type. Adapter fits all pipettes from 0.1 to 100 mL. Membrane filter protects controller from liquids. Filter and adapter are autoclavable.	02
10	(A) Vinyl Adhesive Tape, Labware coding. Multicoloured & Tough vinyl tape resists scuffs. Adhesive sticks to most surfaces. Tapes are on a 3" dia core. Dimensions (ft/roll): 108; Material: Vinyl; Dimensions (" W): 0.75 (i) Size: 1.9cm wide x 33m long (a) White; (b) Yellow; (c) Orange; (d) Red; (e) Green; (f) Blue; (g) Black (ii) Size: 2.5cm wide x 33m long (a) White; (b) Yellow; (c) Orange; (d) Red; (e) Green; (f) Blue; (g) Black	02 each
	(B) Multiple-Roll Tape Dispenser: for 3" Diameter Core, 10" L. Keep tapes handy and clean. A serrated cutting edge and bottom suction cups make these a stable choice. Features a flip-top dust cover, measures 10" wide and hold tapes with a 3" diameter core. Product Type: Acrylic Tape dispenser	02 each
11	Adhesive Tape: 36 yd/RL, 1 RL/Pk. PTFE film (5 mil thick) with silicone adhesive backing. Nonstick, chemically inert surface or wrap. Excellent electrical and thermal operating characteristics; temperature range is -99 to 500°F (-73 to 260°C). Dimensions (ft/roll): 108; Material: PTFE; Thickness (mil): 5 (a) 0.5 inch (b) 1 inch	02 each
12	Test Tube Brush: Made of Nylon. Pack of 12. Specifically designed for cleaning test tubes. Radial Tip/ Stainless wire stem brushes, durable and provide superior performance. Tied tip brushes, sponge tip are made to expand to give a more thorough cleaning and protecting from scratches. Adjustable test tube brush spreads apart to fit all sizes of test tubes. (i) Radial tip; (a) Size: 10.2 x 1.9 cm; (b) Size: 7.6 x 1.3 cm; Size: 7.6 x 1.6 cm (ii) Radial tip/SS; (a) Size: 7.6 x 1.3 cm; (b) Size: 10.2 x 3.5 cm (iii) Tied tip; (a) Size: 15.2 x 1.9 cm; (b) Size: 10.2 x 3.2 cm	02 pkd each
13	Microfiber Cloth/ Cleaning Wipes: Reusable, washable and ecofriendly microfibre cloth. With Microban antimicrobial protection, Use wet or dry; can be laundered up to 300 times. Size: 40x40cm.	01 pkd

14.	<p>Four Channel Digital Pump System: Multichannel dispensing & Head applications; 0.1-600 rpm. Multichannel dispensing applications. Maintenance-free brushless motor dispensing drive. Program dispensing parameters—including volume, copy, time, and delay interval—for automated dispensing. Four-channel, six-roller pump head offers low pulsation and synchronous flow between channels for high accuracy and consistent fills. BioPharm Plus platinum silicone tubing delivers exceptional flow stability over time making it ideal for dispensing applications. 1/10-hp continuous-duty brushless drive; tach feedback for $\pm 0.1\%$ speed control. Remote control via DB25 female connector on drive. Membrane keypad with lockout. Min flow rate (mL/min): 0.047; Max flow rate (mL/min): 280; Tubing: Bio-Pharm Plus silicone tube set, L/S 16; pk of 8; Control type: Digital Variable Speed; Power (VAC): 90 to 260; Power (Hz): 50/60; Power (Amps): 2.2 / 1.1</p>	02
15	<p>Digital Laboratory Mixer: Digital display with programmable timer to monitor set speed, real speed, torque, and remaining mixing time. Sealed housing shields stirrer from aggressive liquids and offers premium resistance from acids, bases, and solvents. Plus the soft-start function increases speed slowly to minimize splatter. Electronic counter-reaction ensures mixing speed remains constant even when liquid viscosity changes. Self-locking keyless chuck and a through-shaft design. Use the programmable timer up to 999:59 minutes and automatic switch-off to operate your mixer completely unattended. Handles volumes up to 6.6 gallons (25 liters). Advanced safety features include overload, overcurrent, and overtemperature protection. Chuck: 10 mm; Input power: 120; Min speed (rpm): 50; Max speed (rpm): 2000; Motor (hp): 0.16; Remote control: No; Max torque (in-oz): 56; Viscosity (cp): 25,000; Power (VAC): 80/260; Power (Hz): 50/60; Through-shaft: Yes; CE Compliance.</p>	01
16	<p>Compact Digital Mixer System with Plug Adapter Kit (0-240VAC) Compact size: 2"W x 4"H x 6"D. Maintenance-free brushless DC motor. LED Display with precise adjustments and repeatability. Motor housing is lightweight molded nylon, resistant to splash and spill. With integrated stand clamp for quick and secure mounting. Stainless steel collet, with screws, accepts 6mm shafts. Chuck: stainless steel with set screws; Min speed (rpm): 50; Max speed (rpm): 2500; Motor (hp): 0.01; Shaft dia (Max): 0.25 in (6-mm); Power (VAC): 100 to 240; Power (Hz): 50/60; Torque (Max): 14.2 in-oz (10 N-cm); CE Compliance</p>	02
17	<p>Analytical Precision Balance: Clear visibility of LCD. 3-door glass draft . Internal calibration. Built with advance weighing technology and easy-to-use operation. Die cast aluminum housing and chemical resistance. Splashproof design, sealed keypad. removable steel weighing pan. Lock doen mounting point for security from theft. Auto shutoff: Yes; Calibration: Internal; Capacity: 220g; Housing dimensions: 25.4x27.3x50.8 cm; Pan size (inch): 3-1/2 Dia; Readability: 0.0001g; Linearity: ± 0.0002g; Repeatability: ± 0.0002g; Weighing units: g, ct, oz, mg, dwt, grains; Stabilization time: 2 to 4 seconds</p>	03
18	<p>Weighing Spatula Balance: Digital display spatula Balance is scoop designed and detachable. With Chemical- and corrosion-resistant ABS plastic construction. Markings on see-through scoop should be graduated from 5 to 30 mL in 5-mL increments for weighing liquids with ease. 3-positioned soft-touch keys in the handle tares, holds and changes gram to ounce. Accuracy: ± 0.2 g; Capacity: 300g; Capacity range: 32 mL; Housing dimensions: 5.1 x 2.5 x 22.9 cm; Dimensions (inch):</p>	02

	2W x 1H x 9D; Readability: 0.1 g; Repeatability: ± 0.1 g; Weighing units: g, oz	
19	<p>Disposal Weigh Dish: Unique hexagonal design for non-slip handling and pouring. Biologically inert; Translucent, anti-static, polystyrene; flexes easily for weighing, dispensing, or pouring liquids or solids. resistant to most dilute acids, aqueous solutions, and alcohol bases. Flat bottoms resist tipping. Hundreds of sampling and weighing applications. Material: antistatic polystyrene; Product Type: Weighing Dish; Qty/pk: 500 (a) Cap.: 50ml; Dimension: 7.6x1.91cm (b) Cap.: 200ml; Dimension: 12.1x2.22</p>	02 pkd each
20	<p>Weighing Paper: Weighing paper glassine type and disposal. Non absorbent & moisture resistant. To keep balance clear. (a) 7.6 x 7.6cm (b) 10.2 x 10.2cm</p>	02 pkd each
21	<p>Digital Utility Water Baths: LCD display. Program up to 3 commonly used setpoints. Built-in timer to notify completion of process. Safety shut down and high temperature alarm. Bath have dual thermostat with built-in primary microprocessor-based temperature controller providing $\pm 0.1^{\circ}\text{C}$ precision and secondary safety sensor which prevents overheating of samples. Primary controller can be calibrated to your reference thermometer. Tank is stainless steel with rounded corners to provide an easy to clean interior. Hinged polycarbonate lid allows condensation to flow back. Capacity: 28Litres; Min temperature: Ambient $+5^{\circ}\text{C}$; Max temperature: 99°C; Dimensions (Inch): 17.5W x 14H x 22.5L; Temp control: PID; Temp display: LED, switchable between C and F; Temp stability: $\pm 0.1^{\circ}\text{C}$; Uniformity: $\pm 0.2^{\circ}\text{C}$; High-temperature cutoff: Yes; Working area (Inch): 17W x 9.5L x 8D; Wetted materials: 304 Stainless Steel; Heater wattage: 1400; Power (VAC): 240; Power (Hz): 50; Power (Amps): 6; CE Compliance</p>	01
22	<p>Portable Centrifuge: , 8-PI Rotor, 18-Tube Holder; 12 VDC. Dual-lid latch to ensure unit is securely shut during runs for added safety. Fixed-angle rotors accept any sample ranging from 2 to 15 mL. Max RCF: 1640; Rotor: Fixed angle; 8 places; Speed range: 3500 rpm; Max capacity: 8; Tube capacity: 15 mL; Power (VAC): 12 VDC; Rotor (included): Yes; Timer: Yes; Timer range: 0 to 30 min; Dimensions: 20.3 x 25.9 c 30 cm</p>	01
23	<p>Conductivity Probe: 4-cell, K = 1.0, Glass/Pt, 2.5 ft Cable</p>	01
24	<p>Multiparameter with electrode & stand: Compact design. Large & dual display easy to read from a distance. Toggle at-ease between pH, mV, conductivity, TDS & temperature measurements. pH auto-buffer recognition for both USA and NIST buffer sets. automatic or manual temperature compensation, temperature selectable in either $^{\circ}\text{F}$ or $^{\circ}\text{C}$, display Hold, and water-resistant membrane keypad. Quick and easy retrieval of previous calibration points, electrode slope and offset, and conductivity/TDS cell constant. Meter style: Benchtop; Range (pH): -2.00 to 16.00; Range (mV): ± 2000; Range (Conductivity): 0 to 200 mS; Range (TDS): 0 to 200 ppt; Range (Temperature $^{\circ}\text{C}$): -10 to 110; Range (Temperature $^{\circ}\text{F}$): 14 to 230; Resolution (pH): 0.1/0.01; Resolution (Temperature): 0.1;</p>	01

	Resolution (mV): 0.1/1; Resolution (Conductivity): 0.01, 0.1 μ S; 0.001, 0.01, 0.1 mS; Resolution (TDS): 0.01, 0.1 ppm, 0.001, 0.01, 0.1 ppt; Accuracy (pH): \pm 0.01 pH; Accuracy (Temperature): \pm 0.5°C; Accuracy (mV): \pm 0.2 mV or 0.05%, whichever is greater; Accuracy (Resistivity): \pm 1% full-scale; Accuracy (Conductivity): \pm 1% full-scale; Accuracy (TDS): \pm 1% of reading; Accuracy (Salinity): \pm 1.0% full-scale; Temperature compensation: Automatic or manual; Display: LCD; Calibration: Up to 6 points; Connections: BNC, Temp 2.5mm; Buffer recognition: USA, NIST, DIN; Dimensions (inch): 6-7/8W x 2-3/4H x 6-1/8L; Power: 100 to 240 VAC, 50/60 Hz	
25	Programmed Controlled Furnace: Furnace with autotune feature which allows the furnace to perform better at a particular set point and load, eliminating temperature overshoot for a commonly used application. Temperature quick-rise times as fast. Energy efficient insulation keeps exterior safe. Programmable controlled furnace with 2 LED display of actual and set point temperature. Having 31 programs with upto 126 segments total. Create programs with copy, paste, edit, and delete functions. Setting of furnace run programs upto 999 times. . Min. temp.: 100 ° C; Max. temp.: 1100 ° C; Chamber size (inch): 12H x 18D; Temp control accuracy: \pm 1° C; Rise time: 45 minutes to 1100°C; Temp uniformity: \pm 4°C; CE Compliance: Yes; Control type: PID microprocessor; Power (VAC): 208/240; Power (Hz): 50/60	01
26	BOD incubator: Digital LED display clearly showing temperature readings and alarm indicator. Undercurrent type BOD Incubator which holds up to 114 BOD bottles. Microprocessor-based controller mounted on the door for convenient, easy access. LED alarm alerts you to over/under temperature conditions. Incubator includes a chamber safety thermostat set at 62°C. Compressor is protected from accidental overload by a relay. Chamber interior features a 2 A outlet. Bottom rollers make installation, leveling, and moving simple. Specification:- Product Type: BOD Incubators, VAC: 230; Hertz: 50; Temp accuracy: \pm 0.2°C, Min temperature (° C): -10, Max temperature (° C): 60, Resolution: 0.1°C, Temp control: Microprocessor, 0Display: Digital, Capacity (cu ft): 6.1, Chamber size (inch): 21W x 28.25H x 20.5D, Temp resolution: 0.1°C, Uniformity: \pm 1°C, Control type: Microprocessor, Dimensions (inch): 24W x 34.5H x 24.5D Shelves: two removable (three shelves in door).	01
27	Waterproof Pocket pH Tester: Ergonomically designed LCD measurement. Can be seen at a glance. Single junction waterproof pocket pH Tester is easy to use and handy. Simply dip and read—the orientation of the display means no need to turn your head or tilt the tester. Offers up to 3 point calibration with auto-buffer recognition for quick calibrations, automatic temperature compensation for accurate reading under changing conditions, hold function to lock measure value, and auto-off to prolong battery life. Meter style: Tester; Range (pH): 0.00 to 14.00; Range (Temperature °C): -5 to 50; Range (Temperature °F): 32 to 122; Resolution (pH): 0.1; Resolution (Temperature): 0.1; Accuracy (pH): \pm 0.1 pH; Temperature compensation: Automatic; Display: LCD; Calibration: Up to 3 points; Waterproof: Yes; Buffer recognition: USA, NIST; Power: Four 1.5 V batteries (included); CE Compliance; Dimensions (inch): 1-5/8W x 6-1/4H x 1-1/8D	01

28	<p>Pocket Conductivity tester-Economic Model: Economically designed pocket conductivity meter have large LCD measurement display. Can be seen at a glance. Single junction waterproof pocket conductivity Tester is easy to use and handy. Low range conductivity readings from 0 to 19.90 mS. Simply dip and read—the orientation of the display means no need to turn your head or tilt the tester. Waterproof and dustproof housing is designed for use in dirty and damp field conditions. Electrodes are made of stainless steel for both rugged and chemical resistant. Single point calibration. auto-shutoff to prolong battery life, hold function to lock in a measured value, and self-diagnostic error messages. Meter style: Tester; Range (Conductivity): 0 µS to 20.00 mS; Range (Temperature °C): -10 to 110; Range (Temperature °F): 14 to 230; Resolution (Temperature): 0.1; Resolution (Conductivity): 0.01, 0.1 µS; 0.001, 0.01, 0.1 mS; Accuracy (Conductivity): ±2% full-scale; Temperature compensation: Automatic or manual; Display: LCD; Calibration: 1 point; Waterproof: Yes; Power: Four 1.5 V batteries (included); Battery life: > 200 hours; CE Compliance.; Brand: Oakton; Dimensions (" W): 1-5/8; Dimensions (" H): 1-1/8; Dimensions (" L): 6-1/4</p>	01
	<p>TDS Pocket Tester: Low-cost TDS pocket meter feature large designed LCD display. Non-replaceable sensors makes it economic. Single point electronic calibration. Waterproof and dustproof. Auto-shutoff to prolong battery life, hold function to lock in a measured value, and self-diagnostic error messages. Tester also has a self-adjusting TDS factor from 0.40 to 1.0. Electrodes are made of stainless steel for both rugged and chemical resistant. Meter style: Tester; Range (TDS): 0 to 10.0 ppt; Resolution (TDS): 0.01, 0.1 ppm, 0.001, 0.01, 0.1 ppt; Accuracy (TDS): ±2% full-scale; Temperature compensation: Automatic; Display: LCD; Calibration: 1 point; Waterproof: Yes; Power: Four 1.5 V batteries (included); Battery life: > 200 hours; CE Compliance; Dimensions (inch): 1-5/8W x 1-1/8H x 6-1/4L</p>	01
29	<p>Waterproof Pocket pH Tester: pH Tester for outdoor applications. Water-proof and water-floating type attached with a housing. Replaceable sensors for easy maintenance. Electrodes have double-junctions sensors and also offers clog resistant junction and a recessed glass pH bulb to protect against breakage. 3-point calibration with auto-buffer recognition. Automatic temperature compensation, hold function, self-diagnostic error messages, auto-off function, battery life indicator. Meter style: Tester; Range (pH): -1 to 15 pH; Range (Temperature °C): 0 to 50; Range (Temperature °F): 32 to 122; Resolution (pH): 0.01; Accuracy (pH): +/- 0.01; Temperature compensation: Automatic; Display: LCD; Calibration: Up to 3; Waterproof: Yes; Buffer recognition: USA, NIST; Power: Four 1.5V batteries; Battery life: 500 hours; CE Compliance; Dimensions: 6 1/2" L x 1 1/2 " Dia</p>	01
30	<p>pH/Conductivity/TDS/Salinity Tester: Tester feature measurement for pH, conductivity, TDS, salinity & temperature. pH electrodes with wide range of sample compatibility. Pin style conductivity sensors are stainless steel electrodes for chemical resistance and durability. Reusable meter body by having replaceable sensor module. Auto-shutoff, user-adjustable temperature coefficient, self-adjusting TDS and salinity factor, and low-battery indicator. 5-point pH calibration. Waterproof and water-floating body. Meter style: Tester; Range - pH 0.00 to 14.00pH; Conductivity: 0 to 20.0 mS; TDS: 0 to 10.0 ppt; Salinity: 0 to 10 ppt; Temperature: 0 to 110°C; Resolution - pH: 0.1/0.01; Temperature: 0.1°C;</p>	01

	Conductivity: 0.1, 1 μ S; 0.01 mS; TDS: 0.01, 0.1 ppm, 0.001, 0.01, 0.1 ppt; Salinity: 0.1 ppt, 0.01%; Accuracy (pH): \pm 0.01 pH; Accuracy (Temperature): \pm 0.5°C; Accuracy (Conductivity): \pm 1% full-scale; Accuracy - TDS: \pm 1% of reading; Salinity: \pm 1.0% full-scale; Temperature compensation: Automatic; Display: LCD; Calibration: Up to 5 points; Waterproof: Yes; Buffer recognition: USA, NIST; Power: Four AA batteries (included); Battery life: 150 hours; CE Compliant; Dimensions: 6-1/2 " L x 1-1/2 " Dia	
31	Handheld Ion Meter Kit: Ion meter kit features reading of ion concentration directly. Rubber boot, Case, Solutions, and pH/ATC Probe with all push-button calibration, hold function, auto-off, and splash-resistant keypad. Pre-programmed ion calibration points. Having mV mode to check performance and electrode calibration. mV range compatible with all ISE electrodes. Meter style: Portable; Range - pH: 0.00 to 14.00; mV: \pm 1999; ISE: 0.01 to 1999 ppm; Temperature: -10 to 110°C; Resolution - pH: 0.1/0.01; Temperature: 0.1°C; mV: 0.1/1; ISE: 0.01 ppm; Accuracy - pH: \pm 0.01 pH; Temperature: \pm 0.5°C; mV: \pm 1mV \pm 1 digit; ISE: \pm 0.5% of reading; Temperature compensation: Automatic; Display: LCD; Calibration: Up to 5 points; Buffer recognition: USA, NIST, DIN; Power: Four AAA batteries (included); Battery life: 700 hours; CE Compliance; Dimensions: 3-3/8" W x 1-11/16" H x 6-3/16" L	01
32	Multiparameter Bench-top Meter: Advance all-in-one solution for laboratory research type with ion concentration readings. With pH electrode, conductivity/temp probe, and electrode stand Feature pH auto-buffer recognition. Previous point calibration, slope and offset electrode and conductivity/TDS cell constants storing in memory for easy retrieval. Meter style: Benchtop; Range - pH: -2.000 to 20.000; mV: \pm 2000; Conductivity: 0 to 500 mS; TDS: 0 to 500 ppt; Salinity: 0 to 80 ppt; Resistivity: 0 to 20.00 M ohm; ISE: 0 to 19999 ppm; Temperature: -10 to 110°C; Resolution - pH: 0.1/0.01/0.001; Temperature: 0.1; mV: 0.1/1; Conductivity: 0.01, 0.1 μ S; 0.001, 0.01, 0.1 mS; TDS: 0.01, 0.1 ppm, 0.001, 0.01, 0.1 ppt; Resistivity: 0.01 m ohm, 0.001, 0.01 k ohm, 0.01, 0.1 ohm; ISE: Up to 3 digits; Salinity: 0.01, 0.1 ppm; 0.001, 0.01 ppt; Accuracy - pH: \pm 0.002 pH; Temperature: \pm 0.5°C; mV: \pm 0.2 mV or 0.05%, whichever is greater; Resistivity: \pm 1% full-scale; ISE: \pm 0.5% of reading; Conductivity: \pm 1% full-scale; TDS: \pm 1% of reading; Salinity: \pm 1.0% full-scale; Temperature compensation: Automatic or manual; Display: LCD; Interface: RS-232; Calibration: Up to 6 points; Connections: BNC, Temp 2.5mm; Buffer recognition: USA, NIST, DIN; Power: 100 to 240 VAC, 50/60 Hz; Datalogging (points): 500; CE Compliance; Dimensions (inch): 6-7/8W x 2-3/4H x 6-1/8H	01
33	pH indicator strips: Plastic type enabling pH Testing immediate and long lasting. Three times matching of area. Handy flip top vials with handy colour chart. Distinct, bright colour separations. with Parameters: pH; Range: 0 - 14; Graduations: 1	01 pkd
34	pH Buffer for various pH values: Accurate and convenient measurement of pH through economical pouches. Standardization Buffers are NIST traceable pH references. (a) pH: 4.01; (b) pH: 7.00; (c) pH: 10.00; (d) Rinse Solution	03 pkd
35	All-in-One pH Buffer Kit:	02 pkd

	Portable pH buffers kit feature 4, 7, & 10 buffer. Standardize performance with color-coded pH buffer kit for easy identification. Packaged with buffer/temperature tables for accurate calibrations. Buffers are standardized against NIST-traceable pH references for superior accuracy. Volume (mL): 60; Product Type: pH Buffers	
36	<p>(A) pH electrode with ion selective function: Glass body provides high quality laboratory applications results. Double junction in design. Combined with ion selective electrodes and epoxy body. Use electrode with resolution of 0.1mV meter. Suitable for field applications. Body type: Glass. For various electrodes: (a) Ammonium; (b) Cadmium; (c) Calcium; (d) Chloride; (e) Copper; (f) Fluoride; (g) Nitrate; (h) Potassium; (i) Sodium; (j) Surfactant; (k) Water hardness(Ca⁺/ Mg⁺²)</p>	01 each
	<p>(B) Ion-kit Formulations for Standard Solutions: The kit include one reference filling pipette, one bottle of reference fill solution, one bottle of 1000ppm standard solution and one 475-mL bottle of ionic strength adjustor. Double junction type. For various ion-solutions: (a) Ammonium; (b) Cadmium; (c) Calcium; (d) Chloride; (e) Copper; (f) Fluoride; (g) Nitrate; (h) Potassium; (i) Sodium; (j) Surfactant; (k) Water hardness(Ca⁺/ Mg⁺²)</p>	01 each
37	<p>Ultra-Low Temperature Freezer, Portable: Ultra-low temperature storage freezer is energy efficient. Easy grip moulded in-handles offers comfortable transport. AC to DC change operation. Portable freezer is to bring -86°C temperature secure mobile transport to biological specimen. Ideal for use within biorepositories. The Humm free-piston stirling engine contains two moving parts that float on helium gas bearings to eliminate contact bearing. Weather resistant and touch-pad controller with digital temperature display indicating interior temperature and error codes, if detected. Presets button allows to set temperature -20, -40, or -86°C (default at startup). A system lock indicator confirms system set points are locked and prevents errors or unauthorized adjustment. The over/ under-temperature alarm activates visual and audible beep warnings if temperature exceeds set point and silences automatically when set point is restored. System lock indicator confirms system set points are locked and prevents errors or unauthorized adjustment. Composite vacuum-insulation panels with CFC-free foam strengthen and protect from high ambient temperatures. Sub-lid constructed of high-density, closed-cell rigid foam enhances temperature uniformity and provides additional protection when lid is opened. Other features include a slide-out air filter that is easy to remove and clean, and a 1/4" (0.64 cm) access port with stopper. Product Type: Chest Freezer; Capacity (cu ft): 0.9; Capacity (Liters): 25; Dimensions (inch): 13.6W x 18.3H x 27.1D; Min Temp - Freezer (° C): -86; Max Temp - Freezer (° C): -20; Temp accuracy: ±0.75°C, top to bottom; Power (Hz): 50/60; Power (Amps): 2; Power (watts): 250; Alarm: Visual / Audible; No. of boxes: 18, 2" boxes; Temp control: 1°C Increments, Presets at -86, -40 and -20°C; Display: Digital; CE Compliance; Power (VAC): 120/220 or 12V DC</p>	02
38	<p>Sieve Cleaning Brush: (i) Round brush for 120 mesh (ii) Rectangular brush for 100 mesh</p>	01
39	Visible Spectrophotometer:	01

	Single beam for quantitative analysis with wide variety of quality control protocols. Narrow bandwidth with 4-cell convenience. Visible spectrophotometer with low profile with a large LED display. Standard 4 cuvette holder. Optional four-position holder accommodates cuvettes upto 100mm pathlength. Obtain accurate routine spectrophotometric analysis. Product Type: Spectrophotometer; Bandwidth: 4 nm; Wavelength range: 325 to 1000 nm; Wavelength accuracy: ± 2 nm; Photometric range: -0.1 to 2.5 Absorb, 0 to 1999 conc.; Output: RS-232; Sample compartments: Stand four-position; Pathlength: 10 mm, expandable to 100 mm.	
40	Oil Content Spectrophotometer-cum-Analyzer: Infrared spectral data with peak integration to determine oil concentration. Non-absorbent solvent is used to match the IR wavelength. Oil content analyzers for measuring of oil in water or soil for wide variety of applications. Analyzer surveys water quality and hazardous water, industrial waste-water, post-cleaning discharge, oil residuals on textile and metals. With Oil or solvent solution to extract sample for the analyzer for single button measurement. The analyzer reads/ measure oil down to 0.1ppm. With built-in time stamping to documents results. Results on LCD display or print from parallel port via RS232. Product Type: Spectrophotometer; Photometric readout: a) 0 to 200 mg/L, ranges 0 to 9.9, 10 to 99.9 or 100 to 200, b) 0 to 1000 mg/kg, ranges 0 to 9.99, 10 to 99.9 or 100 to 1000, c) 0 to 1 Absorbance, range 0 to 1000; Sensitivity: 1% of scale lower limit; Detector: Pyroelectric; Output: RS-232C and centronics printer port; Pathlength: 200 mm quartz cell; Display: LCD; Dimensions (cm): 25cm x 20cm x 28.5c	01
41	Turbidity Meter: Handheld, Large custom LCD displays readings and measurement units. Easy calibration Turbidity Meter prompts to the next calibration standard. Waterproof and water-floating. Meet ISO criteria performance. EPA recognized. 4 point calibration. 1000 readings on power saving function mode. Sealed with optical system and infrared light source offers high accuracy across entire range. Product Type: Turbidity Meter; Meter style: Portable; Range - Turbidity: 0.01 to 1000; Temperature: 0 to 50°C; Resolution - Turbidity: 0.01, 0.1, 1; Accuracy (Turbidity): $\pm 2\%$ of reading; Display: LCD; Waterproof: Yes; Power: Four AAA batteries (included); CE Compliance	01
42	Bench-top Turbidity Meter: Advance and versatile benchtop Turbidity Meter for nephelometric measurement. ISO compliant. Push button calibration and operations. Wide array of samples and turbidity from ration optical system provide simple laboratory work. Smart self diagnostic alert and air purge system with dry air and minimizes condensation of cell. Product Type: Turbidity Meter; Meter style: Benchtop; Range (Turbidity): 0 to 10,000; Resolution (Turbidity): 0.01, 0.1, 1; Accuracy (Turbidity): $\pm 2\%$ of reading; Display: LED; Interface: RS-232; Power: 230 VAC; CE Compliance	01
43	Microwave digester	05
	Capacity	45 mL
	Product Type	Acid Digestion Bombs
	Max operating temperature (° F)	482

	Max operating temperature (° C)	250	
	Max operating pressure	1200 psig	
	Materials of construction	High strength polymer with PTFE cup	
44	Microwave Oven Capacity 28 Litres		01

Annexure X

Technical Specification for Transportation Engineering Laboratory

Sl. no	Specification	Quantity
1	<p>Laboratory California Bearing Ratio Test Apparatus, Motorised, Three Speed with Mild Steel Mould. Ref. Standards IS:9669, IS : 2720 (Part XVI), BS 1377; 1924; EN 13286-47/ ASTM D 1883; AASTHO T 193 .</p> <p>Equipment consisting of :-</p> <ul style="list-style-type: none"> • Load Frame, 50 kN Capacity with Horizontal Clearance-265mm, Vertical clearance-700mm, Maximum Platen dia-157mm with Hardness of material(platen): 60 RHC, • Maximum Platen Travel-100mm with Specimen dia-38mm to 100mm. Three Speed 1.5, 1.25 & 2.5 mm/min. • Paint quality:-Powder coating 70-80 micron thick • Frame Stiffness:-Approx 100kn/mm • Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%) • Mould - MS150mm ID x 175 mm H, Perforated Base Plate - MS • Extension Collar - MS150 mm ID x 50 mm high • Penetration Piston 50 mm face dia • Adjustable Bracket for Penetration Dial Gauge, • Circular Metal Spacer Disc, with detachable handle, 148 mm dia x 47.7 mm high, Annular Metal Weight 2.5 kg, 147 mm dia with 53 mm dia central hole Slotted Metal Weight 2.5 kg, 147 mm dia, with 53 mm dia slot • Perforated Plate 148 mm dia, with adjustable stem and lock nut Metal Tripod for Dial Gauge Cutting Collar • Rammer 2.6 kg, 310 mm controlled drop • Rammer 4.9 kg, 450 mm controlled drop • Proving Ring Capacity 50 kN • Dial Gauge 25 mm travel, 0.01 mm least count. • Load frame pillar thread M30 X 600mm. • Suitable for operation on 220 V, 50 Hz, single phase, AC supply. It must be table top machine. 	1
2	Mild Steel, Zinc Plated Mould, 150mm ID x 175mm	1
3	Mild Steel, Zinc Plated Perforated Base Plate for MS Mould	1
4	Mild Steel Zinc Plated Extension Collar 150mm ID x 50mm high	1
5	<ul style="list-style-type: none"> • Sand Pouring Cylinder Apparatus, 100mm Dia. Ref. Standard IS:2720 (Part 28) • Sand Pouring Cylinder fitted with Conical Funnel and Shutter, capacity 3 litre 1 • No. Cylindrical Calibration Container 100 mm ID x 150 mm height 1 No. • Metal Tray size 30 x 30 x 4 cm, with 10 cm central hole 1 No. 	1
6	<p>Sand Pouring Cylinder Apparatus,</p> <ul style="list-style-type: none"> • large, Ref. Standard IS:2720 (Part 28) • Large sand Pouring cylinder, 16.5 ltr.capacity fitted with conical funnel and 	1

	<ul style="list-style-type: none"> shutter, Cylindrical calibrating container, internal diameter 200 mm and internal depth 250mm and Metal tray size, 45x45x5 cm deep with hole 	
7	<p>Sieve Shaker Motorised, with Built-in Digital Timer, A digital timer adjustable from 0-99 minutes is incorporated as an integral part of the equipment. The Sieve Shaker can carry upto 8 sieves of 45cm dia. It is driven by a ¼ HP geared motor. The Sieve Table is inclined from the vertical axis and the direction of inclination changes progressively in the clockwise direction. In addition to the gyratory motion of the table, there is a tapping motion as well. Vibration pads 4 Nos. Paint quality:-Powder coating 70-80 micron thick Suitable for operation on 220 V, 50 Hz, Single Phase,AC supply</p>	1
8	<p>Sieve G.I. Frame 45cm dia x 125mm Material of construction: G.I Protective Coating : Powder Coating Weight: preferably - 1.590 kgms Wire mesh Preferably imported quality With NABL Certificate</p>	1
9	<p>(i) Sieve G.I. Frame 45cm dia x 106mm (ii) Sieve G.I. Frame 45cm dia x 100mm (iii) Sieve G.I. Frame 45cm dia x 90mm (iv) Sieve G.I. Frame 45cm dia x 80mm (v) Sieve G.I. Frame 45cm dia x 75mm (vi) Sieve G.I. Frame 45cm dia x 63mm (vii) Sieve G.I. Frame 45cm dia x 53mm (viii) Sieve G.I. Frame 45cm dia x 50mm (ix) Sieve G.I. Frame 45cm dia x 45mm (x) Sieve G.I. Frame 45cm dia x 40mm (xi) Sieve G.I. Frame 45cm dia x 37.5mm (xii) Sieve G.I. Frame 45cm dia x 31.5mm (xiii) Sieve G.I. Frame 45cm dia x 26.5mm (xiv) Sieve G.I. Frame 45cm dia x 25mm (xv) Sieve G.I. Frame 45cm dia x 22.4mm (xvi) Sieve G.I. Frame 45cm dia x 20mm (xvii) Sieve G.I. Frame 45cm dia x 19mm (xviii) Sieve G.I. Frame 45cm dia x 16mm (xix) Sieve G.I. Frame 45cm dia x 14mm (xx) Sieve G.I. Frame 45cm dia x 13.2mm (xxi) Sieve G.I. Frame 45cm dia x 12.5mm (xxii) Sieve G.I. Frame 45cm dia x 11.2mm (xxiii) Sieve G.I. Frame 45cm dia x 10mm (xxiv) Sieve G.I. Frame 45cm dia x 9.5mm (xxv) Sieve G.I. Frame 45cm dia x 8.6mm (xxvi) Sieve G.I. Frame 45cm dia x 8mm (xxvii) Sieve G.I. Frame 45cm dia x 6.7mm (xxviii) Sieve G.I. Frame 45cm dia x 6.3mm (xxix) Sieve G.I. Frame 45cm dia x 6.0mm (xxx) Sieve G.I. Frame 45cm dia x 5.0mm (xxxi) Sieve G.I. Frame 45cm dia x 4.75mm (xxxii) Sieve G.I. Frame 45cm dia x 4mm (xxxiii) Sieve G.I. Frame 45cm dia x 3.35mm (xxxiv) Sieve G.I. Frame 45cm dia x 2.8mm (xxxv) Sieve G.I. Frame 45cm dia x 2.36mm (xxxvi) Sieve G.I. Frame 45cm dia x 2.0mm (xxxvii) Pan and Cover for 45cm dia sieves</p>	1 each

10	<p>Los Angeles Abrasion Testing Machine Ref. Standards - IS:10070 Machine consisting of hollow steel cylinder arranged for rotating about its axis in a horizontal position closed at both ends, having an inside diameter of 700 mm and an inside length of 500 mm. Steel wall thickness:-12mm thick, Filler plate thickness:-12mm+thickness of gasket. Stud staff made of mild steel, cover for opening made of mild steel(240X6mm).Shelf made of mild steel wide:-90+/- 2mm ,Thick 25+/-1mm, 500mm long, ball bearing heavy duty having 50mm bore. Drive should be by means of a chain running over a sprocket on the stub shaft and a sprocket on the shaft of a gear box coupled to a motor (1 hp, 3 phase, 1 440 rpm). A clutch shall be provided. A revolution counter shall be provided to indicate the number of revolutions. The rate of rotation of the cylinder shall be 30-33 rpm. Frame Stiffness:-Approx 100kn/mm Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%) Paint quality:-Powder coating 70-80 micron thick Counter sensor must be non contact type. Abrasive Charge - The abrasive charge shall consist of 12 cast iron spheres 48 +/- 2 mm in diameter and each weighing between 390 and 455 g and a total of 12 numbers of spheres weighing 5 000 +/- 25 g shall be supplied</p>	1
11	<p>Aggregate Impact Tester for determining the aggregate impact value It has been designed in accordance with IS:2386 (Part 4), IS:9377. The sturdy construction consists of a base and support columns to form a rigid frame work around the quick release trigger mechanism to ensure an effective free fall of the hammer during test. The free fall can be adjusted through 380 ± 5 mm. The hammer is provided with a locking arrangement. With cylindrical Cup, Metal Measure, Tamping Rod, Automatic Blow Counter</p>	1
12	<p>Specific gravity Test with Buoyancy Balance Apparatus shall consist of the following: Balance -A balance or scale of capacity not less than 3 kg (Balance—15 kg x 0.5g) Suitable for operation on 220 V, 50 Hz, Single phase, AC supply. to 0-5 g and of such a type and shape as to permit the basket containing the sample to be suspended from the beam and weighed in water. A wire basket of not more than 6-3 mm mesh or a perforated container of convenient size 20 cm dia x 20 cm high (approx.). Preferably chromium plated and polished, with wire hangers not thicker than one millimetre for suspending it from the balance.A stout watertight container in which the basket may be freely suspended</p>	1
13	<p>Compaction Test Apparatus Manual -Light Compaction made of Mild Steel, Ref. Standards IS:2720 (Part 7), IS:9198, IS:10074.. Compaction mould, complete Rammer with Collar and Base Plate, made of Mild steel 100 mm ID, 127.3 mm height ,1,000 ml volume. Rammer:- 2.6 kg x 310 mm fall</p>	1
14	<p>Compaction Test Apparatus Manual-Heavy Compaction made of Mild Steel, Ref.</p>	1

	Standards IS:2720 (Part 8) IS:9198, IS:10074, Compaction mould, complete Rammer with Collar and Base Plate, made of Mild steel 150 mm ID, 127.3 mm height 2,250 ml volume. Rammer:- 4.9 kg x 450 mm fall	
15	Universal Penetrometer Ref. Standards IS:1448 (Part 60), ASTM D 937, IP 179, BS:4698, ASTM D217, IP 50, ISO 2137 Ref. EN 1426, 13179-2 Penetration Needle Transfer Dish made of copper. Aluminium Sample Containers Set of two.	1
16	Ductility Testing Machine with Digital Temp Indicator Two rates of travel i.e. 5 cm/min and 1cm/min are provided. Made of SS, Paint quality:-Powder coating 70-80 micron thick. Lead screw must be made of SS. Suitable for operation on 220 V, 50 Hz, Single Phase, AC supply. Ductility Mould, with Base Plate ...4Nos.	1
17	Flash Point (Closed) Pensky-Martens Apparatus Ref. Standards - IS:1209, IS:1448 (Part 21), ASTM D 93, BS:2839, ISO 2719, DIN 51758, AFNOR M/07-019, IP34 Electrical heating, with gas test jet and electric heater with Energy regulator. Suitable for operation on 220 V, 50 Hz, Single Phase, AC Supply.	1
18	Flash Point (open) Pensky-Martens Apparatus Ref. Standards - IS:1209, IS:1448 (Part 21), ASTM D 93, BS:2839, ISO 2719, DIN 51758, AFNOR M/07-019, IP34 Electrical heating, with gas test jet and electric heater with Energy regulator. Suitable for operation on 220 V, 50 Hz, Single Phase, AC Supply	1
19	(i) Thermometer IP 15C Range 5°C to +110°C (ii) Thermometer IP 16C Range 90°C to +370°C (iii) Thermometer IP 8C, Range 0°C to 45°C (iv) Thermometer IP 9C, Range 40°C to 85°C (v) Thermometer IP 10C, Range 76°C to 122°C	1 each\
20	Standard Tar Viscometer 10mm cup and ball valve with Thermometer IP 8C, Range 0°C to 45°C and Thermometer IP 9C, Range 40°C to 85°C with Electrical Heating with Immersion Heating Elements and Dimmerstat for controlling the temperature. Complete with 10 mm Cup and Valve.	1
21	Standard Tar Viscometer 4mm cup and ball valve with Thermometer IP 8C, Range 0°C to 45°C and Thermometer IP 9C, Range 40°C to 85°C with Electrical Heating with Immersion Heating Elements and Dimmerstat for controlling the temperature. Complete with 4 mm Cup and Valve	1
22	Rotational Viscometer For determining the viscosity of Bitumen with required software with following specification: <ul style="list-style-type: none"> • Model: Visco 2000 • Rotational Speed: 0-10000rpm • Share Rate: 1/s 4-1,200. 	1

	<ul style="list-style-type: none"> • Viscosity Range: 5mPa.s-10000000mPa.s • Temperature Range: Ambient to 300°C. • Type of Oven: Special design electrical oven. • Temp Controller: PID Type. • Type of Sensor : Pt 100 Sensor • Torque Range: 0-10 mNm • Viscosity Pas : 0.006-350 • Operating Voltage: 220V, 50Hz • Display Unit: Micro Controller Multi line LCD with high resolution blue back light. • Software: Machine Control , Machine Configuration and testing of Bitumen ,Asphalt, Polymer Binders. • Geometry Type: Bob & Cup Co axial cylinder made up with stainless Steel 560,000.00 	
23	<p>Centrifuge Extractor Capacity 1500g Electrically Operated ,Ref. Standards ASTM D 2172, AASHTO T-58, T-164, EN 12697-1 supplied complete with a set of 25 Filter Paper Discs. Suitable for operation on 220 V, 50 Hz, Single Phase, AC supply.</p>	1
24	<p>Marshall Apparatus 50kN Single speed , New Model for 4" dia sample table top model Ref. Standards - ASTMD1559 BS:598-197, EN-12697-34 Material of Construction: Special quality low carbon mild steel (Carbon-16%-17%) Frame Stiffness:-Approx 100kn/mm Paint quality:-Powder coating 70-80 micron thick.</p> <ul style="list-style-type: none"> • Maximum Vertical Clearance = 470mm • (Platen Down, Cross-head up) • Minimum Vertical Clearance = 250mm • (Platen up, Cross-head down) • Horizontal Clearance = 265mm • Platen Diameter = 133mm with Hardness of material(platen): 60 RHC • Platen Travel = 25mm • Platen Speed = 50.8mm/min • Rated Power = 375W • Dimension (I x w x h) = 550×400×870mm • Weight = 60kgMarshall Load Frame Cap 50kN • Speed- 50.8mm/min 1 No. • Breaking Head Stability Mould 1 No. • Compaction Mould Steel, cylindrical 3 Nos. • Base Plate 3 Nos. • Extension Collar 3 Nos. • Compaction Pedestal, 1 No. Manual Operation, comprising a Steel Plate capped on a wooden post. A Mould Clamp is fitted to the top of the plate • Compaction Hammer 2 Nos. for use with Compaction Pedestal and Mould, weight 4.5 kg with a free fall of 457 mm • Load Transfer Bar 1 No. • Sample Eject for 4" dia Sample 1 No. • Dial Gauge 25mm travel, 0.01mm least count 1 No. • Proving Ring capacity 25 kN. 1 No 	1
25	Serological Water Bath	1

	Double Walled, with Digital Controller Cum Indicator with stirring arrangement, inside Stainless Steel, Temp.range amb.+5°C to 95°C +/- 0.2°C Size 600x300x175mm (for 8 racks	
26	Film Stripping Device Used to measure the resistance of bituminous mixtures to stripping of asphalt from aggregate particles. It is generally used to evaluate mineral aggregates & to judge the adhesion of the Bituminous materials. The device consists of a disk on which 4 bottles are mounted. The disc rotates at a speed of approx. 100 rpm. The sample, usually the aggregate fraction which passes a 9.525 mm sieve but is retained on a No. 8 sieve, is placed in the bottles & agitated for 15 minutes. The percentage of aggregate stripped can be visually estimated. The device is provided with a preset counter. Suitable for operation on 220 V, 50Hz, Single Phase,AC supply	1
27	Specific Gravity Bottle 50ml capacity normal type with narrow mouth for Bitumen	10
28	Laboratory Electric Oven Digital Indicator Cum Controller with Safety Alarm, range 50° to 250°C +/-1°C with Air Circulating Fan, S.S. Inside Size 600 x 900 x 600mm	1