INTERNATIONAL ISLAMIC UNIVERSITY ISLAMABAD

Purchase & Store Section, Admin Block, New Campus, Sector H-10, Islamabad.
Tel: 051-9019255 Fax: 051-9258073

Tender No. IIUI-_____

TENDER DOCUMENT For Civil Engineering Department

"TERMS AND CONDITIONS"

[All pages (BoQs & Terms & Conditions) are mandatory to be signed / stamped, failing which the bid may lead to rejection]

1. **Any addition, deletion or modification of any clause of the procurement terms & conditions of International Islamic University Islamabad (IIUI) by any vendor will not be acceptable and may lead to rejection of the bid.**

2. Original Manufacturer / Authorized Distributors / Suppliers *(with valid authorization / distribution certificate)* **registered with Income Tax, Sales Tax Department and who are on Active Taxpayers List (ATL) of FBR, are eligible to participate in tender.**

3. Documents along with Pay Order / Demand Draft / Cash Receipt issued by Finance Department of IIUI amounting to **Rs. 1,000/-** as a tender document fee (Non-Refundable) shall be submitted in favor of International Islamic University, Islamabad, to the address given below. *(See No. 13)*

4. The exact completion/delivery time from the date of the purchase / work order will be maximum of **120 days**. The handing over / completion time is of critical importance.

5. **The bid proposal(s) should be inclusive of:**

    i. **All FREIGHT and PACKAGING CHARGES (*Items deliverable at Islamabad Airport/Dry Port on "CPT/CFR Basis as per BoQs Format*)**

    ii. **All Taxes, if prices are quoted on "FOR Basis" as per BoQs Format (*Items deliverable (Free of Cost) to International Islamic University, New Campus, Sector H-10 Islamabad*)**

6. **The Payment Terms will be:**

    i. **For the CPT/CFR quoted items; payment will be made through irrevocable L.C (90:10 Model) in favor of Manufacturer.** Where, 90% under the said model will be released upon receipt of shipment and delivery documents. Remaining 10% will be made /

released after successful inspection of the equipment at International Islamic University Islamabad.

ii. **For the FOR quoted items; 100% payment will be made after supply and successful inspection of the ordered equipment(s) at International Islamic University Islamabad.**

7. **For the CPT/CFR quoted items; shipment(s) will be cleared by the International Islamic University, Islamabad from Custom Authorities.**

8. After opening of bids, International Islamic University Islamabad will examine the bids for completeness as per tender document's Terms & Conditions AND Technical Specifications, (As per BoQ)

9. Purchase order (s) will be awarded to the lowest evaluated OR technically recommended bidder (s) on the basis of item wise / subtotal wise / grand total wise according to the nature of BoQs/Compatibility requirements.

10. Procedure of open competitive bidding shall be: **Single Stage One Envelope procedure**

11. Bidders cannot challenge the finding(s) of the Evaluation Committee or ask for reason of disqualification.

12. The bid should be submitted in a sealed envelope up to the specified deadlines for the items for **Civil Engineering Department, FET**(i-e **January 10, 2018**) on or before **10:30 a.m** and will be opened on the respective date **at 11:00 a.m** in the presence of available bidders or their representatives who may like to attend the bid opening.

13. The envelope should be marked as under;

Mr. Javaid Rabbani
Dy. Director (P&S)
Room No. 213, 2nd Floor, Admin Block, New Campus, Sector H-10
International Islamic University Islamabad.
Tel: 051-9019255

14. The envelope shall also bear the word **"CONFIDENTIAL"** and following identification quotation for:
"Supply of Lab Equipment for "Department of Civil Engineering (FET)"

15. The bid form (BoQs) must be duly filled in, stamped and signed by the authorized representative of the bidder.

16. **If the vendor fails to deliver the goods / services to International Islamic University, Islamabad in time then the penalty will be charged as under: -**

i. 02% per month of the total Purchase Order value;
ii. If the vendor fails to deliver the goods / services during the extended period *(if allowed)* then the purchase / work order may be cancelled and Earnest money may be forfeited.

17. If the delivered goods / services are not according to the required quality standards / specifications, the same shall be liable to be rejected after inspection. The bidder/vendor will be required to REPLACE as per requirements mentioned in our BoQs at no cost to the IIUI, otherwise the purchase / work order will be cancelled after due date with confiscation of earnest money AND bidder will bear all cost and expenses thereof.

18. All prices should be quoted on both **CPT/CFR Islamabad Basis or FOR (IIUI) Basis or Both**.

19. All prices should be valid for at least **90 days.** Withdrawal or any modification of the original offer within the validity period shall entitle IIUI to forfeit the earnest money in favor of the IIUI and / or put a ban on such vendor for participation in IIUI tenders / works.

20. It is the sole responsibility of the agent / supplier / manufacturer / vendor to comply with the applicable laws, be national or international.

21. In case of any dispute, decision of the President, IIUI will be final and binding upon the parties.

22. The IIUI reserves the right to modify the quantities of goods / services at any time before the award of purchase / work order.

23. **Earnest Money:**
The bidder is required to furnish in form of "Pay Order/Demand Draft" equivalent to **2%** of the total Bid price (in PKR) as Earnest Money in favor of "International Islamic University Islamabad". Any bid not accompanied by the Earnest Money shall be rejected without any right of appeal.

24. **Retention Money:**
An amount equal to 10% (in PKR) of the total value of the Purchase Order/Contract Price shall be retained by the International Islamic University, Islamabad for the Warranty Period (*Refer to Clause 4 of Special Conditions*) as follows:
    - The successful bidder(s) for the CPT/CFR items shall have to be required to submit a "Pay Order/Demand Draft" equal to 10% of the total value of Purchase Order from a Scheduled Bank of Pakistan within 10 days after supply of ordered item(s) for the warranty period.
    - 10% of the total value of the Purchase Order will be withheld by the IIUI from the payment of successful bidders, on FOR Basis supplied items, for the warranty period.

25. The bidder is also required to furnish Company Profile, Client List and Detail of similar Projects/Works along with the proposal.

26. **International Islamic University Islamabad reserves the rights to accept or reject the bid/s, if;**

- Received without earnest money.
- Received later than the date and time fixed for tender submission.
- The tender is unsigned/ unstamped.
- The offer is ambiguous.
- The offer is conditional.
- Offer is made by the unauthorized agent/ supplier of the original equipment manufacturer.
- The offer is from a firm, which is black listed by any Govt. Office.
- The offer is received by telephone/telex/fax/telegram.
- Any unsigned / ambiguous erasing, cutting / overwriting etc. is made.
- Received without Company Profile, Client List and Detail of similar Projects/Works with evidence.
- Without Guarantee / Warrantee of the quoted equipment(s). *(Minimum **twelve (12) months** after the Goods, or any portion thereof as the case may be, have been delivered to and accepted*

27. The bidder should furnish a **CERTIFICATE** on judicial STAMP PAPER worth Rs. 100 as worded below in token of acceptance of all the terms and conditions of the tender. Otherwise the tender will not be considered under any circumstances.
    I / We

    Company / Vendor Name:_____

    - **Postal Address:** _____
    - **Tel. No:** _____ **Mob No.** _____
    - **NTN# :** _____ **GST#:** _____

    The undersigned certify that the terms and conditions as contained in this document, viz "***Terms and Conditions***" are accepted unconditionally and in the event of selection of my/our bid/s; the agreement will be entered into, in the prescribed format attached as **Annex-I**. The Special Conditions that are attached as part of proposed agreement at **Annex-II** are also accepted unconditionally.

_____
Sign & Stamp

Note:

1. Please quote the rates on our BoQs and clearly mention the quoted Make / Model / Country of Origin, otherwise your bid / items may lead to rejection.
2. PRICES quoted in different currencies on CPT/CFR basis will be evaluated after converting them into PKR (local currency) at the EXCHANGE RATE prevailing at the State Bank of Pakistan / Open Market on the date of Opening of Bid(s)
3. In Addition to filling of the attached BoQs, supporting literature of the quoted model must be attached for verification & technical evaluation of the required specification by the bid evaluation committee. In case of any clash found between the quoted model and the literature model, the item/bid may be rejected.
4. Terms & Conditions and BoQs should be attached with the proposal (Technical & Financial Bids), otherwise your tender/bid(s) may be rejected.
5. Please also attach the Certificate supporting being Active Taxpayer as per requirement of FBR.

BoQs for the Supply of Lab Equipment for Department of Civil Engineering, FET

S. No	Equipment Name	BoQs/Specifications	Qty.	Make/ Model & Country of Origin	FOR Price (PKR)		CPT/CFR Price	
					Unit Price	Total Price	Unit Price	Total Price
1	**Total Station with complete Accessories (Prism, Prism Rod, Battery, Battery Charger, Lens Cap, Tool Kit with Case, Plastic Rain Cover, silicon cloth, Carrying Case etc.)**	The total station that make survey work easier and faster, including an 800m range Non-prism EDM, time-saving autofocus and dual full displays. With the Total Station, fieldwork is always accurate and efficient thanks to proven workflows and an array of features, including: • Autofocus powered that delivers quick, precise focus. • Colours touch screens, which allow Survey Basic, Survey Pro, and Layout Pro to run on board. • Optics for crisp, bright sightings even in low light conditions. • For easy, effective tracking, so you always know where your assets are. In the field, the Total Station reduces the need for downtime thanks to hot swappable batteries. The lightweight, compact design makes the total station easy to store, transport and handle. The total Station optics deliver crisp, bright images, reducing eye fatigue. The Total Station is durable too–standing up to the toughest worksite conditions. Surveyors all over the globe rely on Total Station to deliver exceptional results, wherever their work takes them. **Specifications** • Long distance with minimum 5000m with single prism and Non Prism up to 800 m • Higher accuracy in precise mode : (2+2ppm x D mm) • Measuring Interval 0.3 s • Telescope tube length up to 125 mm • Atmospheric correction -40 to + 60 °C • Adopted absolute encoder, which doesn't require 0 set. • On- board data collection, stakeout/survey, road calculation, and many more functions. • Integrated alphanumeric keyboard realizes the quicker operation • Large internal memory minimum 24,000 pts. • Autofocus • Fast, powerful EDM • Dual colour touch screen displays	**5**					

		• Locate2Protect ready • PIN security • Angle Accuracy 1", 2", 3", and 5" accuracies • Hot swappable batteries **Steel Tape for Measuring Base Line (Quantity 01 imported):** 300' nylon reinforced steel blade measuring tape with speed rewind is required: **Features:** • Tough, double nylon-coated steel blade • Metal, planetary gearing for super-fast 3X rewind and no more stripped gears • Wide base crank with metal reinforcement for increased durability • Rubber grip shovel handle for comfortable, rapid reeling **Accessories:** • Temperature gauge for temperature measurement • Pull gauge to measure force • Pressure gauge to measure atmospheric pressure **Specifications:** • Housing — Open • End — Hook • Zero point — Hook end • Blade length — 300' • Blade width — 3/8" **Make**: USA, UK, Japan & Europe or Equivalent						
2	**Static Global Positioning System (GPS)**	**Key Features:** • One configurable receiver that is scalable for future needs • Available in post-processing, base only, rover only, or base & rover configurations • Advanced satellite tracking with 360 receiver technology Includes Maxwell 6 chips with 440 channels • Simple integration with Total Stations and the V10 Imaging Rover • Intuitive Access Field Software and Office Software **Specifications** • Advanced 6 Custom Survey GNSS chips with 440 channels • Future-proof your investment with tracking • High precision multiple correlate for GNSS pseudo range measurements • Unfiltered, un-smoothed pseudo range measurements data for low noise, low multipath error, low time domain correlation and high dynamic response • Very low noise GNSS carrier phase measurements with 1 Hz	**2**					

		bandwidth • Signal-to-Noise ratios reported in dB-Hz • Proven low elevation tracking technology • Satellite signals tracked simultaneously: • GPS: L1C/A, L1C, L2C, L2E, L5 • GLONASS: L1C/A, L1P, L2C/A, L2P, L3 • SBAS: L1C/A, L5 (for SBAS satellites that support L5) • Galileo: E1, E5A, E5B • BeiDou (COMPASS): B1, B2 • SBAS: QZSS, WAAS, EGNOS, GAGAN • Positioning rates: 1 Hz, 2 Hz, 5 Hz, 10 Hz, and 20 Hz Positioning Performance • Horizontal: 0.25 m + 1 ppm RMS • Vertical: 0.50 m + 1 ppm RMS • SBAS differential positioning accuracy: typically < 5 m 3DRMS Static GNSS Surveying **High-Precision Static** • Horizontal: 3 mm + 0.1 ppm RMS • Vertical: 3.5 mm + 0.4 ppm RMS **Static and Fast Static** • Horizontal: 3 mm + 0.5 ppm RMS • Vertical: 5 mm + 0.5 ppm RMS **Post processed Kinematic (PPK) GNSS surveying** • Horizontal: 8 mm + 1 ppm RMS • Vertical: 15 mm + 1 ppm RMS **Real Time Kinematic surveying** **Single Baseline** • Horizontal: 8 mm + 1 ppm RMS • Vertical: 15 mm + 1 ppm RMS **Network RTK** • Horizontal: 8 mm + 0.5 ppm RMS • Vertical: 15 mm + 0.5 ppm RMS • Initialization time: typically < 8 s • Initialization reliability: typically >99.9% **Walkie Talkie:** **Specifications** • Colour: Yellow or Black • Frequency Band: PMR446 • Tx Power: 500mW • Bandwidth: 12.5Khz						

		• Channels: 16 +121 privacy codes** • Weight: 197 grams (with belt clip and battery) • Range: Up to 10km • Size WxDxH: 5.7 x 18.1 x 3.3 cm **Features:** • Hidden display • LED torch • Channel scan • VOX • Auto squelch • Channel monitor • Emergency alert button • Easy pairing • Dual channel monitor **Make**: USA, UK, Japan & Europe or Equivalent						
3	**Prism**	• Triple Prism Set • Triple Prism Set with Bag for total station surveying • Prism constant: -30mm Offset • Prism in Canister : 64mm • All metal holder and target • It has 5/8x11 female thread • Adapter with OPTICAL PLUMMET • Three Jaw Tribrach • Package Contains: • Three Prisms + Target + Holder +pole + Adapter w/ Optical Plummet+ Three Jaw Tribrach + Soft BAG, **Make**: USA, UK, Japan & Europe or Equivalent	**4**					
4	**Prism Rod**	• Aluminum prism rods for total station prism (Single, Double and Triple adjustable) **Make**: USA, UK, Japan & Europe or Equivalent	**4**					
5	**Metric Chain**	Chains are the measuring instrument used in surveying: • Consist of 100 links of 4mm galvanized mild steel wire. These links are joined by 3 circular or oval wire rings. These rings provide the flexibility to the chains. • Consist of 30 m length. **Make**: Local/ China	**10**					
6	**Gunter Chain**	Chains are the measuring instrument used in surveying: • Consist of standard 66ft length. • Chain must consist of 100links, each link being 0.66ft or 7.92inches. **Make**: Local/ China	**10**					

7	**Planimeter**	**Technical Specifications:** • Accuracy: ≤±0.2% • Top-bottom: max. 328mm • Left-right: 30m from moving side • Size: 21*37.5*7cm • Continuous working: 30 hours • Measurement functions: area, sum, average value. • Measuring by 6-digit pulse count enables to measure 100 times larger accumulative area. • Easy calculations of Cumulative and Average Value Measurement. **Make**: Local/ China	**5**					
8	**Clinometer**	Clinometer is a precision instrument used all over the world by surveyors, engineers, cartographers, geologists, miners and architects and many others to measure heights, vertical angles and slopes quickly and easily. **Specifications** • Clinometer features a sturdy housing body made from corrosion resistant anodized aluminum alloy. • The scale cards run on special bearings in hermetically sealed plastic containers filled with a liquid which guarantees that they run smoothly and stop quickly. Liquid must not freeze or evaporate and must have damping properties • Clinometer features two scales: 0 ± 90°, 0 ± 150 %. The left-hand scale gives the slope angle in degrees from the horizontal plane at eye level. The right-hand scale gives the height of the point of sight from the same horizontal eye level, and it is expressed in per cent of the horizontal distance. Complete directions must be included. • It must have side window to display slope in degrees • A conversion table on the back contains cosines 0-45°. • Adjustable eye piece • Nylon pouch with belt loop must be included **Make**: Local/ China	**5**					
9	**Metacentric Height Test Apparatus**	The experiment consists of a rectangular pontoon floating in water. Plastic materials and corrosion-resistant finishes throughout the equipment give the fullest possible protection against corrosion. The pontoon has a plastic sail with five rows of slots. These rows are at equally spaced heights on the sail. The slots are equally spaced around the centre line. To change the centre of gravity and the tilt (list) angle of the pontoon, students fit an adjustable weight into one of the slots. A plumb line from the top centre of the sail and a scale below the base indicate the tilt angle. Students obtain fore and aft balance by positioning two small magnetic trim weights on the bottom of the pontoon.	**1**					

		Dimensions: Net: 650 mm x 450 mm x 350 mm; packed: 0.11 m3 **Weight**: Nominally Net: 5 kg; packed: 9 kg **Water tank**: Moulded plastic, 600 mm x 400 mm x 120 mm **Floating pontoon**: 360 mm x 203 mm x 76 mm **Angular tilt of pontoon**: Nominally 8° each side of vertical centre line **Working height of sail**: 240 mm **Adjustable sail weight**: 525 g **Total weight of floating assembly**: Nominally 3.2 kg **Make**: USA, UK, Europe, Sweden or Equivalent						
10	**Bourdon's Gauge**	It consists of a precision machined stainless steel piston and cylinder with calibrated weights. The weights are applied on the upper end of the piston rod to generate pressure. The assembly is mounted on adjusting screws footings with a bull's eye level. The pressure gauge is connected to the cylinder, thus subjects to known pressure and comparison with the gauge reading can be made. The cylinder can be refilled without removing the piston. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
11	**Orifice Tank**	Pump: 0.37 kW. Bench top dimensions: 126 cm long x 77 cm wide. Open channel section: 25 cm wide x 17 cm deep. Measuring tank: Low flow 10 l, high flow 45 l. Main storage tank: 165 l. Accessories: Stop watch and outlet hose with fittings for connection to accessory. Hook and point gauge. Rectangular and V-shape notch. Power supply: 220 V, 1 Ph, 50 Hz. Other power supply is available on request. Net (unpacked) shipping dimensions WxLxH: 78 x 126 x 95 cm. Net weight: Approx. 70 kg. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					

12	**Digital Vernier Caliper**	The Fowler Light Line Vernier Caliper is light weight, economical vernier caliper with stainless steel jaws and a parallax vernier scale for ease of reading. • Lightweight beam made of oxide coated aluminum with double inner prismatic guide ways for optimal guidance and sliding characteristics • Stainless steel jaws, hardened and finely ground with knife edge top jaws (3.5"/90mm length) • Jaws are adjustable and exchangeable • Spare jaws can be modified and exchanged with standard jaws for special applications • Parallax free vernier scale for ease of reading • High contrast white numbering on black anodized frame • Inch and metric graduations (0.001"/0.05mm) • Made in Germany • Includes fitted case • Optional ranges and jaws available as special order **Range:** 35″/900mm **Accuracy:** 0.0015″/0.04mm Digital thermometers are temperature-sensing instruments that are easily portable, have permanent probes, and a convenient digital display. The way a digital thermometer works depends upon its type of sensor. Sensor types include resistance temperature detector (RTD), thermocouple and thermistor. **Make**: USA, UK, Europe, Sweden or Equivalent	**10**					
13	**Pelton Wheel Turbine**	This equipment demonstrates Pelton turbine characteristics i.e. torque, power and efficiency at different speeds for various heads and flow rates of water. The adjustable turbine nozzle directs water jet to the runner buckets. Nozzle pressure is indicated by a pressure gauge. Following experiments should be performed: • Torque vs. speed at various heads and flow rates. • Power output vs speed for various heads and flow rates. • Efficiency vs speed for a given head and flow rate. • Racing characteristics. Technical specification: • Construction: Stainless steel runner, nozzle and casing with transparent window • Maximum power: 40 W • Dynamometer: Mechanical brake • Sensors: Torque and speed • Software for data display and analysis by computer. This includes flow	**1**					

		and load control motors Mini turbine service unit and software for data display. **Make**: USA, UK, Europe, Sweden or Equivalent						
14	**Francis Reaction Turbine**	This equipment will demonstrates Francis turbine characteristics i.e. torque, power and This will be a mini Francis turbine for studying the turbine characteristics with data analysis by computer. The unit must consist of the mini Francis turbine with a dynamometer, output power sensors, and software. The turbine adjustable guide vanes direct water to the runner. Following experiments can be performed: •Torque vs speed at various heads and flow rates. •Power output vs speed for various heads and flow rates. •Efficiency vs speed for a given head and flow rate. •Racing characteristics. **Technical specification:** •Construction: Metal runner with adjustable guide vanes Non-corrosion metal casing with transparent window. •Maximum power: 25 watt •Dynamometer: Mechanical brake •Sensors: Torque and speed •Software for data display and analysis by computer. This includes control motors Mini turbine unit and software for data display analysis and control by computer. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					

15	**Centrifugal Pump Test Rig**	Self-contained bench top unit for studying the centrifugal pump flow rate vs head at a various speed. The unit should consist of a storage tank and a centrifugal pump with motor on a steel base, and measuring instruments. Following experiment should be performed: • Flow rate vs head at various speeds. • Pump input, output, and true efficiency at various speeds. **Technical specifications:** • Pump Motor with constant rpm. • Maximum flow rate: 150 lpm. • Maximum head: 30 m water. • Speed control: Advanced inverter. • High precision pressure gauge/electronic pressure sensors at pump suction and discharge. • Flow meter/water meter and a stop watch. • Pump speed and input power: Advanced inverter. • Workable on 220V 1Ph 50~60 Hz. • A computer interface showing all output graphs as well. This includes flow sensor instead of water meter, two pressure sensors instead of pressure gauges, computer interface unit and software for data display and analysis by computer. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
16	**Reciprocating Pump**	This must be a self-contained unit for studying the reciprocating pump characteristics with data display and analysis by computer. The unit must consist of an industrial reciprocating pump driven by a reduction gear and motor, a PVC storage tank, sensors, and software. The unit is on a steel base. Following experiment must be performed with equipment: • Flow rate vs head characteristics. • Pump input, output and overall efficiency at various speeds. • Effect of pulse chamber. • Volumetric efficiency. **Technical specifications:** • Pump rating at 300 rpm. • Maximum flow rate: 15 lpm. • Maximum head: 30 m water. • Pressure relief valve. • Pulse chambers with isolating valves.	**1**					

		• Discharge flow control valve. • Sensors for flow, pressures at pump suction and discharge. • Software for data display and analysis by computer. • Power supply: 220V 1Ph 50~60 Hz. • A computer interface showing all output graphs as well. This includes flow control motor computer interface unit and software for data display analysis and control. **Make**: USA, UK, Europe, Sweden or Equivalent						
17	**Bourdon Gauge**	It consists of a precision machined stainless steel piston and cylinder with calibrated weights. The weights are applied on the upper end of the piston rod to generate pressure. The assembly is mounted on adjusting screws footings with a bull's eye level. The pressure gauge is connected to the cylinder, thus subjects to known pressure and comparison with the gauge reading can be made. The cylinder can be refilled without removing the piston. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
18	**Hydraulic Bench**	Pump: 0.37 kW. Bench top dimensions: 126 cm long x 77 cm wide. Open channel section: 25 cm wide x 17 cm deep. Measuring tank: Low flow 10 l, high flow 45 l. Main storage tank: 165 l. Accessories: Stop watch and outlet hose with fittings for connection to accessory. Hook and point gauge. Rectangular and V-shape notch. Power supply: 220 V, 1 Ph, 50 Hz. Other power supply is available on request. Net (unpacked) shipping dimensions WxLxH: 78 x 126 x 95 cm. Net weight: Approx. 70 kg. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					

19	**Flow through an orifice**	It consists of a precision machined stainless steel piston and cylinder with calibrated weights. The weights are applied on the upper end of the piston rod to generate pressure. The assembly is mounted on adjusting screws footings with a bull's eye level. The pressure gauge is connected to the cylinder, thus subjects to known pressure and comparison with the gauge reading can be made. The cylinder can be refilled without removing the piston. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
20	**Orifice & Jet Flow**	The equipment consists of a removable clear acrylic cylinder with sharp edge orifice installed at and flush with the lower inside wall of the cylinder. An adjustable overflow allows various constant heads for the test and trajectory of the jet is indicated by probes on the jet path. Heights of the probes are indicated by scales. The apparatus rests on adjustable footings and a level gauge is provided. Orifice diameter 2 different sizes Trajectory probes 8, stainless steel. Measuring cup 1 l dimensions WxLxH 36 x 68 x 70 cm Net weight Approx. 10 kg **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
21	**Pipe friction Test Apparatus**	This is a self-contained unit for studying the friction loss in pipes, pipe fittings and valves at various flow rates. The unit should consist of a pump, a storage tank and a water proof panel on which all friction loss components are arranged. The loss is measured by differential pressure using manometers. Pressure tapping is by small valves with quick connection. All pressure taps are connected by flexible hoses to a set of specially arranged manifolds such that differential pressure across any component can be measured simply by opening valves without removing the hoses. The unit should be mounted on a frame on wheels Pump: 0.55kW. • Maximum flow rate: ≥90 lpm. • Friction loss components: • Linear pipes, PVC (3): 3/4- 3/8 in. • Short radius bends: 2 ea. • Regular elbow: 1 ea. • 45o elbows: 2 ea. • Valves: Gate, globe, ball, and check. • Other components: Tee section, sudden expansion and sudden contraction.	**1**					

		Measuring Instruments: • Flow meter/Water meter and a stop watch. • Water manometer with a hand air pump: 2 tubes, 950 mm x 1 mm graduation. • Mercury manometer: 2 tubes, 950 mm x 1 mm graduation. • Workable Power supply: 220 V, 1 Ph, 50 Hz **Make**: USA, UK, Europe, Sweden or Equivalent						
22	**Centrifugal Pump**	Self-contained bench top unit for studying the centrifugal pump flow rate vs head at a various speed. The unit should consist of a storage tank and a centrifugal pump with motor on a steel base, and measuring instruments. Following experiment should be performed: • Flow rate vs head at various speeds. • Pump input, output, and true efficiency at various speeds. **Technical specifications:** • Pump Motor with constant rpm. • Maximum flow rate: 150 lpm. • Maximum head: 30 m water. • Speed control: Advanced inverter. • High precision pressure gauge/electronic pressure sensors at pump suction and discharge. • Flow meter/water meter and a stop watch. • Pump speed and input power: Advanced inverter. • Workable on 220V 1Ph 50~60 Hz. A computer interface showing all output graphs as well. This includes flow sensor instead of water meter, two pressure sensors instead of pressure gauges, computer interface unit and software for data display and analysis by computer. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
23	**Osborne Reynold's Apparatus**	It consists of a removable clear acrylic cylinder with an adjustable overflow pipe. Water is admitted at the bottom of the tank through a diffuser and stilling materials, and is discharged via a bell mouth transparent vertical test pipe with a flow control valve. Flow rate is measured by a measuring cup. A dye injection system is installed on top of the acrylic cylinder tank and flow patterns in the pipe can be observed against a white background plate. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					

24	**Impact of Jet**	The equipment consists of a removable clear acrylic cylinder. Water is supplied through a tube at the bottom of the cylinder and discharged vertically through a nozzle onto a target plate. Each plate maintains the same working distance from the nozzle. A clear acrylic guard is provided to prevent water jet from splashing on the target. Force on the plate pushes its stem upward. Dead weight is then applied on the stem to counter balance the force exerted by the water jet. This balance is indicated by a pointer on a steel rod next to the weight. The apparatus rests on adjustable footings and a bull's eye level is provided. **Target plates**: Flat, 120o inward cone, 180o hemisphere, 120o outward cone. **Weights**: 1 lot. **Dimensions WxLxH**: 36 x 35 x 76 cm **Net weight**: Approx. 8 kg **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
25	**Bernoulli's Theorem Apparatus**	Static pressures at various points along the wall of a transparent Venturi tube are directly measured on a manometer equipped with a vent valve and a hand air pump. A movable stainless-steel total head probe is also provided. Flow through the Venturi tube is controlled by a valve at the outlet. As a primary flow measuring device, coefficient of discharge for the Venturi tube can also be determined. Diameter 28 mm inlet. Taper angles Inlet 21^o Outlet 10^o Water manometer 8 tubes. Total head probe 1 ea. Net (unpacked) shipping dimensions WxLxH 36 x 60 x 83 cm Net weight Approx. 6 kg **Make**: USA, UK, Europe, Sweden or Equivalent	**2**					
26	**Computer Control Flow Channel**	**(Section: 0.6x0.45 m, length: 12.5 m)** Channel shall be made up of group of modular parts of 2.5 m long. Each rectangular piece of different sections with tempered glass transparent walls of 10 mm thick is made in such a way that guarantees a uniform section along the entire channel. All the sections are made of tempered glass, stainless steel and anodized aluminum, guaranteeing corrosion resistance. The alignment process and level testers should guarantee a perfect alignment of the perfectly watertight assembled unit. The assembly will have inlet and outlet gates to carry out different experiments and safety level switches that	**1**					

		prevent water from exceeding the maximum level. The sections of the channel will have openings with double seal at the bottom. They allow the introduction of the pressure measurement intake pipes belonging to different hydraulic models without disturbing the water flow during the experiment. Metal beam structure, made of welded steel, to support the assembly of sections. It allows for adjusting the tilt from -0.5% to 2.5%. The tilt of the channel will have controlled and monitored from the computer through a displacement sensor. Fiberglass inlet tank with draining valve and safety water level switch. Fiberglass reception tank with draining valve and safety water level switch. Two storage tanks with cover and draining valve at the bottom to store the recirculation water. Capacity: 1200 l per tank. Computer controlled variable speed driving pump. The power of the pump varies in function of the channel version up to 140 m^3/h, 4KW. Water velocity inside the channel shall be controlled from 0 m/s to the maximum flow rate supplied by the pump. Instrumentation: • Displacement sensor to obtain the channel height position (tilt). • The readout will display in the computer at all times. • Two differential pressure sensors for inlet flow measurement. • Displacement sensor. • Differential pressure sensor. **Accessories:** • Hook and Point gauge. • Sluice gate Pitot tube and manometer board Broad and thin weirs. • Bridge Pier (circular, rectangular, elliptical). • Digital Velocity Meter. • Sediment transport study system. • Artificial roughened bed (three different models). • Wave generator Training of two Staff person in machine Manufacturer plant country. **Make**: USA, UK, Europe, Sweden or Equivalent						

27	**Notches & Weirs**	4 types of Notches including • Rectangular Notch • 60° V Notch • 90° V Notch • Cipolletti or (Trapezoidal) Notch Notches should be attached to Open Channel of Hydraulic Bench Should be provided with Hook Gauge & Scale **Make**: USA, UK, Europe, Sweden or Equivalent	**3**					
28	**Bends and Fitting Apparatus**	F1-22 Energy Losses in Bends • Circuit with four bends of different radii • Enlargement, contraction and gate valve, plus flow-control valve • Manometer board with 12 tubes plus differential pressure gauge • Hand pump for pressurisation of manometers • Quick-release fitting for easy connection to Hydraulics Bench • Educational software available as an option Pipe diameter: 19.48mm Differential pressure gauge: 0-3 bar Enlargement diameter: 26.2mm Contraction diameter: 19.48mm Fittings: -45° mitre -elbow -short bend -large bend enlargement -contraction Manometer range: 0-440mm Number of manometer tubes: 12 Differential manometers: 6 **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
29	**Centre of Pressure Test Apparatus**	This equipment allows the moment caused by a fluid thrust on a wholly or partially submerged plane surface to be measured directly. This surface can be tilted. A quadrant is hinged on a shaft pivoted on knife edges which coincide with the quadrant center. The quadrant position is adjustable relative to a balance arm such that the submerged plane surface can be tilted. A depth scale is indicated on the quadrant. When the quadrant is immersed in water, there are hydrostatic forces. The balance arm has an adjustable counter balance and weights with a hanger. The quadrant is mounted on top of a clear acrylic tank which allows water to be admitted and drained to required level by a valve. The tank rests on adjustable footings and a bull's eye level is provided. Quadrant Inner radius 100 mm	**2**					

		-Outer radius 200 mm -Width 75 mm Tilting angle 0 to 30 degrees in either direction. Weights 1 lot. Net (unpacked) shipping dimensions WxLxH 36 x 55 x 35 cm Net weight Approx. 6.5 kg **Make**: USA, UK, Europe, Sweden or Equivalent						
30	**Water Hammer Test Apparatus**	Pipe surge and water hammer, phenomena which occur when fluid flowing in a pipe is accelerated or decelerated. As associated pressure transients can damage pipe work, systems must be designed to avoid or withstand them. A freestanding unit designed to demonstrate the phenomena of pipe surge and water hammer when connected to a Hydraulics Bench. Includes two separate stainless-steel test pipes, both 3m long, constant head tank, slow acting valve, fast acting valve etc. A transparent surge shaft (40 mm diameter and 800mm high) with scale allows transient water levels to be observed and timed Electronic sensors used to measure pressure transients at two locations in the water hammer test pipe, one adjacent to fast acting valve and one-half way along the test pipe. Straight metal pipes used, rather than a coiled arrangement, to minimize distortion to the pressure profile. Hydraulics Bench Service unit. Test pipes: Stainless steel, 20.2mm inside diameter, nominally 3m long. Surge shaft: Clear acrylic, 40mm inside diameter, 800mm high. Head tank: PVC, capacity 45l, Height: 1.865m, Length: 3.575m, Depth: 0.725m. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
31	**Particle Image Velocity PIV Apparatus**	The 16-MHz MicroADV (Acoustic Doppler Velocimeter) is the most significant breakthrough in 3-axis (3D) current meter technology. The original ADV has compared favourably with Laser systems costing ten times as much — the MicroADV fares even better. The higher acoustical frequency of 16 MHz makes the MicroADV the optimal instrument for laboratory work. Like all instruments, the MicroADV is extremely simple to set up and use. Most users are taking high-quality data within minutes of receiving the system. **Standard Features:**	**1**					

		Three-axis velocity measurement Sensor mounted on a 25cm stem High sampling rates — up to 50 Hz Small sampling volume — less than 0.1 cm3 High accuracy: 1% of measured range Large velocity range: 1 mm/s to 2.5 m/s Excellent low-flow performance No recalibration needed Comprehensive software, including Horizon-ADV Training of one Staff person in machine Manufacturer plant country. **Make**: USA, UK, Europe, Sweden or Equivalent						
32	**Current Meter**	It is widely used for measurements of the flow velocity and high flow velocity in river, lakes, reservoirs, pressure conduits and spillway of hydropower stations. •Measuring Range: 0.04-10.0m/s •Water Depth: 0.2-40m •The Current Meter needs wading rod, monitor, wire for use. Cup Type Current Velocity Meter (1 quantity) Its size is quite small and sensitivity is high. Measurements of very low velocity in the shallow streams and canals. The Current Meter needs wading rod, cable for use. •Measuring Range: 0.015-3.5m/s •Water Depth: 0.05-3m **Make**: USA, UK, Europe, Sweden or Equivalent	**3**					
33	**Simulation Software ANSYS, FLUENT 12, GAMBIT 6.3**	Simulation Software ANSYS, FLUENT 12, GAMBIT 6.3 **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
34	**Manometer**	The SERIES 477AV Handheld Digital Manometer is now available with pressure, flow, and velocity measurements along with a number of other convenient features. The built-in air velocity and flow calculations provide accuracy and conserve time and error associated with manual calculations. Also featured on this unit are adjustable zero and span values for calibrating in the field, as well as a damping feature to compensate for the fluctuating of readings. **Make**: USA, UK, Europe, Sweden or Equivalent	**3**					

35	**Pitot tube**	A Pitot tube operates according to the basic dynamics of the flow of air or gas and is a classic practical application of Bernoulli equations. A Pitot tube is an open tube at one end that is placed against a current with the axis of the tube parallel in respect to the direction of the current causing the current to hit the front of the tube opening. The rear section is attached to the air flow meter. These devices can be recalibrated to guarantee the highest possible accuracy and can come with an optional ISO calibration certificate. Recalibrations should be done annually or as stated in your internal ISO manual. The data obtained by Pitot tube pressure meters can be transferred to a computer by way of an RS-232 cable. These devices come calibrated from the factory, but a DIN ISO calibration can be ordered separately, and includes a laboratory calibration and a certificate showing the recalibration values. **Make**: USA, UK, Europe, Sweden or Equivalent	**3**					
36	**Resistivity Meter**	• Casing: Rugged aluminum case meets IEC IP66 • Computer: Embedded ARM 9, 400 MHz • GPS: Built-in GPS with support for GLONASS • Display: 8,4" Active TFT LCD, full colour, daylight visible I/O ports: 2x KPT 32 pin for imaging AUX, Interconnect, USB A, RJ45 for LAN • WLAN: IEEE 802.11 b/g/n, built-in antenna • 3G/GSM: 3G (UMTS/HSPA+) and GSM (GPRS/Edge), built-in antenna. Five bands 3G: 850/800, 900, 1900 and 2100 MHz. Quad-band GSM: 850/900/1800/1900 MHz • Measure modes: Resistivity, SP, Resistivity and IP using 50 % or 100 % duty cycle depending on model configuration • Service point: Accessible through Internet • Memory capacity: 16 GB, microSD card accessible from outside • Power: 12V, 8Ah internal battery, built-in charger 12-18 VDC external power • Dimensions: 39x21x32 cm (WxLxH) • Weight: 13.9 kg, 12.2 kg without internal battery • Ambient temperature range -20 C to + 70 C operating and -30 C to + 80 C storage Up to 12 measurement channels • Unique design of measurement channels and high power current transmitter • IP measurements with 100 % duty cycle • 1D, 2D, 3D and 4D measurements • IEC IP 66 classification	**2**					

		• Wi-Fi and 3G connectivity Software licensing system Training of two Staff person in machine Manufacturer plant country. **Make**: USA, UK, Europe, Sweden or Equivalent						
37	**Hydralic Jump Apparatus**	Hydraulic jumps are very efficient in dissipating the energy of the flow to make it more controllable & less erosive .In engineering practice, the hydraulic jump frequently appears downstream from overflow structures (spillways) ,or under flow structures (sluice gates),where velocities are height. • Objectives of the experiments: * To create the hydraulic jump.* To verify the questions of fluid flow.* To determine the slatrility & characteristics of the hydraulic jump obtained in the lab using Impulse momentum & specific energy equations. * To compare measured flow depths with theoretical results. • Apparatus:• Channel Size : 1000 x 250 x 200 mm• Sump tank capacity : 75 liters • Volumetric tank capacity : 40 liters • Pump : Motor 0.5 HP,Mono block type,0-60 Liter/min• Piping with necessary Valves and Fittings. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
38	**Dead weight Pressure Tester**	It consists of a precision machined stainless steel piston and cylinder with calibrated weights. The weights are applied on the upper end of the piston rod to generate pressure. The assembly is mounted on adjusting screws footings with a bull's eye level. The pressure gauge is connected to the cylinder, thus subjects to known pressure and comparison with the gauge reading can be made. The cylinder can be refilled without removing the piston. **Make**: USA, UK, Europe, Sweden or Equivalent	**1**					
39	**Casagrande Apparatus**	This Apparatus is used for determination of liquid limit of soil. **Specifications:** • Liquid Limit device with counter • Porcelain dish • Spatula • Grooving Tool • Glass Surface for rolling • Containers for moisture determination **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

40	**Core Cutter Mold**	This apparatus is used for undisturbed soil samples **Specifications:** • Core cutter mold • Drive Cylinder, Detachable Drive Head • Drive Hammer • Hand Chisels for digging test hole • Steel straightedge **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
41	**Direct Shear Machine**	Direct shear test apparatus is used for the determination of shear strength of soil sample. The automatic direct shear test apparatus have usually automatic running of tests , closed-loop control of test speed, large, monochromatic graphic display for viewing and recording data in real time ,different calibration functions (linear and polynomial), language selection, travel and cycles ,RAM memory with battery back-up with clock/calendar, operative even when the unit is switched off. **Specifications:** • Speed range: 0.00001 – 11.00000 mm (preset via firmware) • Maximum shear force: 5000 N • Maximum vertical load: 500 N or 5000 N using 10:1 lever-arm device • Speed drive ratio: stepper motor 1/10000 resolution • Horizontal travel: preset via firmware up to 20 mm • Displacement limits: controlled by optical safety switch • Maximum shear cycles: up to 10 (forward and reverse) • Digital: large 240 x 128 pixel display • Specimen sizes: 60 and 100 mm square; 50, 60, 63.5 and 100 mm diameter • Overall dimensions: 953 x 387 x 1180 mm (w x d x h) • Weight: 120 kg (approx.) • Voltage: Compatible to 220 V **Accessories:** Electronic measuring devices, Load cell 50 kN with adapters, Linear potentiometric transducer, 10 mm travel for vertical deformation, complete with mounting block, Linear potentiometric transducer, 25 mm travel for horizontal displacement complete with mounting block. **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

42	**Laboratory Vane Shear Test Apparatus**	This apparatus is used to measure the undrained shear strength (CU) of cohesive soils, consists of a cylindrical body with a torsional spring and three interchangeable vanes of different sizes used depending upon the expected strength of the soil. The height/diameter ratio of all vanes is 2. During operation the vane is driven for 5-6 cm into the soil and then turned with the handle. **Specifications:** Vane dimensions (height x dia.): 32x16; 40x20, 50.8x25.4 mm Measuring range: 0 to 240 kPa (0-24 N/cm2) Torque value: 3.5 N · m Extension rod: 153 mm to reach 300 mm depth. Overall dimensions (assembled): 310x105 mm Weight approx.: 1.3 kg **Accessories:** Extension rod 500 mm (additional) **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
43	**Speedy Moisture Testers**	This apparatus is used for instant determination of moisture Content of soil **Specifications:** Type: Large Speedy Maximum Particle Size: 20mm Moisture Range: 0 —20 x 0.2% Specimen Weight: 20g Min **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
44	**Dynamic Cone Penetrometer (Relative Density Test Apparatus)**	This apparatus is used for the determination of the maximum dry density and water content of cohesionless materials when compacted using a vibrating table. Materials for which this method is applicable may contain up to 12% fines (<0.063 mm) by mass. The maximum particle size of the material to be tested is 80 mm. This method applies to mixtures to be used in road construction. **Specifications:** ▪ Vibrating table (33-T0063/1 Y for 220 V, 60 Hz or 33-T0063/1 Z for 110 V, 60 Hz) with the following specifications: - ▪ Vibration frequency: 3600 r p m ▪ Amplitude range: 0 05 to 0 64 mm ▪ Vibrator type: electromagnetic ▪ Separate amplitude control panel ▪ Table dimensions: 762 x 762 mm	**1**					

		▪ Table capacity: 250 kg ▪ 14200 cm3 (0 5 ft3) mould set ▪ 0 1 ft3 relative density mould set ▪ Relative density gauge set ▪ Voltage: Compatible to 220 V **Accessories:** 12.5 And 25 mm diameter pouring devices, Moisture condition mould, Fiber discs, pack of 6. **Make**: USA, UK, Europe, Japanese or Equivalent						
45	**Electric Drying Oven**	**Specifications:** • Capacity: 250 liters • Digital Control • Maximum Temperature: 250-300 C • Voltage: Compatible to 220 V **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
46	**Grooving Tools**	These are minor equipment's used for conducting the experiments. ▪ Sample Splitters (2", 1", 1/2") ▪ Wire Brush ▪ Hot Plate ▪ Standards Calibrations Weights (50g, 100g, 500g, 1Kg, 2Kg, 5Kg, 10Kg) ▪ Warm air drier ▪ Digital Temperature Gauge (0-300°C) **Make**: USA, UK, Europe, Japanese or Equivalent	**1 Each**					
47	**Hydraulic Jack**	This apparatus is used to lift heavy equipment. **Specifications:** • CAPACITY 2 Ton • MAXIMUM HEIGHT INCHES 20 Inch • COLOR FINISH Black/Red • DESCRIPTION: Low Profile Hydraulic Bottle Jack • LOW HEIGHT INCHES 2-3/4 • CONSTRUCTION Metal • WIDTH INCHES 14 • CHASSIS LENGTH INCHES 27 **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

48	**Weighing Balance**	Used to weight the samples. **Specifications:** • 500 g with 0.01 g Least Count • 8 Kgwith 0.1 g Least Count • 15 Kg with 0.1 g Least Count • 30 Kg with 0.5 g Least Count **Make**: USA, UK, Europe, Japanese or Equivalent	**1 Each**					
49	**Proctor Penetrometer**	Used for establishing the moisture content-penetration resistance relationship of fine-grained soils. **Specification:** • Load scale: 0 to 55 kg , 1 kg subdivisions with max load indicator • Diameter of interchangeable needles: 28.55, 24.79, 20.22, 16.54, 12.83, 9.07, 6.40, 5.23 and 4.52 mm • Weight approx.: 3.5 kg **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
50	**Proctor Test Apparatus**	Standard & Modified Proctor Test Apparatus • Mold with detachable collar and detachable base plate • Rammer of 2.5 & 4.5 Kg **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
51	**Sieve Sets**	**Sieve Sets 8 inch diameter** (3/4",1/2",3/8",#4,#8,#10,#12,#16,#30,#40,#50,#80,#100,#200,wet washing sieve 4" deep with 75 micron, lid and receiver) **12 inch Diameter** (3",2.5",2",1.5",3/4",1/2",3/8",#4,pan & cover) **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
52	**Sand Cone Apparatus**	• Sand Cone Apparatus with plastic bottle • Tray with holes (6"Dia) • Hand chisels for digging hole • Hammer **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
53	**Shear Strength Machine (Seismograph)**	This multifunctional equipment is used for oil, gas and mineral exploration, ground water surveys, site remediation, rippability surveys, fault location, depth-to-bedrock, VSP and tomography and other general geotechnical surveys. **Specifications:** 24-Bit Delta-Sigma A/D conversion 3,200 Channels on 32 lines 2D and 3D operation Wide dynamic range (120db @ 2ms) Lightweight, rugged, waterproof case Fully automated system performance tests	**1**					

		Intuitive operation under Windows XP/Vista 3D Operation controlled by Mesa Script files Continuous recording for seismic interferometry and MASW Voltage: Compatible to 220 V Training of two staff persons in machine manufacturing country. **Accessories:** Complete seismograph pack with Laptop and software, Main cables, 48 geophones, shear wave velocity generator, connecting cables and accessories, extension cables, battery pack with charger. **Make**: USA, UK, Europe, Japanese or Equivalent						
54	**Triple Beam Balance (Water Level Indicator)**	This Equipment is used for determining the water level in boreholes, wells and other open underground structures **Specifications:** • Drum mounted, with an ON/OFF indicator. • Audio signal when probe touches water. • Sensing probe of stainless steel tip with plastic shielding to prevent false readings. • Probe diameter of 10 mm allowing easy passage through ½" tubing. • Cable marked at 1 cm intervals. • Battery operated: 9 V DC **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
55	**Unconfined Compression Apparatus**	This apparatus is used to calculate the unconfined compressive strength of soil. **Specifications:** • Capacity to fit user needs up to 11 kN -22 KN • Total automation of data collection and reporting of test results • Prepare tables and plots of report quality within minutes of completing a test • Generate columns of data for easy reduction using your own spreadsheet software • Ability to access and control the unit over a computer **Accessories:** Complete apparatus with PC **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

56	**Standard Penetration Test Apparatus**	The Standard Penetration Test, or SPT, is the most widely used in-situ test throughout the world, as an indicator of the density and compressibility of granular soils. It is also commonly used to check the consistency of stiff or stony cohesive soils and weak rocks. Estimation of the liquefaction potential of saturated granular soils for earthquake design is often based on these tests. Available design methods for both shallow and deep foundations rely heavily on SPT results. **Specifications and complete accessories:** • Sampler assembly should consist of : Split-Barrel Sampler made of hardened machined steel (1 3/8'' id., 18'' length), SPT Plastic Catcher, SPT Adapter, SPT Cutting Shoe, a pair of SPT Split Spoons, SPT Nose Cone, SPT Steel Catcher, Sampling Rod (set of 20 Steel pipe,1.5 meter length) • Drive weight assembly should consist of: Hammer (steel, 63.5 kg weight), Guide Rod (Steel, 76.2 cm drop height), and Anvil (machined steel). Tripod assembly should consist of: Tripod stand (steel pipe), Vertical Guide (machined steel), Rope (3/4" x 15 metre), Pipe Wrench (set of two, 24'' length), Pulley (20 cm diameter), Motor hoisting machine" **Make**: Local/ China	**1**					
57	**Plate Load Test Apparatus**	This apparatus is used for estimating the bearing capacity of a soil under field loading conditions for a specific loading plate and depth of embedment (ASTM D1194). They also cover load tests on soil and flexible pavement components, for use in evaluation and design of airport and highway pavements (ASTM D1195, D1196 - BS 1377 - CNR No. 92 and No. 146 – DIN 18134). **Specifications:** • Capacity, kN: 200 • Plate diameter, mm: 300, 450, 600 and 760 mm • Deflection measurement method: Three electronic transducers • Load measurement method (scale and divisions/ resolution): Pressure transducer and data logger • Data acquisition: Datalog8* with 82-P9008/1 Inverter and case **Accessories:** Plate bearing test apparatus, 200 kN capacity, 300, 450, 600 and 760 mm diameter plates, complete with pressure transducer, three linear displacement transducers and Datalog8 data acquisition and display unit Battery operated with adaptor for 110-230 V Conforming to ASTM D1194-D1195-D1196, BS 1377:9 and CNR N° 146 method "B" **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

58	**Constant Head Permeameter**	**Specifications:** • Constant Head Permeable Cell 114 mm • Manometer Tube and Stand • Portable Vacuum Pump • Scoops Aluminum • Stop Watch Digital • Measure Cylinder • Pan 370X270X57mm • Dial Thermometer 0+250^{0}C **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
59	**Variable Head Permeable Apparatus**	**Specifications:** • Stand+ Tubes+ Reservoir+ Tubing • Compaction Permeater diameter 4” • Plien base and collar for compaction • Mould body, 2 Lateral wear inlet/outlet • De-Airing Tank • Water Trap • Rubber Tubing Diameter 5mm • Rubber Tubing for Vacuum 3 Meter • Nylon Tube 4mm diameter **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
60	**Triaxial Testing Machine**	Investigation of stress-strain relationships in soil is usually carried out with triaxial tests where undisturbed, remoulded or compacted specimens are subjected to different stress level sand drainage conditions to simulate as closely as possible the different situations that can occur in the subsoil on site and the possible effects of construction, excavations, embankments, landslides, etc. **Specifications:** • Maximum sample diameter: 150mm • Minimum testing speed, mm/min: 0.00001 • Maximum testing speed, mm/min: 99.99999 • Maximum compression force, kN: 100 • Maximum tensile force, kN: 5 • Minimum vertical clearance, mm: 390 • Maximum vertical clearance, mm: 1140 • Horizontal clearance, mm: 498 • Platen diameter, mm: 158	**1**					

		• Platen travel, mm: 100 • Dimensions, mm (h x w x d) (approx.):1830 x 750 x 520 • Power, W: 680 • Weight, kg (approx.) : 120 • Voltage: Compatible to 220 V • Training of two staff persons in machine manufacturing country. **Accessories:** Triaxial load frame, Digital measuring system (Displacement transducer , External / submersible load cell, Pore pressure transducer), Standard Triaxial cell with accessories, Pressure/volume controller, De-airing system, Data acquisition and control units, Triaxial test automatic control and processing software with PC. **Make**: USA, UK, Europe, Japanese or Equivalent						
61	**Sand Equivalent Test**	**Specifications:** • Sand Equivalent Set • Sample Tin • Graduated Cylinder • Weighted Foot Cylinder • Irrigation Tube • Clamp, Funnel • Siphon Assembly • Wooden Case • Stock Solution **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
62	**Oedometer**	The oedometer consolidation test is used to determine the rate and magnitude of consolidation of a soil specimen restrained laterally and subjected to a number of successive increments of vertical load. **Specifications:** • Maximum vertical force: 15 kN - 30 kN • Load cell capacity: 15 kN • Displacement transducer: 10 mm maximum travel - Maximum air pressure supply: 10 bar • Specimen size: from 50.47 to 112.80 mm diameter consolidation cells. • Software • PC connection: LAN cable (included) • Measurement accuracy: better than 1% • Overall dimensions: 280 x 300 x 600mm (w x dx h) • Weight approx.: 25 kg (approx.)	**1**					

		Accessories: PC with Software, Consolidation cells, Permeability attachment with 50 ml graduated burette, Consolidation Geo-Analysis template conforming to ASTM D2435 standard, Air supply, LAN Hub with necessary cables **Make**: USA, UK, Europe, Japanese or Equivalent						
63	**Universal Extruder / Sample Extruder**	The hydraulic extruder can accommodate standard U4 tubes and a range of adaptors to extrude soil samples 35, 38, 101.6, 106 and 152.4mm dia. It can also be used to remove Marshall, Proctor and CBR specimens **Specifications:** • Max load cap.: 60 kN (6000 kgf) • Ram travel: 480 mm • Dimensions: 1140x300x370 mm **Accessories:** Adaptor for extruding soil samples 35, 38, 101.6, 106 and 152.4 mm dia. Total length 280 mm approx. Extension for extruding up to 450 mm long samples. **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
64	**Soaking Tank**	5 ft X 2.5 ft **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
65	**C.B.R Test Machine**	This method is used for the laboratory evaluation of subgrade and sub base coarse materials in road construction. This machine should compliance with ASTM D1883, AASHTO T193 standard. **Specifications:** • Multispeed automatic universal tester • Maximum capacity: 50 kN • PC software for CBR, Marshall, Indirect tensile and Universal tests • CBR Test set to perform the CBR test in the digital mode • Test set to perform the Marshall test in the digital mode • Accessories to perform Indirect tensile tests on bituminous mixtures • Accessories to perform Unconfined compression on soil specimens • Data are presented numerically and graphically in real-time • Data export to MS Excel • Language selection: English • digital speed control • test speed from 0.05 to 51 mm/min • USB port for USB memory	**1**					

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Touch screen graphic display
Large memory data storage
Voltage: Compatible to 220 V

Training

Training of two Staff person in machine Manufacturer plant country

C.B.R Accessories:
<table>
<tr><th>Description</th><th>Qty. Required</th></tr>
<tr><td>Moulds with Base plate & collar</td><td>12</td></tr>
<tr><td>Rammer</td><td>5</td></tr>
<tr><td>Tripod</td><td>15</td></tr>
<tr><td>Dial Gauges</td><td>15</td></tr>
<tr><td>Surcharge weights (Annular surcharge & Slotted surcharge)</td><td>25</td></tr>
<tr><td>Perforated plate with adjustable stem (Swell plate)</td><td>15</td></tr>
<tr><td>Spacer disk</td><td>2</td></tr>
<tr><td>Filter Paper</td><td>1 Packet</td></tr>
<tr><td>Straight Edge</td><td>3</td></tr>
</table>
Make: USA, UK, Europe, Japanese or Equivalent
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<tr>
<td>66</td>
<td>Gyratory Compactor</td>
<td>
The machine must compliance with Standards EN 12697-10 | EN-12697-31 | ASTM D6925 | AASHTO T312 (TP4) | SHRP* M002 | AS 2891.2.2 *Strategic Highway Research Program. Compaction is achieved by combining a rotary shearing action with a vertical static force applied by a mechanical head.
Specifications:

High precision, robust load mechanism combined with an extremely rigid frame assures high accuracy and repeatability.
Load cell fitted directly on the vertical actuator for accurate load measurement and feedback control.
Quick and easy manual/mechanical adjustment of the gyratory angle shown on the display.
User defined axial stress and speed of rotation.
Sliding transparent door with safety interlock.
Catch tray to collect expelled liquids using perforated moulds.
Fresh concrete configuration available
Easy control using the integrated 7” colour touchscreen control panel or connected PC.
User friendly PC software for data analysis and test set up. Remote communication is available to receive immediate diagnostics.

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		• Automatic data saving on USB or on Windows PC. • Lightweight yet robust moulds strictly comply with international standards. • Safe and easy mould insertion and extraction with automatic lifting ensures low effort for the operator and higher productivity. • Simultaneous extraction of last specimen while compacting the next specimen for higher productivity • Easy specimen extraction with the integrated extruder. • Perfect gyratory angle with real-time closed loop automatic angle adjustment recovering compliance and minor strains independently from the vertical load. • Easy and accurate motorised regulation of the gyratory angle set and displayed from the control panel. • Possibility to automatically set the zero angle at the end of the test. • Real-time direct shear and torque resistance measurement. Automatic calculation of the compaction energy, an important parameter for Research. **Make**: USA, UK, Europe, Japanese or Equivalent						
67	**Hydrometer**	• Hydrometer complete with Stirrer at over 10,000r.p.m, includes dispersion cup & stirring paddle, • Hydrometer Bath (50 L Capacity) • Hydrometer, 151 H • Hydrometer, 152 H • Sedimentation cylinder, 1000ml Rubber Stopper • Glass Thermometer, max 50ºC • Sodium Hexametaphosphate • Digital Stop Watch, incl. Battery **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
68	**Aggregate Impact Machine**	This machine is used to determine the aggregate impact value (AIV) which provides a relative measure of the resistance of an aggregate to sudden shock or impact. This machine should compliance with BS 812 standard and supplied complete with Sample Splitters used to divide representative dry samples into the required batch sizes for testing. **Specifications** • With complete test frame assembly • Made from steel protected against corrosion • Fit with a counter to check the number of blows • Maximum particle size of sample splitters (1", 2", 3"), One complete	**1**					

		set for each size with 2 spare boxes **Make**: USA, UK, Europe, Japanese or Equivalent						
69	**Los Angeles Machine**	This test procedure is for determining the resistance of coarse aggregates to abrasion. This machine should compliance with ASTM C131 and AASHTO T96 standard. **Specifications** • Los Angeles machine with automatic digital counter • The cylinder rotates at 31-33 rpm • Machine should be made of sound-Proofing Material for Noise Reduction • Set of 12 steel balls • Sieve # 12 (1.7mm) • Approximate dimensions: 1000x800x1000 mm **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
70	**Flaky and Elongation Test Apparatus**	**Flaky and Elongation Test Apparatus (2 Imported and 6 Local)** **Flaky and Elongation Index Proportion Calliper (2 Imported)** Use for the rapid and easy determination of percentage of flat particles, elongated particles, or both in coarse aggregate fractions of 9.5mm (3/8 in) or larger. The machine size should conform to ASTM D4791standards. **Specifications** • 13in (330mm) pivoting arm. • The positioning of the pivoting arm allows to obtain desired ratio among 1:2, 1:3, 1:4, or 1:5 **Make**: USA, UK, Europe, Japanese or Equivalent (4 Items) **Make**: Local/ China (6 Items)	**10**					

71	**Ring and Ball Apparatus**	This test is used to determine the softening point of bitumen. This machine should compliance with EN 1427, ASTM D36 and AASHTO T53 standards. **Specifications** • Automatic Ring and Ball Apparatus • Hot plate with magnetic stirrer with speed control from 0 to 160 rpm • Automatically determines the softening point of asphalt • Laser sensors • Language selection: English • Temperature probe • 2 Steel balls diameter 3/8” • 2 brass rings • 2 brass ball centring guides • 2 Ring holder/assembly • Thermometer (Approximate -2 to +80^{o}C, 0.2 °C graduations) • Beaker 600 ml • Power supply: 230V, 1ph, 50/60Hz **Make**: USA, UK, Europe, Japanese or Equivalent (2 Items) **Make**: Local/ China (1 Items)	**3**					
72	**Penetrometer Test Apparatus**	This test is used to determine the penetration of bituminous materials under fixed conditions of load, time and temperature. Thermostatically controlled digital water bath with cooling system and conditioning vessel provides water at the required temperature 25 °C to perform the penetration test. **Specifications** • Standard Digital Automatic Penetration of bituminous materials with Digital Circulation Water Bath • Penetrometer with cast iron base and leveling screws. • Separate key board for parameters entry and measurement operations. Electronic control of the approach. • Steeper motor for penetration depth as low as 0.01 mm. • Programmable penetration time between 0 and 999 min. • Mirror with articulated holders to check surface contact between the needle and the sample. • Position recall for routine tests can be set. • Automatic approach for conductive samples. • Optoelectronic detection of depth penetration.	**5**					

		• Automatic level detection device for bituminous materials. • Holder. Electromechanical release and locking device of the needle. Needle diameter = 5 mm on the monitor. Motorized return of the needle. Penetrometer needle 2.5 ± 0.05 g. • Sample cups 70 mm diameter x 45 mm height (Pack of 10). • USB Port for Printer or PC connection. • Weight approx. 20 -25 kg. • Over all dimensions 260 x 320 x 540 mm (l x w x h). • Digital circulation water bath capacity ranges 05- 15 liters with insulation, immersion heater with digital thermostat, motor pump with connections, cooling coil device, current water operated, to maintain a constant temperature of the bath. • Digital circulation water bath temperature ranges from -8 to 32 °C, 0.1 ± °C graduations. • Overall dimension of digital circulation water bath 480 x 380 x 275 mm. • Weight approximately of digital circulation water bath ranges 10- 25 kg. • Power Supply 220 V **Make**: USA, UK, Europe, Japanese or Equivalent (2 Items) **Make**: Local/ China (3 Items)						
73	**Ductilometer Apparatus**	The ductility of bitumen is determined by measuring the elongation before failure of sample subjected to tensile stress in pre- determined condition of speed and temperature (50mm/min.: 25^{o}C) Conforming to ASTM D113, ASTM D6084 and AASHTO T51. **Specifications** • The tank and the external frame are all made from stainless steel • Temperature range at 25±0.2°C and from 4 to 30 ± 0.2°C • Cooling coil, water circulating pump, thermostat approximate (±0.1^{o} or ±0.2^{o} C) with digital display • Adjustable speed range from approximate 5 to 100 mm/min (Advanced- Use for research purpose) • High carriage return speed of approximate 500 mm/min • Suitable for testing 3 samples simultaneously. • Electric motor • Maximum Stroke approximate 1500 mm. • Ductility briquette Mold's, (brass made) Quantity 6 No.	**1**					

<table>
<tr><td></td><td></td><td>Make: USA, UK, Europe, Japanese or Equivalent</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>74</td><td>CleveLand Open Cup Apparatus</td><td>Used for determining the flash and fire point of petroleum products. This machine should compliance with EN 2592, ASTM D92 and AASHTO T48 standards.
Specifications
• Brass cup
• Electric furnace with electronic control of heating power
• Flame rotating ignition device Glass cup
• Insulating plate
• Support and clamp for thermometer
• Stainless steel frame
• Thermometers -6 to +400°C
• 230 V, 50-60 Hz, 1 ph
Make: USA, UK, Europe, Japanese or Equivalent (1 Item)
Make: Local/ China (4 Items)</td><td>5</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>75</td><td>California Bearing Test Machine</td><td>This method is used for the laboratory evaluation of sub grade and sub base coarse materials in road construction. This machine should compliance with ASTM D1883, AASHTO T193 standard.
Specifications:
• Motorized loading
• Maximum capacity: 50 kN
• Test speed: 1.27 mm/min
• Voltage: Compatible to 220 V
C.B.R Accessories:
<table>
<tr><th>Description</th><th>Qty. Required</th></tr>
<tr><td>Moulds with Base plate & collar</td><td>12</td></tr>
<tr><td>Rammer</td><td>5</td></tr>
<tr><td>Tripod</td><td>15</td></tr>
<tr><td>Dial Gauges</td><td>15</td></tr>
<tr><td>Surcharge weights (Annular surcharge & Slotted surcharge)</td><td>25</td></tr>
<tr><td>Perforated plate with adjustable stem (Swell plate)</td><td>15</td></tr>
<tr><td>Spacer disk</td><td>2</td></tr>
<tr><td>Filter Paper</td><td>1 Packet</td></tr>
<tr><td>Straight Edge</td><td>3</td></tr>
</table>
Make: USA, UK, Europe, Japanese or Equivalent</td><td>1</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

76	**Marshall Stability Test Machine**	This machine used to measure the load and flow rate of asphalt specimens. **Specifications** • Marshall compression testing machine with motorized ram • Load ring, 50 kN cap • speed: 50.8 mm/min • Stability mould for 4" dia • Flow meter • 230 V, 50 Hz, 1 Ph **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
77	**Curing Marshall Specimen**	Used to condition Marshall (60±1°C) and other asphalt specimens in water. **Specifications** • Digital recirculating water bath, 56 liters cap. 230 V, 50-60 Hz, 1 ph • supplied with perforated base shelf and internal case **Make**: USA, UK, Europe, Japanese or Equivalent (2 Items) **Make**: Local/ China (8 Items)	**10**					
78	**Marshall Compactors Automatic**	The apparatus automatically compacts the sample of asphalt. Conforming toASTM D1559, AASHTO T245 standards. **Specifications** • Automatic control • High resolution graphical display • Marshall impact automatic compactor for 101.6 mm dia. Specimens • Sliding mass weight: 4535 ± 15 g • Free fall height: 457± 3 mm • Noise reduction cabinet for automatic Marshall compactors • Counter shuts off the unit automatically at completion of compaction • 230 V, 50 Hz, 1 ph Make: USA, UK, Europe, Japanese or Equivalent	**1**					
79	**Marshall Moulds**	Marshall compactions moulds are made from steel, protected against corrosion. The three parts of the compaction moulds comprises Mould body (4" dia), Base plate and Filling collar. Supplied with 1 Pack of filter papers. **Make**: USA, UK, Europe, Japanese or Equivalent	**10**					

80	**Air Compressor**	4-8 Liter Capacity **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
81	**Impact Soil Tester**	Used to obtain an indication of the degree of compaction of soil in road construction. Results can be directly correlated to the CBR test. **Specifications** • Battery operated (rechargeable) • Graphic display 128x64 pixel • Measuring range up to 102 IV (Impact Value) **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
82	**Vacuum Picnometer**	Approximate 4-5 liters capacity, made from aluminum with a transparent lid. Suitable for paving mixture samples up to 2 kg, with a maximum aggregate size of 19.1 mm (¾") supplied complete with rate of spread apparatus use to determining the rate of spread of binder on the surface of the road.300 mm square metal tray (3 No.). Chain for lifting tray attached to a digital balance. **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
83	**Dynamic Clegg Impact Test Apparatus**	Penetrometers are used to establish the thickness of different stratifications when investigating the suitability of a site for bridge, road or other construction works. **Specifications** • Anvil with driving rod • 10 kg rammer, rammer fall 50 cm • 11 sounding rods • 1 grooved rod • 2 drive points, 90°, 500 and 1000 mm2 • Lifting device for sounding rods • Couplings • Carrying case **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

84	**Oven**	Used for drying materials like aggregates, soils and other materials that require air drying. **Specifications** • Nominal cap. 100 Liters • Max. temperature 200°C • digital thermo regulator/indicator • 230 V, 50-60 Hz, 1 ph **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
85	**Skid Resistant Apparatus**	This test is used functional performance of skid resistance of roads. **Specifications** • Additional scale for tests on Polished Stone Value specimens • Thermometer 0 to 220°C for surface temperature measurement • Washing bottle, 1 l cap. for surface wetting • Tool set with case for machine assembly • Rule for sliding length verification • Carrying case • Traceable certificate of conformity to EN 1097-8 ASTM E303 • Mounted rubber slider for Polished Stone Value test (PSV laboratory). Complete with conformity certificate. TRL rubber, 32 mm width. • Mounted rubber slider for site use. Complete with conformity certificate. TRL rubber, 76 mm width. • Mounted rubber slider, 4S rubber, 32 mm • Mounted rubber slider, 4S rubber, 76 mm • Base plates • Metal base plate to clamp the Polishes Stone Value specimen. • Metal base plate for testing surface friction properties of Natural stones (EN 1341, EN 1342) and Paving blocks (EN 1338). **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

86	**Triaxial Machine**	Investigation of stress-strain relationships in soil is usually carried out with triaxial tests where undisturbed, remoulded or compacted specimens are subjected to different stress level sand drainage conditions to simulate as closely as possible the different situations that can occur in the subsoil on site and the possible effects of construction, excavations, embankments, landslides, etc. **Specifications:** • Maximum sample diameter: 150mm • Minimum testing speed, mm/min: 0.00001 • Maximum testing speed, mm/min: 99.99999 • Maximum compression force, kN: 100 • Maximum tensile force, kN: 5 • Minimum vertical clearance, mm: 390 • Maximum vertical clearance, mm: 1140 • Horizontal clearance, mm: 498 • Platen diameter, mm: 158 • Platen travel, mm: 100 • Dimensions, mm (h x w x d) (approx.):1830 x 750 x 520 • Power, W: 680 • Weight, kg (approx.) : 120 • Voltage: Compatible to 220 V **Accessories:** Triaxial load frame, Digital measuring system (Displacement transducer , External / submersible load cell, Pore pressure transducer), Standard Triaxial cell with accessories, Pressure/volume controller, De-airing system, Data acquisition and control units, Triaxial test automatic control and processing software with PC **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
87	**Rolling Thin Film Oven Test**	This machine is used for measuring the effect of heat and air on a moving film of semi-solid bituminous materials. The machine size should conforming to ASTM/AASHTO standards. **Specifications** • Door locking system allowing easy opening also with busy hands. Door with double-glazed window • Diaphragm pump, free air displacement, 4-8 litres/min at maximum pressure of 2.4 bar (when used as an air compressor). Power: 65 W approximately	**1**					

		• Scraper for RTFOT bottle. Metal rack for holding/cooling RTFOT bottles. RTFOT bottle tong.
		• Spares, Spare glass container. ASTM 13C thermometer, +155 to +170°C, 0.5° divisions.
		• 8 heat resistant glass containers (64 m high x 140 mm diameter) approximately.
		• Touch-screen display with 4.5" colour control panel, including timer function, visual warnings and digital air flow regulator
		• Full conformity to temperature specifications (time to reach target temperature after switch on, target temperature adjustment after samples insertion) from the Standards
		• Carousel rotation with closed-loop controlled speed
		• Safety features: Automatic over-temperature switch, door switch, pilot lamp and alarm for door open with fan still running; magnet o thermic switch
		  • High quality stainless steel structure, internal and external
		  • Internal chamber made from stainless steel
		  • Insulation with fibreglass
		  • External frame made from engine turned stainless steel
		  • Dimension 800 x 800 x 900 mm approximately
		  • Weight Approximately 50 kg
		  • Training of one staff person in machine manufacturer plant country.
		
		Make: USA, UK, Europe, Japanese or Equivalent						

88	**Pressure Ageing Vessel**	The Pressure Ageing Vessel (PAV) has been developed to simulate in-service ageing of asphalt binder after 5 to 10 years. The binder is exposed to high pressure and temperature for 20 or 65 hours (selectable up to 99) to simulate the effect of long-term oxidative ageing This standard should meet with ASTM D6521, AASHTO R28 and EN 14769. **Specifications** • Vacuum Degasing Oven • PAV with encased band heaters and integral pressures and temperature manageable • Platinum RTD measures internal test temperature to 0.1 ±°C. • Pressure is monitored by transducer and controlled to 2.1 ± 0.1 MPa. • Temperature and pressure digital indicators display both set points and actual values.	**1**					

		• Data logging of both temperature and pressure • Bottled compressed air with regulator • Supplied complete with 10 stainless pans • Precision assembled rack to support the pans power card • Operator's manual • Serial data cable • Dimensions 650 x 430 x 405 mm approximately • Weight approx. 70-75 kg • Freely selectable test temperatures from 8° to 120°C, PID controlled to +/- 0.5°C • Efficient heating system allowing the test temperature to be achieved in one hour, exceeding the Standards' specification • Programmable pre-heating functions (limited to 60° C to avoid accidental burns during sample rack positioning) for time optimization • User friendly software allows real time readout of vessel temperature and pressure • 6" colour touch screen reclinable display • Temperature and pressure calibrations performable by the user • Network ready for remote monitoring of the test status from PC, tablet or smartphone • CE and ASME certified pressure vessel • Electrically locked top cover, to avoid direct exposure of the pressure vessel during the test • Forced ventilation cooling system allowing quick cooling of sample rack to avoid accidental burn • Over temperature limit switch • Over pressure relief valve • Working temperature range: 80 to 120° C • Testing time: up to 99 hours • Spare sample container (TFOT pan) for PAV • Spare sample rack for PAV • Power: 1000 W approximately • Training of one staff person in machine manufacturer plant country. **Make**: USA, UK, Europe, Japanese or Equivalent						

89	**Bending Beam Rheometer**	The Bending Beam Rheometer (BBR) test provides a measure of low temperature stiffness and relaxation properties of asphalt binders. These parameters give an indication of an asphalt binder's ability to resist low temperature cracking. The Bending Beam Rheometer (BBR) is engineered to perform flexural tests on asphalt binder and similar specimens per ASTM D6648 and AASHTO T313. These tests consist of a constant force being applied to a specimen in a chilled bath in order to derive specific rates of deformation at various temperatures. **Technical Specifications:** • Load Frame: Integral stainless steel frictionless construction • Loading shaft: In-line stainless steel with blunt point • Test Load: Variable test range from 0 to 250 g standard. • System maintains required test load to within ±0.5 g throughout the test cycle • Test Cycle Times: Cycle times for pre-load, recovery, and test load are completely operator- adjustable • Load cell: 400- 500 g (temperature-compensated) • Mechanical: overload • Protection: Standard • Test weights: Calibrated and traceable • Sample supports: 25 mm (0.98 in.) diameter stainless steel spaced 101.6 mm (4.00 in.) apart • LVDT displacement transducers 6.35 mm (0.25 in.) calibrated range to provide 2 µm resolution throughout testing and verification range • Testing Software Features: Large on-screen display of load, displacement and bath temperature provides ease of setup and operation. Real-time displacement, loading, and temperature graphs are displayed during the test cycle and can be re-scaled as needed for easy viewing • Cooling Unit: Included (non-CFC refrigerant) Recommended Cooling • Bath fluid: Non-flammable ethylene glycol mixture • Operating temperature Ambient to -40° C (-40°F) approximately • Temperature Measurement: Platinum RTD • Compressed air requirement: 0.34 MPa (50 psi) clean, dry air supply required • Extra aluminium beam mould. Set of five.	**1**					

		• Set of 36-50 plastic strips for BBR specimen moulds. • Weight approx. 115-120 kg approximately • Training of one Staff person in machine Manufacturer plant country. **Silent Features** • Durable, corrosion-resistant construction • Computerized control, data acquisition and analysis • PID temperature controller with digital display • Two independent platinum RTDs for precise temperature control • Mechanically-refrigerated cooling bath with environmentally-safe non-CFC coolant • Integral LVDT and temperature compensated load cell for accurate test results • Includes complete calibration kit with carrying case • Includes ASTM/AASHTO-compliant specimen moulds • PC and software included • Machine control by PC (included) with dedicated software **Make**: USA, UK, Europe, Japanese or Equivalent						
90	**Dynamic Shear Rheometer**	The Dynamic Shear Rheometer (DSR) determines linear viscoelastic properties of performance-graded asphalt binders at temperatures from 5°—85°C (41°—185°F). DSR determines Dynamic shear modulus and phase angle properties of binder. **Specifications** • DSR Silicone Rubber Mould Set for 8mm & 25mm Samples are flexible moulds to form specimens with dimensions of 8mm and 25mm when tested. Actual mould dimensions are 9 and 19mm diameter • DSR Viscosity Standard Fluid used for calibration of Dynamic Shear Rheometer. NIST-traceable • Computer System is a Windows® compatible PC to collect, store and report test data • Reference Thermal Detector Probe allows direct in-place calibration of the DSR's built-in resistance temperature detector • 8mm DSR Extra Lower Plate is stationary and holds 8mm specimens in place; extra plates increase sample preparation efficiency • 25mm DSR Extra Lower Plate is stationary and holds 25mm	**1**					

		specimens in place; extra plates increase sample preparation efficiency • DSR 8mm Extra Upper Plate oscillates to produce strain on 8mm diameter asphalt samples; extra plates allow for continuous operation and higher productivity • DSR 25mm Extra Upper Plate oscillates to produce strain on 25mm diameter asphalt samples; extra plates allow for continuous operation and higher productivity • One year of software updates • Training of one Staff person in machine Manufacturer plant country. **Make**: USA, UK, Europe, Japanese or Equivalent						
91	**Rotational Viscometer**	Viscosity of solid road unfilled asphalts has to be measured at temperatures ranging from 34°C to 260° according to the Specifications of ASTM D4402. **Specifications** • Temperature adjustable unit with temperature range from ambient plus 5°C to 300°C. • Complete stand with set of 4 spindles. • Boss head, spindle protection, spindle rack • Calibration certificate • Usb cable • Data logger software and power supply cable • Voltage 220-240V, 50-60Hz, 1 ph • Aluminium disposable test chamber • Stainless steel reusable test chamber • 12-key touchpad keyboard. Direct readout on a graphic display. • Data displayed: Selected speed. Selected spindle. Viscosity reading. Percentage of full scale. Sample temperature. Shear rate (with coaxial spindles). Shear stress (with coaxial spindles). Density (entered by the user). Step program status. Analysis and visual characteristics (flow curves). Viscosity reading: dynamic viscosity (cP or mPa•s) or kinematics viscosity (cSt) • Program features: Time to torque: target torque pre-setting device. Time to stop: target time pre-setting device. 10 working memories. Customizable options. Programmable. Multistep. . Ramp • AUTO-TEST with visual and audible malfunction alarm • AUTO-RANGE function	**1**					

		• Temperature reading • User-enable viscosity and temperature calibration • 10 language options **Make**: USA, UK, Europe, Japanese or Equivalent						
92	**Wheel Tracker**	The Wheel Tracker Test is used to determine the rut depth in the asphalt mixtures. **Specifications** • Conforming to EN 12697-22 Small scale device • Table displacement with adjustable speed by inverter • Motorized vertical adjustment of the loading arm • Wheel with solid rubber tyre 200 mm external dia. • Wheel weight 700 N (900 N available on request) • Suitable for large core specimens and slabs up to 400x300 mm. • Slab thickness from 25 to 100 mm • 25 mm stroke transducer with resolution better than 0.1 mm • Integral temperature controlled cabinet • Test temperature range adjustable from environment to 65°C • Double glazed doors for test monitoring **Hardware** • 16 bit microprocessor. • One CPU card to control both test data visualization, temperature control, database and internal functions management control. • Large permanent memory to store test results. • 10 key membrane touch keyboard. • 240 x 128 pixel graphical display. • RS 232 output for PC connection. **Firmware** • Language selection. • Clock/Calendar system. • Fully automatic test control • Test setting menu, complete with descriptive sample parameters. • Calibration menu to set and check temperature, table speed and	**1**					

		displacement, and featuring a special function for manual control of the test performance. • Test performance menu with simultaneous display of all the test data (including real time table speed). • Internal database up to 100 tests. Each test can be downloaded to a PC, displayed, printed or deleted. • Download to PC via serial port. • Data processing to EN 12697-22 Small scale device, procedure A and B, and customized test • Windows 7 or 10 compatible software, for printing of test certificates and multiple test processing (mean values). **Safety Features** • Automatic stop of climatic chamber and moving table when opening the door **Training** • Training of one Staff person in machine Manufacturer plant country. **Make**: USA, UK, Europe, Japanese or Equivalent						
93	**Straight Edge Test Apparatus**	This test is used to find the rutting in the roads. **Specifications** • Used to measure irregularities in road pavement. Made from aluminium alloy, 3 m length. Complete with two steel wedges. Wooden carrying case is not included and must be ordered separately. See accessories. • Weight approx.: 10 kg • Carrying canvas for MOT Straightedge and related wedges **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
94	**Laboratory Mixer**	The main function of this machine is to prepare homogenous bituminous mixtures Laboratory samples at strictly controlled temperature in a short time period (few minutes) to avoid any mechanical aggregate degradation for Asphalt mix design. The mixers prepared samples to perform gyratory compaction tests, Marshall Stability Tests, Wheel Tracking wet and dry Test, Slabs compaction laboratory Tests, Beam Fatigue and Stiffness Test and Asphalt general purpose Test. **Specifications** • Automatic Asphalt Laboratory Mixer	**1**					

		• The mixing capacity ranges up to 30-45 liters. • Mixing speed adjustable ranges from 4 to 50 rpm. • Mixing temperature adjustable up to 260 °C. • Main Frame holding a horizontal stainless steel container • Mixing container material made up of stainless steel with helical mixing shaft and double wall thermally insulated. The container contains an electric heater with probe sensor granting constant and uniform temperature control. • Digital Temperature Display, Digital Thermo regulators to set and control mixing temperature, mixing speed controller, command to tilt the bowl , main and start/stop switches and other functions should available in machine. • Electro mechanical motion allows easy unloading by motorized tilting system, total rotation ranges from 100 – 150 °C. • Heating power ranges 3000-7500 W • Temperature control with PT 100-150 • Over all Dimensions 1350 x 650 x 1205 mm (w x d x h) • Weight Approximately 300- 350 kg • Voltage 220 V **Make**: USA, UK, Europe, Japanese or Equivalent						
95	**Double Shelf Laboratory Trolley**	Shelf size 800 X 400 X 870 mm **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
96	**Centrifugal Bitumen Extractor**	Centrifuge extractor is used for determining the percentage of bitumen in bituminous mixtures meet the standard of EN 12697-1, ASTM D2172 and AASHTO T164/A. **Specifications** • 3000 g capacity digital centrifuge extractor • Explosion-proof version • Speed control up to 3600 rpm • Automatic fast stop bowl rotation • Speed regulator and digital display monitoring the frequency • 200 filter papers, 3000 g Capacity • Calcium Tetra Chloride (20 Litre) • Sodium sulphate or Magnesium Sulphate (50 Kg) **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
97	**Reaction Frames**	They are used to apply horizontal and vertical loading on beams and columns to determine their response against earthquake loadings.	**1**					

		Specifications: • Four legs reaction frame with monkey ladder fitted with each leg. • Height of reaction frame above plinth level = 35 feet • Detachable reaction beams which may be fitted at any height from 4ft to 30 ft. • Lateral load capacity of vertical legs = 5000 kN • Capacity of frame to sustain vertical point load from top = 5000 kN • The reaction frame should be supplied with all the accessories required for proper functioning of reaction frame including but not limited to tie rods, hooks, nut, bolts, bed plate, load transfer beams and bracings, etc. **Make**: Local/ China						
98	**Strain & Stress Controlled Universal Testing Machine**	This hydraulic universal computerized testing machine (UTM) is used for the following purposes; • To perform the tensile strength test on a metal • To perform shear strength test of steel • To perform compressive strength test on steel and concrete • To perform bend test on mild steel rod • To perform peel test of steel • To perform the puncture resistance test of steel **Specifications:** • Machine must conform to standards of ASTM A370, EN ISO 6892, 7500-1. • For tensile test it must comply ASTM E290 and for tensile test on steel and steel reinforcing bars standard is ASTM A370. • Environmental and user-friendly machine with improved control performance and easy operational interface. • Provided with semi-auto-tuning function which enables high precision stress and strain control in compliance with ISO 6892-2009 and JIS Z2241 metallic materials tensile testing standards). • For easy operation and visibility an extra-large (10 to 11") color LCD with touch screen facility must be provided. • A standard key switch must be provided to ensure properly controlled security. • A USB memory stick connectable to measurement controller with test parameters stored in USB memory provided, tests can be performed without a computer because of USB memory stick. Furthermore, after tests measurement data can be automatically saved in the USB. • It must have energy efficient hybrid hydraulic unit with reduced	**1**					

power consumption.

Note: Training must be provided for two staff members at parent manufacturing country.

The detailed technical specifications are shown in table 1.0 and table 2.0 as follows;

Table 1.0 Capacity Details of UTM

Capacity	
Max. capacity	2000 KN for Compression & Tension
Force range	Rangeless
Analog indicator (Option)	2000/1000/400/200/100/40kN

Table 2.0 Technical Specifications Of UTM

Specifications		
1.Loading Speed (50/60Hz) (mm/min)	Servo Valve Hybrid	40/50 max. 90max
Drive Motor	Servo Valve Hybrid	5.5 Kw 4.4 Kw
2. Tensile Test	Max. grip span (mm)	1100
	Grip space for rod specimens (mm) (Two sets of grip Liners)	Ø 20 to 90, 1 type with liner
	Grip space for plate specimens with additional grip faces (3 Sets of standard grips)	0 to 85, 1 type (90 in width)
3. Compression Test	Max. compression plate span (mm)	950
	Compression Plate size (mm)	Ø220
4. Transverse/ Bending Test	Max. Support span (mm)	900
	Support Diameter x Width (mm)	70 x 200
	Punch Tip radius (mm)	30, 40
	punch width (mm)	160

5. Crosshead elevation speed (50/60 Hz) Approx.	290/350
Drive Motor	1.5 Kw
6. Ram stroke (mm)	300
7. Column Span (mm)	750
8. Effective table dimension (W X D) (mm)	850 x 850
9.Power Supply Capacity (3 phase, 220V, 50Hz/200 to 220V,60Hz)	12 KVA 12 KVA
10. Breaker Capacity (3 phase, 220V, 50Hz/200 to 220V,60Hz)	75 A 75A
11. Testing Machine Size (W X D X H) (mm)	1560×920× 3400
Testing Machine — Measurement Controller (mm)	740×1000× 1800

The standard specifications for measurement controller are shown in table 3.0

Table 3.0. Standard specifications for measurement controller

1	**Loading method**	Computer-controlled electro-hydraulic servo system	
2	**Force measurement**	Method	Cylinder internal pressure measurement with high-precision pressure cell
		Precision standard type	Within ±1.0 % of indicated value (when the force is 1/1 to 1/250 of rated value) (Conforming to JIS B7721 Class 1, ISO 7500/1 Class 1, and ASTM E4)*[1]
		High-precision type (option)	Within ±0.5 % of indicated value (when the force is 1/1 to 1/250 of rated value) (Conforming to JIS B7721 Class 0.5, ISO 7500/1 Class 0.5, and ASTM E4)
		Magnification	Rangeless

		3	**Force display**	Operation unit	Digital display	Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)						
				Analog force indicator	Analog display	Scale plate diameter: 450 mm; Min. scale: 1/1000 (300 kN/3000 kN: 1/600)						
					Digital display	Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)						
		4	**Stroke measurement display**		Measurement with optical encoder; digital display (resolution: 0.01 mm)							
		5	**Automatic load control**	Method	Fully closed-loop automatic load control							
				Test control functions	Single test control, Cycle test control (triangular wave, trapezoidal wave), Stress test control (metal tensile test control:							
					compliant with ISO 6892-2009/JIS Z2241), Strain test control (metal tensile test control: compliant with ISO 6892-2009),							
					Stroke speed 3-step switching control, Concrete test control (compression, bending, cleavage tests)							
				Range	Ram stroke control	Speed range: 0.1 mm/min to max. loading speed						
						Control range: Ram return point to max. ram stroke						
					Test force control	Speed range: 0.2 % to 500 % full-scale/min						

						Control range: 0.4 % to 100 % of full-scale force						
					Strain control	Speed range: 0.1 % to 80 %/min						
						Control range: 5 % to 100 % of full-scale elongation						
			6	**Input/output interface**	External analog input: 2 CH; External analog output: 2 CH External digital input: 2 CH (optional); Internal amplifiers possible: 2 ports Analog recorder (optional) output, USB function (for computer) / Host (for USB memory) interface, and Dataletty (optional) output							
			7	**Standard function**	Auto-test force-strain control (with auto-tuning), Test force auto-zero, Test force auto-calibration, Break detecting (break sensitivity, break level, break peak level, and high sensitivity), Auto-return, Arbitrary stroke speed setting, Stroke speed preset, Cycle count, Stress value display, Displacement meter value display, PEAK/BREAK value display, Test condition files (100 files), Japanese/English display, S-S curve display, Specimen protection, Current speed display, and Manual load control							
			8	**Safety devices**	Overload automatic stop (When the test force value exceeds 102 % of the full-scale value,							

			the loading pump automatically stops.) Software limit detection (automatically stops test upon reaching limit setting value) Control automatic stop (When an excessive control deviation is reached, the test automatically stops.)						
		NOTE: *1 Calibration is required after installation to provide conformance. **Make**: Local/ China							
99	**Stress Controlled Universal Testing Machine**	This hydraulic universal computerized testing machine (UTM) is used for the following purposes; • To perform the tensile strength test on a metal • To perform shear strength test of steel • To perform compressive strength test on steel and concrete • To perform bend test on mild steel rod • To perform peel test of steel • To perform the puncture resistance test of steel **Specifications:** • Machine must conform to standards of ASTM A370, EN ISO 6892, 7500-1. • For tensile test it must comply ASTM E290 and for tensile test on steel and steel reinforcing bars standard is ASTM A370. • Environmental and user-friendly machine with improved control performance and easy operational interface. • Provided with semi-auto-tuning function which enables high precision stress and strain control in compliance with ISO 6892-2009 and JIS Z2241 metallic materials tensile testing standards). • For easy operation and visibility an extra-large (10 to 11") color LCD with touch screen facility must be provided. • A standard key switch must be provided to ensure properly controlled security. • A USB memory stick connectable to measurement controller with test parameters stored in USB memory provided, tests can be performed without a computer because of USB memory stick. Furthermore, after tests measurement data can be automatically saved in the USB.	**1**					

- It must have energy efficient hybrid hydraulic unit with reduced power consumption.

<u>Note:</u> Training must be provided for two staff members at parent manufacturing country.

The detailed technical specifications are shown in table 1.0 and table 2.0 as follows;

Table 1.0 Capacity Details of UTM

Capacity	
Max. capacity	2000 KN for Compression & Tension
Force range	Rangeless
Analog indicator (Option)	2000/1000/400/200/100/40kN

Table 2.0 Technical Specifications Of UTM

Specifications		
1.Loading Speed (50/60Hz) (mm/min)	Servo Valve Hybrid	40/50 max. 90max
Drive Motor	Servo Valve Hybrid	5.5 Kw 4.4 Kw
2. Tensile Test	Max. grip span (mm)	1100
	Grip space for rod specimens (mm) (Two sets of grip Liners)	Ø 20 to 90, 1 type with liner
	Grip space for plate specimens with additional grip faces (3 Sets of standard grips)	0 to 85, 1 type (90 in width)
3. Compression Test	Max. compression plate span (mm)	950
	Compression Plate size (mm)	Ø220
4. Transverse/ Bending Test	Max. Support span (mm)	900
	Support Diameter x	70 x 200

	Width (mm)	
	Punch Tip radius (mm)	30, 40
	punch width (mm)	160
5. Crosshead elevation speed (50/60 Hz) Approx.		290/350
Drive Motor		1.5 Kw
6. Ram stroke (mm)		300
7. Column Span (mm)		750
8. Effective table dimension (W X D) (mm)		850 x 850
9.Power Supply Capacity (3 phase, 220V, 50Hz/200 to 220V,60Hz)		12 KVA 12 KVA
10. Breaker Capacity (3 phase, 220V, 50Hz/200 to 220V,60Hz)		75 A 75A
11. Testing Machine Size (W X D X H) (mm)		1560×920×3400
Testing Machine	Measurement Controller (mm)	740×1000×1800

The standard specifications for measurement controller are shown in table 3.0

Table 3.0. Standard specifications for measurement controller

1	**Loading method**	Computer-controlled electro-hydraulic servo system	
2	**Force measurement**	Method	Cylinder internal pressure measurement with high-precision pressure cell
		Precision standard type	Within ±1.0 % of indicated value (when the force is 1/1 to 1/250 of rated value)

					(Conforming to JIS B7721 Class 1, ISO 7500/1 Class 1, and ASTM E4)*1							
				High-precision type (option)	Within ±0.5 % of indicated value (when the force is 1/1 to 1/250 of rated value) (Conforming to JIS B7721 Class 0.5, ISO 7500/1 Class 0.5, and ASTM E4)							
				Magnification	Rangeless							
		3	**Force display**	Operation unit	Digital display	Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)						
				Analog force indicator	Analog display	Scale plate diameter: 450 mm; Min. scale: 1/1000 (300 kN/3000 kN: 1/600)						
					Digital display	Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)						
		4	**Stroke measurement display**		Measurement with optical encoder; digital display (resolution: 0.01 mm)							
		5	**Automatic load control**	Method	Fully closed-loop automatic load control							
				Test control functions	Single test control, Cycle test control (triangular wave, trapezoidal wave), Stress test control (metal tensile test control:							

					compliant with ISO 6892-2009/JIS Z2241), Strain test control (metal tensile test control: compliant with ISO 6892-2009),							
					Stroke speed 3-step switching control, Concrete test control (compression, bending, cleavage tests)							
				Range	Ram stroke control	Speed range: 0.1 mm/min to max. loading speed						
						Control range: Ram return point to max. ram stroke						
					Test force control	Speed range: 0.2 % to 500 % full-scale/min						
						Control range: 0.4 % to 100 % of full-scale force						
					Strain control	Speed range: 0.1 % to 80 %/min						
						Control range: 5 % to 100 % of full-scale elongation						
			6	**Input/output interface**	External analog input: 2 CH; External analog output: 2 CH External digital input: 2 CH (optional); Internal amplifiers possible: 2 ports Analog recorder (optional) output, USB function (for computer) / Host (for USB memory) interface, and Dataletty (optional) output							

		7	**Standard function**	Auto-test force-strain control (with auto-tuning), Test force auto-zero, Test force auto-calibration, Break detecting (break sensitivity, break level, break peak level, and high sensitivity), Auto-return, Arbitrary stroke speed setting, Stroke speed preset, Cycle count, Stress value display, Displacement meter value display, PEAK/BREAK value display, Test condition files (100 files), Japanese/English display, S-S curve display, Specimen protection, Current speed display, and Manual load control						
		8	**Safety devices**	Overload automatic stop (When the test force value exceeds 102 % of the full-scale value, the loading pump automatically stops). Software limit detection (automatically stops test upon reaching limit setting value). Control automatic stop (When an excessive control deviation is reached, the test automatically stops.)						
		NOTE:									
		*1 Calibration is required after installation to provide conformance.									
		Make: USA, UK, Europe, Japanese or Equivalent									

100	**Electric Hoist Crane**	The crane is used for shifting heavy test samples and testing equipment's with in the premises of laboratory **Specification:** • Capacity up to 3 Tons • Provided with appropriate accessories • Complete assembly • Electrically operated machine • Provided with complete instruction manual and training of a staff member. **Make**: Local/ China	**1**					
101	**Digital data acquisition system**	The apparatus is used for the measurement of change in length and applied load values and calculating strains and stress values via computer software. **Specification:** • Capacity of 16 to 20 Channels • LVDTS of range 50 to 100 mm • Digital load cells with capacity up to 10 Tons • Provided with compatible software to record and control the data. • Provided with instruction manual **Make**: Local/ China	**1**					
102	**Strain Gauge Kit**	Strain gauges are used to measure strains (Deformations) on an object subject to forces. **Specification:** • Number of strain gauges = 30- 40. • Kit contains a selection of resistance strain gauges, • Kit contains necessary accessories associated with their application. • Kit with a portable case. • Pressure-sensitive type adhesive, cleaning agents, terminal strips, tissues and pressure-sensitive tape are also included in the kit. • Provision of instruction manual **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
103	**LVDTs**	An LVDT is an electromechanical device used to convert mechanical motion or vibrations, specifically rectilinear motion, into a variable electrical current, voltage or electric signals, and the reverse. **Specification:** • Range (*) ±1.0" (±25mm) • Linearity error (% F.S.) < ±0.5/ ±0.25/ ±0.1 • Length (body) 8.3" (210.82 mm) • Length (shaft centered) 10.8" (274.32 mm) • Total weight 10 oz. • Spring force at X 7.2 oz.	**1**					

		• Spring rate 3.0 oz./inch • Inward over-travel 0.12” • Outward over-travel 0.39” • Excitation/supply +5V to +18V DC, 100mA typical • Output ±2.2V • Output load 2kΩ (minimum) • Output ripple 30mV (peak-to-peak) • Electrical output bandwidth 200Hz (flat) • Output impedance 2Ω • Temperature coefficient (zero) ±0.006% F.S. / °F (typical) • Temperature coefficient (span) ±0.017% F.S. / °F (typical) • Operating temperature range -58°F to +158°F • Cable BDI RC-187 **Make**: Local/ China						
104	**Strain Measuring Devices (Digital strain Display)**	Digital strain display is used to give direct strain readings by connection with most types of strain bridge connections. **Specification:** • Digital 12 – 16 channel equipment connects to strain gauges to give direct strain readings. • Dynamic output for transient strain measurement. • Suitable for half and full bridge strain connections. • Provided with Cable, crimp and self-locking connectors. • Programmable display to match the strain gauges and their connections. • Internal makeup resistors. • Supplied with user guide manual. **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					
105	**Muffle Electric Furnace**	The electric muffle furnaces cover practically all requirements of construction materials laboratory: from aggregates to concrete/cement and asphalt testing. **Specification:** • Conforming to EN 12697-1 and EN 13108 • Max temperature 1100 ºC • Accuracy ± 4 ºC • Power 3.9 Kw • Weight approximately 100 Kg • Inside dimensions (cm): 25 x 32 x 20 • Outside dimensions (cm): 50 x 75x 65 **Make**: USA, UK, Europe, Japanese or Equivalent	**1**					

CONTRACT / AGREEMENT

THIS CONTRACT/ AGREEMENT is made on the _____**_____, 201___**
BETWEEN

INTERNATIONAL ISLAMIC UNIVERSITY, ISLAMABAD, a Public Sector University of the Government of Pakistan incorporated under the laws of Islamic Republic of Pakistan and having its principal place at Sector H-10 Islamabad (hereinafter called "the Purchaser"),

AND

M/s _____ incorporated under the laws of Pakistan and having its principal place of business at _____, Pakistan (hereinafter called "the Supplier").

WHEREAS the Purchaser invited bids for Procurement of Lab Equipment for **"Department of Civil Engineering (FET)"** under its approved PC-I titled: ***"Expansion and Upgradation of International Islamic University Islamabad"*** and has accepted a bid/quotation No. _____ dated: _____ submitted by the Supplier for the supply of following item(s) against total **CPT/CFR/FOR Price** _____ (_____) hereinafter called "the Contract Price" and the Purchaser agrees to pay the Supplier/Manufacturer the Contract Price or such other sum(s) as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

Sr. No.	**Item Name**	**Specifications**	**Qty.**	**Make/Model/** Country of Origin	**Unit Price**	**Total Price**
				TOTAL		

The Purchaser and the Supplier agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement:
   - ***(a)*** The Tender Document "Terms & Conditions"
   - ***(b)*** BoQ
   - ***(c)*** The Certificate *(As referred at # 27 of Tender Document)*
   - ***(d)*** The Purchase Order
   - ***(e)*** The Special Conditions
3. In consideration of the payments to be made by the Purchaser to the Supplier/Manufacturer as indicated in this Agreement, the Supplier hereby covenants with the Purchaser to execute the Goods and Related Services and to remedy defects therein in conformity in all respects with the provisions of the Contract/Purchase Order.
4. The Purchaser hereby covenants to pay the Supplier/Manufacturer in consideration of the supply of the Goods and Related Services therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract/Purchase Order.

Agreement to be executed in accordance with the laws of Islamic Republic of Pakistan on the day, month and year indicated above.

Signed by:

_____
For and on behalf of the Purchaser
Name:
CNIC:

In the presence of:
Witness,

Signature: _____

Name: _____
CNIC:
Address: _____
Date: _____

Signed by:

_____
for and on behalf the Supplier
Name:
CNIC:

in the presence of:
Witness

Signature: _____

Name: _____
CNIC:
Address: _____
Date: _____

SPECIAL CONDITIONS

1. **Specifications and Standards:**

1.1 The Supplier shall ensure that the Goods and Related Services comply with the technical requirements.

1.2 The Supplier shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designed by or on behalf of the Purchaser, by giving a notice of such disclaimer to the Purchaser.

2. **Packing and Documents:**

2.1 The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination as indicated, during transit, the packing shall be sufficient to withstand, without limitation, rough handling and exposure to extreme temperatures, salt and precipitation, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods final destination and the absence of heavy handling facilities at all points in transit.

2.2 The Packing marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Purchase Order, including requirements, if any and in any other instructions ordered by the Purchaser.

3. **Transportation:**

3.1 Unless otherwise specified, responsibility for arranging transportation of the Goods shall be in accordance with the specified Incoterms.

4. **Warranty:**

4.1 The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise by the Purchaser.

4.2 Unless otherwise specified in these conditions, the warranty shall remain valid for **twelve (12) months** after the Goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in these conditions or for eighteen (18) months after the date of shipment, from the port, or place of loading in the country of origin, whichever period

concluded earlier.

4.3 The Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. The purchaser shall afford all reasonable opportunity for the Supplier to inspect such defects.

4.4 Upon receipt of such notice, the Supplier shall, **within the 30 days** expeditiously repair or replace the defective Goods or parts thereof, at no cost to the Purchaser (IIUI)

5. The Payment Terms will be:

5.1 For the CPT/CFR quoted items; payment will be made through irrevocable L.C (90:10 Model) in favor of Manufacturer. Where, 90% in this model will be released upon receipt of shipment and delivery documents. Remaining 10% will be made / released after successful inspection of the equipment at International Islamic University Islamabad.

5.2 For the FOR quoted items; 100% payment will be made after supply and successful inspection of the ordered equipment(s) at International Islamic University Islamabad after deduction of 10% retention money as per "Terms & Condition".