TENDER DOCUMENTS

CIVIL LAB EQUIPMENT

NUTECH/SCM/Civil Lab-2019/TD-035

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE

National University of Technology (NUTECH)

NUTECH/SCM/Civil Lab-2019/TD-035

Sealed bids are invited from Government / FBR Registered Firms for the procurement of Civil laboratory equipment for NUTECH Technology Labs.

1. Tender documents containing terms & conditions and detailed specifications of items can be downloaded from NUTECH website "https://nutech.edu.pk/d-p.php" w.e.f **11 Mar 2019.**
2. Quotations shall be submitted as per requirement of the tender documents.
3. Bidders will be required to submit bank draft/PO equal to 5% of quoted value as Bid Bond in favor of National University of Technology (NUTECH).
4. Sealed bids with detailed specification should reach on the following address latest by **1130 hours on 29 Mar 2019.** Late submission will not be entertained.
5. Bids will be opened at **1200 hours** on **29 Mar 2019**at SCM Office.
6. Project is to be completed in 75 days from the date of award of contract.
7. Submit Rs 1500/- as Tender fee in favour of NUTECH HBL account**: NUTECH Tendering and contracts, 5037- 7000210755.** Please attach bank receipt with technical offer. Offers will not be entertained without payment of processing fee.

Deputy Director (Supply Chain Management Office)
NATIONAL UNIVERSITY OF TECHNOLOGY (NUTECH) IJP ROAD, SECI-12,
ISLAMABAD
Tel: 0092-51-5476768, Ext :178

NATIONAL UNIVERSITY OF TECHNOLOGY

SUPPLY CHAIN MANAGEMENT OFFICE

INVITATION TO TENDER

Submission Date/Time 29 Mar 2019 at 1130 hours

1. NUTECH desires to procure the list of item(s)/Store(s) as per **Annexure-A**. Interested bidders are requested to send their bids through courier or deliver at NUTECH under two separate sealed envelopes (placed together in third envelope), marked clearly, **"Technical Offer"** and **"Commercial Offer"**, respectively to the undersigned, latest by or before above mentioned due date. If due to any unforeseen circumstances, NUTECH establishment remains closed, then the last date of submission will be extended to next working day.

2. Please also note that Technical Offer should contain Annexes-A & B duly filled in (supported with relevant technical literature /details/ catalogues etc) and receipt of tender processing fee. Commercial Offer will contain Annexure- C and bid bond. Please ensure no space is left blank in the annexes.

3. Following must be noted for this IT (Invitation to Tender):-

   a. 2 x copies of technical offer are to be provided. Also provide soft copy of technical offer by USB or CD along with technical proposal.

   b. Annexes A, B and C must be signed and stamped, Attach only relevant documents.

   c. Please complete all document as per given format. Do not use any other format or letter head. Offer may be rejected if given format is not followed.

   d. Validity of offer will be 90 days.

   e. Delivery period will be 75 days after the date of award of contract.

   f. Tender(s) must be accompanied with a Bid Bond in agreement of faithful compliance of the conditions of Contract/Purchase Order. This amount will be equivalent to 5% of the total quoted value. In case of non-acceptance of any offer, the Bid Bond will be returned to the bidder by fastest possible means. The Bid Bond amount submitted by the successful bidder will however, be refunded on effective termination of Contract/ Purchase Order. (The Bid Bond will be forfeited in case of default by the bidder from his commitments made through his offer). Submission of Bid Bond is mandatory, otherwise your offer will be rejected.

   g. 2 years warranty against 5% bank guarantee will be required from the successful bidders from the date of commissioning.

h. Rates should be quoted on Free Delivery basis at NUTECH Islamabad.

4. We reserve the rights to accept or reject any or all tenders as a whole or in part without assigning any reason whatsoever. The decision in this regard will be firm, final and binding on all bidders.

DD (Supply Chain Management)

NATIONAL UNIVERSITY OF TECHNOLOGY

SUPPLY CHAIN MANGEMENT OFFICE

TECHNICAL OFFER

Annex A

User Reference No **Civil Lab Egpt-002**___ Date: **21-01-2019**

Technical Specification

Ser	Part No	Nomen/ Experiment	Description	Country of Origin	A/U	Qty Req	Bidder Compliance			Tech Scrutiny to be done by user	
							Yes	No	Alternate Offer	Accepted	Rejected
										Reason of Rejection	
1. 1.	-	HYDRAULIC BENCH	Hydraulic bench with two variable speed pumps. Must include Constant Head Inlet Tank Variable Head Outlet tank Feed Block Manometer with high pressure reading and digital display capability Hook Gauge and Scale The bench must be capable and meet operational requirement of the below mentioned modules and accessories.	North America/Europe/UK	No	1					
	1a	FLOW OVER WEIRS	WEIRS – Compatible with the hydraulic bench. Understanding the use of weirs to regulate or measure the flow of water is both useful and interesting. Offer two products comprising of sets of weirs. The Weirs are	North America/Europe/UK	No	1					

			mounted on the location studs provided at the end of the flow channel in the bench, and depth of water is measured with the hook gauge.							
	1b	ORIFICE EXPERIMENT	ORIFICE EXPERIMENT - ADVANCED Compatible with the hydraulic bench. Four different orifices with different shapes (square and triangular) and different entry profiles to round orifices (Board Mouthpiece and Bell mouthed). Determination of the discharge coefficient Comparison of time for emptying a vessel	North America/Europe/UK	No	1				
	1c	PUMP TEST SET	Compatible with the hydraulic bench Speed display with one Wattmeter. Pump arrangement (2 variable speed pumps & speed displays) and Wattmeter. This bench is equipped with 2 variable speed electric motors each driving a centrifugal pump which enables each pump to be run over its full speed range individually or in a parallel or series arrangement. Suitable associated pipework and valuing arrangements are supplied to allow easy operation of both pumps in either series or parallel configurations. This allows the approximate doubling of discharge flow and head when operating in parallel and series modes respectively. Suction and delivery pressures can be varied by means of the inlet and outlet valves on the P6100 Hydraulics Bench and displayed on a bourdon pressure gauge. Flow measurement is	North America/Europe/UK	No	1				

			measured via calibrated weir or stepped volumetric measuring tank supplied with P6100 Hydraulics Bench. A Wattmeter is included to measure the electrical input to the pumps. PUMP PERFORMANCE 42 litres per minute against 5 metres head. Maximum head of 20 metres of water at zero flow.							
	1d	Bernoulli Apparatus	A dye injection system is provided which allows for a single filament of dye to be introduced into the entrance to the convergent section to enable laminar and turbulent flow regimes to be demonstrated. The differential head across the test section can be varied from zero up to a maximum of 450 mm. The test section is manufactured from acrylic sheet. The convergent divergent duct is symmetrical about the centre line with a flat horizontal upper surface into which the eleven static pressure tappings are drilled. The lower surface is at an angle of 4° 29'. The width of the channel is 6.35 mm. The height of the channel at entry and exit is 19.525 mm and the height at the throat is 6.35 mm. The static tappings are at a pitch of 25 mm distributed about the centre and therefore about the throat	North America/Europe/UK	No	1				
2.	-	FREE & FORCED VORTEX Apparatus	FREE AND FORCED VORTEX APPARATUS Free and Forced Vortex Apparatus for the study of the shape of 'free and forced vortices' consists of a 250 mm diameter cylindrical, transparent vessel 180 mm depth, having two pairs of diametrically opposed inlet	North America/Europe/UK	No	1				

			tubes of 9.0 mm and 12.5 mm diameter. The 12.5 mm diameter inlet tubes which are angled at 15° to the diameter, so that a swirling motion is imparted to the liquid entering the vessel, are used as entry tubes for the free vortex experiment. A smooth outlet is centrally positioned in the base of the vessel and a set of push-in orifices of 24, 16, 12 and 8 mm diameter is supplied to reduce the outlet diameter to a suitable value. The profile of the vortex formed at the top of the vessel is determined by a gauge, housed on a diametrically mounted bridge piece, which measures the diameter of the vortex at various depths. This gives the co-ordinate points required to plot the vortex profile. The forced vortex is created in the vessel described above by using as the inlet the 9 mm bore tubes which are angled at 60° to the diameter. The input water from these tubes impinges on a simple two blade paddle which acts as a stirrer/flow Straightener. The water 'leaves' the vessel via the 12.5 mm diameter angled tubes which are used as the 'entry' tubes for the free vortex experiment. The two bladed paddle rotates on a vertical shaft supported by a bushed plug, in the hole used as the outlet for the free vortex experiment, and located at the top by a suitable hole in the bridge piece fitting across the diameter of the vessel. This bridge piece also houses the probes required to determine the co-ordinates of the vortex profile to							

			be measured.							
3.	-	FLOW CHANNEL	FLOW CHANNEL - 2.5M The 2.5 m and 5 m Flow Channel apparatus comprising flow straightening section at inlet complete with set of glass beads mounted on stand with spirit level micrometer level adjustment screw, set of weirs including sharp crested, overshot weir, triangular hump section weir, broad crested weir, hydraulic jump sluice gate and water supply pipe. Outlet flow controlled by undershot weir	North America/Europe/UK	No	1				
4.	-	LAMINAR FLOW TABLE	HELE SHAW APPARATUS TWO DIMENSIONAL POTENTIAL FLOW APPARATUS Based on the well-known Hele Shaw experimental method. This unit provides a parallel laminar water flow field to allow a full study of the low Reynolds number flow patterns around submerged models representing cylinder, aero foils, bluff bodies, knife edge weirs etc. or through various passages such as valve bodies, nozzles etc. Four independently controlled sinks and sources permit the study to be extended to more complex problems involving fluid removal or addition at discrete points in the potential flow. The apparatus is equipped with multiple dye injection to provide flow visualization. Alternative passage and submerged models can be easily cut from the flexible sheet material supplied. A supply of de-aerated water improves the quality of the experiment	- North America/Europe/UK	No	1				
5.	-	PELTON WHEEL	PELTON WHEEL Pelton Wheel consists of a model	- North America/E	No	1				

			Pelton Wheel mounted on a base plate and fitted with a friction dynamometer as illustrated in Fig. 2 overleaf. The design of the Pelton Wheel follows typical industrial practice with a horizontal shaft, single horizontal jets produced by a single nozzle fitted with a needle or spear regulator, and a wheel fitted with multiple (16) elliptical ridged buckets at a mean diameter of 100 mm. The nozzle is positioned in the same plane as the wheel and arranged so that the jet of water impinges tangentially on to the buckets. The friction dynamometer consists of a 60mm diameter brake wheel fitted with a fabric brake band. The brake band is tensioned by a weight hanger and masses with the fixed end being secured via a spring balance to the support frame.	urope/UK						
6.	-	PERMEABILITY TANK	PERMEABILITY TANK Permeability Apparatus provides the basis for experimental studies of permeability, seepage and drainage, flow nets, lateral and uplift pressures, and the stability of slopes utilizing simulated two dimensional hydraulic models, with integral dye injector system, de-colorizing filter and variable speed pump control. Permeable Medium comprising 150 kg of washed and graded high silica sand containing particle sizes 0.2 mm to 1.0 mm. FEATURES □ Two-dimensional permeability tank □ Stainless steel mesh end baffles	- North America/E urope/UK	No	1				

			□ Independently adjustable supply and drain header □ Models of impermeable sheet piling and foundation slab □ Permeable dam toe-filter □ Fourteen pressure tapings and multitube manometer □ Dye injection system for tracing flow patterns and activated carbon de-colourising filter □ Scratch resistant toughened glass front and rear sides							
		LOT 2. ENGINEERING MECHANICS LABORATORY **Make: UK, USA, France, Germany only**							
7.	-	TORSIONAL VIBRATIONS APPARATUS	TORSIONAL VIBRATIONS APPARATUS This unit imparts simple harmonic motion to the torsion shaft and comprises an electric motor with closed-loop speed control driving a crank mechanism with phase control by a differential gear unit. Crank angle is read directly from the phase angle dial, while crank speed is shown on an analogue meter in the Frequency Control Unit which contains all the electronic equipment for the closed-loop speed control over the frequency range 0 - 10 Hz. □ HYDRAULIC DAMPING UNIT A semi-rotary, silicone fluid viscous damper with coefficient adjustable from 0.1 to 1.4 Nm/rad/s with calibrated knob. □ TRANSDUCER UNIT Two precision angular motion transducers are provided and can be clamped adjacent to any of the bearing housings. They comprise carbon film potentiometers and are connected to a bridge circuit with	-	No	1				

			its own trim control and power supply. The output is adequate to drive an oscilloscope or thermal array recorder with a gain of 0.05 V/ cm. TORSION SHAFT AND INERTIA DISCS One torsion shaft is provided. This is of steel approximately 6.3 mm diameter but it can be replaced by any round bar in the diameter range 5 to 8 mm. Three sizes of inertia disc are provided and the largest has a groove around the periphery and scale calibrated in radians. Torsional Vibration Apparatus comprising D section tubular steel bed with feet for bench mounting, bearing housing (4) furnished with hollow spindle and fitted chuck and flange, inertia discs (2 plain, 1 divided) torsion shaft, geared drive assembly with differential crank mechanism, hydraulic damping unit, transducer units (2) and frequency control unit. Weight: 40kg Length: 1.6m, Width: 0.2m, Height: 0.4m, Net.							
8.	-	Extension & COMPRESSION OF SPRINGS	EXTENSION & COMPRESSION OF SPRINGS Wall mounted apparatus (for loading spiral springs in either tension or compression with direct gravitational loads) with accurately divided scale and vernier. Supplied complete with four compression and four extension springs each approximately 18 cm long (7") long.	-	No	1				
9.	-	FRICTION ON AN INCLINED	INCLINED PLANE/SLIDING FRICTION APPARATUS The robust apparatus is of all	-	No	1				

		STEEL PLANE	metal construction with an Inclinable 90 cm ground steel plane furnished with course and fine angular adjustment which is determined with the use of a clinometer. Weight carriers of 8 different sliding frictional materials are included together with load masses.							
10.	-	ENERGY OF FLYWHEEL	ENERGY OF FLYWHEEL Energy of Flywheel apparatus is an extremely robust and versatile unit comprising of the main flywheel, the mass of which can be varied by adding and removing two rings and one disc, and mounted on a heavy duty stand suitable for mounting. The unit also includes a vibrating arm to enable traces to be drawn on a paper strip positioned on the circumference of the flywheel. The fully assembled flywheel, which measures 300 mm in diameter and is 75 mm wide, is fitted with a special antifriction bearing. The assembly, of overall dimensions 450 mm long by 400 mm wide by 360 mm high, is supplied complete with paper roll, bottle of ink, spare vibrator brush, ink feed brush and length of cord, but without masses and hanger.	-	No	1				
11.	-	CENTRIPETAL FORCE APPARATUS	CENTRIPETAL FORCE APPARATUS Bench mounted frame carrying a 300 mm diameter turntable and two pairs of masses mounted on radius rods, together with a control box incorporating a variable speed electric drive complete with tachometer.	-	No	1				

12.	-	ACCELERATION APPARATUS	ANGULAR ACCELERATION APPARATUS The apparatus consists essentially of a low inertia circular disc mounted onto a vertical axle that can be rotated under the action of a falling mass. The low inertia circular disc, which is 300 mm diameter and 50.8 mm thick, is manufactured from plywood and is keyed to a 12 mm diameter by 305 mm long stainless steel axle. A 50 mm diameter pulley is attached to the axle. The circular disc and axle are mounted with the axle vertical between pivots, one on the base and one on a radial brace from a vertical pillar. The upper surface of the circular disc is scribed with circles of 100 mm, 150 mm, 200 mm and 250 mm diameter and two holes are provided on each circle as sites to locate additional inertia discs. Four inertia discs are provided, each disc is 50 mm diameter by 15 mm and is manufactured from brass with a mass of 250 gm. A spring steel vibrator, fitted with a fine brush, is supported from the base on a block so that it vibrates at a natural frequency of 5 Hertz. The brush is attached to the vibrator by a hollow screw which allows its position to be readily adjusted so that it draws a fine line on a paper strip fastened to the cylindrical rim of the circular disc. A 10 gram mass hanger and a set of brass masses of 3 off 50 gm, 2 off 20 gm and 1 off 10 gm are provided to accelerate the system via a 1/16" cord passing over a pulley	-	No	1				

			mounted on the vertical pillar and fastened to the pulley on the circular disc axle. A release mechanism is provided which will simultaneously release the vibrator and the circular.							
13.	-	HOOK'S LAW	LINEAR VIBRATION APPARATUS A 1 kg thrust vibration generator - stroke 2.54 mm and combined oscillator/drive amplifier unit, 3 Hz to 50 Hz in one range, with experimental accessories; amplitude indicator with drive assembly, double cantilever with 12 magnetic load units, suspension gantry with measuring scale and spring mass system with 6 load units, all contained in an aluminum carrying case.	-	No	1				
14.	-	FLOOR MTD FRAME	FLOOR MTD FRAME LOAD CELL DISPLAY	-	No	1				
15.	-	PORTAL FRAME	PORTAL FRAME	-	No	1				
LOT 3. STRUCTURE LABORATORY Make: UK, USA, France, Germany only										
16.	-	Structures Platform with Module of BENDING OF BEAMS	STRUCTURES PLATFORM Structures Platform should be able to support various other optional Structures Experiment Modules. Made from precision, slotted aluminium extrusions and steel endplates, this module should be able to form a sturdy, rigid, stable and strong experiment platform for easy assembly and to fit on any standard desktop, it speeds up and simplifies setting up of experiments. Adjustable feet are required to	-	No	1				

			ensure the platform is level before use. Easy-to-read scales on each side of the platform is required to help students to position the parts of their experiment precisely, and removes the need for an additional rule. The Platform must include the USB Interface Plug and Play 'Hub' to simplify connections. The Hub converts signals from the sensors on each experiment module to USB data format for computer display and data acquisition. Manufacutrer must have used LabVIEWTM from National Instruments to create user-friendly data acquisition software that works with each of the optional / additional Experiment Modules. The data acquisition (DAQ) software should be able to experiment data to the universal comma separated value format (CSV) for use in spreadsheet and many other software applications. **Bending of Beam** **EXPERIMENTS AND TOPICS** 1. Stress and strain relationship. 2. Strain gauges as instruments. 3. Finding the neutral axis by experiment and calculation. 4. How the beam cross-section dimensions affect the second moment of area (I value) and neutral axis.							

17.	-	THREE HINGED ARCH	**EXPERIMENTS AND TOPICS** 1. Horizontal reaction due to a varying single point load on a statically determinate structure. 2. Horizontal reaction due to a moving single point load on a statically determinate structure. 3. Horizontal reactions due to a uniformly distributed load on a statically determinate structure. 4. Influence lines and superposition. 5. Lines of thrust in an arch. 6. Graphical construction of a bending moment diagram for point loads. 7. Maximum bending moments due to a load on an arch. • Works with user-friendly software made using LabVIEWTM from National Instruments. • Direct reading of horizontal reaction for quick and simple experiments • Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.	-	No	1				
18.	-	SHEARING FORCE APPARATUS	**EXPERIMENTS AND TOPICS** 1. Shear force at the cut due to a varying single point load. 2. Shear force at the cut due to a moving single point load. 3. Shear force at the cut due	-	No	1				

			to a uniformly distributed load. 4. Influence lines and superposition Works with user-friendly software made using LabVIEWTM from National Instruments. 5. Direct reading of shear force at the 'cut' for quick and simple experiments. This product must include a uniformly distributed load (UDL) that may be applied across the span of the Beam for comparison of results with a single point load. The load cell also needs to connect to the USB Interface Hub of the Structures Platform for computer display and data acquisition. Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
19.	-	BENDING MOMENT APPARATUS	**EXPERIMENTS AND TOPICS** 1. Bending moment at the cut due to a varying single point load. 2. Bending moment at the cut due to a moving single point load. 3. Bending moment at the cut due to a uniformly distributed load. 4. Influence lines and superposition. **Additional Experiments** 5. Show that shear centre can	-	No	1				

			be outside beam section boundaries. 6. Shear centre of an unsymmetrical section. 7. Horizontal and vertical deflection in symmetrical and unsymmetrical sections at different loads and load angles. 8. Using Mohr's circle to find Principal Axes and Second Moments of Area. Direct reading of bending moment at the 'cut' for quick and simple experiments. Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
20.	-	FORCES IN A TRUSS	**EXPERIMENTS AND TOPICS** 1. Strain Gauges as instruments. 2. Forces within and deflections of: 3. A truss structure that is statically determinate. 4. A truss structure that is statically indeterminate. 5. Member forces by the Method of Joints and Method of Sections. 6. Member forces by the use of the strain energy method. 7. Advantages and disadvantages of both versions of the truss. Must use Strain Gauge Amplifier and multiple strain gauges for measurement of force in each	-	No	1				

			member of the truss. Must include following items A. Strain Gauge Amplifier, 16 input B. Pinned and roller supports C. Additional Upright D. Trammel Arm with Digital Indicator of resolution 0.001 mm E. Load Cell of maximum capacity 650 N F. Pre-assembled truss of five joint bosses and eight square-section members G. Three cables for computer display and data acquisition H. Inclinometer I. Hexagon tools for fixings J. Storage Tray K. Simulation Software L. User Guide Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
21		Semi-automatic compression machine Double Chamber 600/15 kN cap. for testing cement, mortar.	Semi-automatic compression machine Double Chamber 600/15 kN cap. for testing cement, mortar, resin, hydraulically bound mixtures and other materials. Conforming to EN 196-1, 1015-11, 12390-5, 12390-6, 1338, 13286-41, 993-5, ASTM C109, C348, C496, C293, C78 using the suitable accessories. - Compression platens 165mm diameter x 30mm thickness - Digital readout unit - LCD display 4x20 characters and		No.	1				

			6 keys membrane keyboard - Load measurement: pressure transducer on 600 kN chamber, high accuracy load cell on 15kN chamber - LAN port for PC connection and USB port for easy data storage on pen-drive - Integrated printer available on request - Dayligths: vertical 345/205 mm; horizontal 265/- mm - Piston travel 50/30mm - Limit switch preventing pistons overtravel - Load measurement accuracy: class 1 to EN 12390-4 / class A to ASTM E74 starting from from 10% of full scale for both chambers; special calibration from 6kN for 600kN chamber and from 0.75kN for 15kN chamber available on request - Supplied complete with traceable calibration certificate for load measurement accuracy 230V/50-60Hz/1Ph							
22	-	DEFLECTION OF BEAMS	EXPERIMENTS AND TOPICS 1. Beam bending formula and structural 'stiffness'. 2. Deflection due to point loads and UDLs (uniformly distributed loads). 3. How beam fixings affect deflection of: 4. Simply Supported beams 5. Fixed or 'Encastre' beams 6. Cantilever beams 7. Propped Cantilever 8. Shape of a deflected beam. 9. Beam length and deflection.	-	No	1				

			10. Beam material and deflection—the Elastic (Young's) Modulus. 11. Beam cross-section and deflection—the Second Moment of Area ('I' value) 12. Pure Bending of a beam. 13. Reciprocal Theorem (Maxwell-Betti). Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
LOT 4. CIVIL ENGINEERING LABORATORY **Make: Italy, Germany, France, Canada, Australia only**										
23.	-	UNIVERSAL TESTING MACHINE (2000 KN)	Automatic Computerized Universal Testing Machine, 2000 kN capacity, HPU 200 power unit, for tensile/transverse/bend and re-bend tests on steel and compression/flexural/indirect tensile tests on concrete and other materials. 380V/50Hz/3ph. The machine is conforming to the following Standards: EN ISO 6892, EN 15630, ASTM A370, EN ISO 7500-1 (class 1 from 20 kN to 2000 kN). System includes:- Upper and lower hydraulically operated jaws -High precision load cell for load measurement -PC and complete software package for different test types;f-Five set of grippers for rounds from 12 mm to 78 mm diameter; -Four set of grippers for flats up to 72 x 100 mm (thickness x width);- Transverse test attachment with roller supports dia.70 x 200 mm (max span 900 mm) and 2 loading rollers dia. 80 mm and 60 mm.Applications: The machine can perform (with the suitable							

			accessories): Tensile tests on steel rounds up to 78 mm dia., flats up to 72 x 100 mm, wire strands up to 15.2 mm dia. and electro welded steel grid; Transverse and Bend and re-bend tests on steel specimens; Shear test on rounds; Compression tests on concrete cubes and cylinders; Flexural test on concrete beams; Indirect tensile test on cylinders, cubes and paving blocks; Determination of the Modulus of Elasticity of concrete; many others tests on Rock, Masonry units, Refractories, etc. with the suitable accessories available on request. Main features:-Sturdy four-columns test frame with 850 mm vertical daylight (for compression and tensile tests) and 850 mm horizontal clearance; -Piston travel: 300 mm;-Max distance between tensile grips: 550mm (+ 300mm piston travel);-Motorized crosshead for easy and fast (270 mm/min) adjustment of the vertical daylight by push button panel;-load measurement by High precision load cell providing high accuracy from 1% of f.s. Include load cells for Mechanical testing 0-500KN. Load cells for testing concrete and civil materials 500-1000kn up to 2000KN;-Hydraulic gripping system operated by push button panel; -Front open crosshead for easy insertion of tensile specimens; -PC controlled. Completely automatic test execution with closed-loop P.I.D. control; -Compact ergonomic design (with small footprint) advanced control						

			console housing hydraulic pack, electronic and PC; -Optional control of a second frame. Hydraulic group -Dual stage pump: centrifugal low pressure for fast approach (max. flow rate 9 l/min) automatically switching to radial multi- piston high pressure (max. flow rate 3.2 l/min) for loading;-Max piston speed (no load condition): 100mm/min;-Oil flow control by servo-controlled proportional valve;-AC motor 3000 W; -Maximum working pressure 650 bar; -Oil temperature controlled by air cooling system; -Console cabinet lined with soundproofing material for operator's comfort. Hardware and firmware -Effective resolution 131.000 points; -Load resolution [kN]: 0.02 kN -Crosshead displacement resolution[mm]: 0.01 mm; -Control frequency 250 Hz; -Sampling rate 500 Hz; -6 channels (one dedicated to crosshead displacement) to measure elongation /displacement/strain with potentiometric, conditioned LVDT and magnetostrictive transducers; -4 channels for strain measurements with strain gauges; -2 channels for load sensors: load cell and load cell/pressure transducer of possible second frame; -simple multi-sensors connection and calibration file selection; -digital linearization of the							

			calibration curve. Software package: The machine is supplied complete with RTM (Real Time Management) user interface environment allowing remote control of the complete system for automatic test execution according to the selected test type, calculation of results, graphical and numerical management of data. The following software modules are available: *UTS Software (included) for steel tensile testing under load/stress control and crosshead separation control. *DATAMANAGER software (included) for compression, flexure and indirect tensile test on concrete, cement specimens and other construction materials. *E-MODULE software (on request) for Poisson ratio and Young Modulus determination on concrete. ACCESSORIES: *Electronic universal extensometer to measure the elongation of wires, steel rebars and round steel specimens - Measuring base: 50 to 200 mm - Linearity: better than +- 1% - Max. travel: 10 mm *Compression device. Includes: upper and lower platens dia. 216mm and spherical seat. *Shear test accessory. Including: - Small double shear test device with 5 sets of bushes for samples of dia. 5mm, 8mm, 12mm, 16mm and 20mm. - Big double shear test device with 5 sets of bushes for samples of							

			dia. 25mm, 30mm, 35mm and 40mm.							
24		Fully Automatic Flexure Machine	High stiffness flexural frame, 350 kN capacity EN 1339 | EN 1340 | EN 12390-5 | ASTM C78 | ASTM C293 | ASTM C1550 | EN 14488-5 | ASTM C1609 | ASTM C1018 350 kN cap. High rigidity flexural frame, complete with load cell and connection kit for separate control console (Displacement Controls). High rigidity (200 kN/mm), especially suitable for testing FRC and sprayed concrete Double testing mode: parallel and orthogonal For testing different kind of specimens (beams, flagstones, slab) Suitable for testing Round panel dia.800 mm to ASTM C1550 Max span between lower rollers: 1.5m Load measurement by high precision load cell Piston return by counterweights Piston travel limit switch Include set of spacers to reduce the vertical daylight by: 50mm, 100mm and 150mm Max cap. kN: 350 Load sensor: Load cell Horizontal clearance [mm]: 900 istance between upper rollers (adjustable) From 100 to 500mm, or single roller Distance between lower rollers - Parallel testing mode (adjustable) From 150 to 800mm Distance between lower rollers -							

			Orthogonal testing mode (adjustable) From 850 to 1500mm Piston travel mm 130 Overall dimensions (lxwxh) mm 1150x 1600 x 1550 Weight approx. kg 520 CONSOL Console Must have Following • Large graphic capacitive color 7” display, 800 x 480 pixel • Dual user interface via console display or PC with software • LinK-lab integration package for connection with bar code readers, balances, calipers, etc. • Variable speed permanent magnet DC motor • For superior performances at low load rates and low load value. Soft platen-to-specimen contact for better accurate speed control from the very beginning of the ramp • Active control of up to 4 frames by selection via display/PC (no manual operation/valve). • ASTM C39 full conformity (initial pause for specimen alignment, double load rate option, height/diameter correction factor, final calculation of effective load rate applied, peak sensitivity in %) • Oversampling function increasing the sampling rate when specimen is approaching the failure for better identification of peak value > 524,000 points high-resolution/stability analogue channels							

			> 6 channels to be factory configured:
			・2 channels for load sensors
			・4 channels for load or displacement/strain sensors
			> Control frequency 250 Hz
			> Sampling frequency 250 Hz
			> 7”, 800 x 480 pixel, 16 M colors, icon-driven capacitive sensing touchscreen graphic display
			> Unlimited storage capacity for test data on internal 8 GB SD card
			> USB port for teste data storage on external USK memory stick
			> Ethernet port for PC / internet / network communication
			> Optional integrated graphic printer including Load-Time plot
			> RS 232 port for data downloading in ASCII format
			> Manufacturer should have possibility to upgrade the system to Wi-Fi or GSM module for future upgrade if required
			• Serial printer on the control panel allowing load/time plot.
			• Software package for displacement controlled tests allowing:
			  • Automatic calculation of test results according to EN 14651, 14488-3, 14488-5, UNI 11039-2, ASTM C1550, C1609, C947, UNE 83515
			  • 8 test pre-set testing procedures according to the above Standards
			  • Customizable test procedure allowing desired loading history
			  • Possibility to change in real time the test parameters:							

			target load/displacement, control variable, test speed. Data saving rate 250/sec							
LOT 5. AGGREGATE TESTING LABORATORY Make: Italy, Germany, Canada, Australia only										
25	-	Seive Analysis	• Pan and cover 200 mm dia	-	No	1				
	-		• 200 mm dia ISO (BS,UNI) sieve op.75 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.150 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.212 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.300 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.425 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.600 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.850 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.1,18 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.1,7 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.2,36 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.3,35 mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm	-		1				
	-		• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm	-		1				
	-		• 300 mm dia ISO(NF,DIN) sieve op.20mm	-		1				
	-		• 300 mm dia ISO sieve op.37,5mm	-		1				
	-		• 300 mm dia ISO(NF,DIN) sieve	-		1				

			op.50mm							
	-		• 300 mm dia ISO(NF,DIN) sieve op.63mm	-		1				
	-		• 300 mm dia ISO(NF,DIN) sieve op.75mm	-		1				
	-		• Pan and cover 300 mm dia	-		1				
	-		• Sieve Brush	-		1				
26	-	Flakiness and Elongation	• Flakiness Gauge	-	No	1				
			• Elongation Gauge			1				
			• Flakiness sieves test set			1				
			• Set of 14 aggregate grids to EN 933-3. Opening mm:2.50 - 3,15 - 4 - 5 - 6.3 - 8 - 10 - 12.516 - 20 - 25 - 31.5 - 40 -50			1				
			• Aggregate shape gauge [ALD]			1				
27.	-	Density Measurer	Bulk Density Measure 1L, 2L, 5 L and 10 Liters	-	No	1				
28.	-	Chemical Tests for Sulphate and Chloride	Measuring Cylinder 100ml	-	No	1				
			• Measuring Cylinder 500ml	-		1				
			• Glass Beaker 600ml	-		2				
			• Volumetric Flask 1000ml with stoper	-		1				
			• Bulb Pipette 50ml Capacity	-		1				
			• Wash Bottle Polythene 500ml	-		2				
			• Regeant Bottle 1000ml Capacity	-		1				
			• Electronic Top Loading Balance, Capacity 30kg x 1gm	-		1				
LOT 6. HIGHWAY LABORATORY Make: Italy, Germany, Canada, Australia only										
29.	-	Asphalt Laboratory Binder Content	1500 g cap. digital centrifuge extractor. Speed control up to 3600 r.p.m. 230V, 50-60Hz, 1ph.	-	No	1				
30.	-	Sieve Analysis	• Sample Splitter with opening 30mm	-	No	1				
	-		• Sample Splitter with opening 50mm	-		1				
	-		• Pan and cover 200 mm dia	-		1				
	-		• 200 mm dia ISO (BS,UNI) sieve op.75 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve	-		1				

			op.150 microns							
	-		• 200 mm dia ISO (BS) sieve op.212 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.300 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.425 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.600 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.850 microns	-		1				
	-		• 200 mm dia ISO (BS) sieve op.1,18 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.1,7 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.2,36 mm	-		1				
	-		• 200 mm dia ISO (BS) sieve op.3,35 mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm	-		1				
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm	-		1				
	-		• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm	-		1				
	-		• 300 mm dia ISO(NF,DIN) sieve op.20mm	-		1				
	-		• 300 mm dia ISO sieve op.37,5mm	-		1				
			• 300 mm dia ISO(NF,DIN) sieve op.50mm	-		1				
			• 300 mm dia ISO(NF,DIN) sieve op.63mm	-		1				
			• 300 mm dia ISO(NF,DIN) sieve op.75mm	-		1				
			• Pan and cover 300 mm dia	-		1				
31.	-	Mortar Mixer	• Mortar mixer complete with stainless steel beater and bowl 5 litres cap. 230V, 50Hz, 1ph.	-	No	1				

			• Heating mantle for 5 litres cap. bowl. 230V, 50-60Hz, 1ph.			1				
32	-	Marshal Machine	Bench compression testing machine with motorised ram, two-column structure and adjustable crossbeam. Loading capacity: 50kN Clearance between columns: 270mm Test speed: 50.8 mm/min [Marshall test] Ram travel: 120mm Power rating: 750W, Supplied with load ring 30kN capacity with peak hold function, complete with 0.001 mm resolution dial gauge [fully conforming to the standards]. 230V, 50Hz, 1ph	-	No	1				
33	-	Flash tester	Cleveland flash tester. CE model with protection.230V/50-60Hz/1ph	-	No	1				
34	-	Muffle Furnace	Muffle furnace 1100°C max temperature 230V/50-60Hz/1PH Stainless steel oven tongs	-	No	1 1				
35.	-	Penetration Test	• Semiautomatic digital penetrometer with micrometer vertical adjustment and digital penetration measurement. 230V, 50-60Hz, 1ph.	-	No	1				
			• Saybolt thermometer 19-27° C			1				
			• Transfer dish with support			1				
			• Sample cup dia 55x35 mm. Kit of 6.			1				
			• Aluminium cup dia 70x45 mm.			1				
			• Set of 6 Verified penetrometer needle			1				
			• Penetrometer needle.			1				
			• Set of 3 Water temperature controller for penetration test, complete with heating and cooling controller. 230V/50-60Hz/1ph			1				
36	-	Hot plate	Hot plate only with cartering/ protection device for 81-B145/C 230V/50-60Hz/1Ph.	-	No	1				
37	-	Digital Balance	420g x 0.001g resolution digital	-	No	1				

			balance, under balance weighing facility, RS232 serial output, battery [rechargeable] and mains operated, complete with DKD calibration certificate. 230V/50Hz/1ph							
38	-	Digital Balance	Digital Electronic Balance Capacity 30kg Resolution: 1gram	-	No	1				
LOT 7. CONCRETE LABORATORY **Make: Italy, Germany, Canada, Australia only**										
39.	-	Preparation of Test Specimen	• 1. Cube Mould (Cost Iron) Size 6" x 6" x 6"	-	No	24				
			• Cube Mould (Cost Iron) Size 4" x 4" x 4"			12				
			• Beam Mould Size 150mm x 150mm x 750mm			3				
			• Compacting Bar			1				
			• Mould Oil (25 kg)			1				
			• Wire Brush			1				
			• Steel Float			1				
			• Electric Motorized Mixer for 1/2 bag concrete			1				
			• Aluminium Scoop Large size			1				
			• Galvanized Sample Tray 48" x 44" x 4" (Approximately)			1				
			• Transportation / storage container Approx. 20 Liters			6				
			• Large caring Tank of size 3 feet x 2.5 feet x 5 feet			1				
40.	-	Vibrating Table	Vibrating table 1250x625 mm with retaining edges. Supplied complete with 2 vibrating units, clamping device for the moulds and waterproof CE pedal Switch. 230V/50Hz/1Ph	-	No	1				
41.	-	Density of Hardened Concrete	Buoyancy Balance 15kg x 1g, c/w frame, tank and cradle	-	No	1				
42	-	Sieve Analysis	• Pan and cover 200 mm dia	-	No	1				
			• 200 mm dia ISO (BS,UNI) sieve op.75 microns			1				

			• 200 mm dia ISO (BS) sieve op.150 microns			1				
			• 200 mm dia ISO (BS) sieve op.212 microns			1				
			• 200 mm dia ISO (BS) sieve op.300 microns			1				
			• 200 mm dia ISO (BS) sieve op.425 microns			1				
			• 200 mm dia ISO (BS) sieve op.600 microns			1				
			• 200 mm dia ISO (BS) sieve op.850 microns			1				
			• 200 mm dia ISO (BS) sieve op.1,18 mm			1				
			• 200 mm dia ISO (BS) sieve op.1,7 mm			1				
			• 200 mm dia ISO (BS) sieve op.2,36 mm			1				
			• 200 mm dia ISO (BS) sieve op.3,35 mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm			1				
			• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.20mm			1				
			• 300 mm dia ISO sieve op.37,5mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.50mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.63mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.75mm			1				
			• Pan and cover 300 mm dia			1				
LOT 8. SOIL & GEOTECHNICAL LABORATORY **Make: Italy, Germany, Canada, Australia only**										

43	-	Pocket penetrometer	Heavy duty pocket penetrometer Pocket penetrometer, range 0-5 MN/m2	-	No	1				
44.	-	Paraffin wax	Paraffin wax 1000 g	-	No	20				
45	-	Sieve Analysis	• Pan and cover 200 mm dia	-	No	1				
			• 200 mm dia ISO (BS,UNI) sieve op.75 microns			1				
			• 200 mm dia ISO (BS) sieve op.150 microns			1				
			• 200 mm dia ISO (BS) sieve op.212 microns			1				
			• 200 mm dia ISO (BS) sieve op.300 microns			1				
			• 200 mm dia ISO (BS) sieve op.425 microns			1				
			• 200 mm dia ISO (BS) sieve op.600 microns			1				
			• 200 mm dia ISO (BS) sieve op.850 microns			1				
			• 200 mm dia ISO (BS) sieve op.1,18 mm			1				
			• 200 mm dia ISO (BS) sieve op.1,7 mm			1				
			• 200 mm dia ISO (BS) sieve op.2,36 mm			1				
			• 200 mm dia ISO (BS) sieve op.3,35 mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm			1				
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm			1				
			• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.20mm			1				
			• 300 mm dia ISO sieve op.37,5mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.50mm			1				

			• 300 mm dia ISO(NF,DIN) sieve op.63mm			1				
			• 300 mm dia ISO(NF,DIN) sieve op.75mm			1				
			• Pan and cover 300 mm dia			1				
46.	-	Sodium	Sodium Hexametaphosphate, (Pack of 1kg)	-	No	1				
47.	-	Sieve Shaker	Electromagnetic sieve shaker for sieves up to 315 mm dia. 230V, 50-60Hz, 1ph.	-	No	1				
48.	-	Digital Balance	Top Pan Digital Balance 4100G X 0.1G	-	No	1				
49.	-	Hydrometer Method	• Hydrometer particle size test set to ASTM D422 -	-	No	2				
			• Constant temperature water bath. 230V/50Hz/Ph			2				
			• Soil hydrometer 152/H			2				
			• Soil hydrometer 151/H			2				
50.	-	Chemical Analysis	• Measuring Cylinder 250ml	-	No	10				
			• Measuring Cylinder 500ml			10				
			• Volumetric Flask 1000ml			10				
			• Quantab chloride titrator type 1175 pack of 40 strips			10				
			• Quantab chloride titrator type 1176 pack of 40 strips			10				
			• Sulphate test strips. (pack of 100)			10				
51	-	Filter Paper Imported/USA	Whatman Filter Paper 15cm (Pack of 100)	-	No	1				
52.	-	Permeability Apparatus	• Constant head permeability cell 75 mm dia.	-	No	1				
			• Stand with 3 manometer tubes			1				
			• Constant level tank			1				
			• Tamping rod dia 8 x 300 mm			1				
53.	-	Falling head permeability	• Falling head permeability cell	-	No	1				
			• Stand with 4 manometer tubes			1				
			• Soaking reservoir							
			• Vacuum control panel for permeameters			1				
			• De airing water tank, 7l capacity. Easy internal cleaning system.			1				

54.	-	**Automatically PC controlled dynamic triaxial system with 15kN electromechanical servoactuation. Supplied complete with PC control and 16 channels data acquisition unit and software.**	Should covers the determination of the modulus and damping properties of soils in either intact or reconstituted states by either load or stroke controlled cyclic triaxial techniques. The system should also perform traditional triaxial tests such as UU, CU and CD as well as more advanced tests such as stress paths and K0. Features: =- Electromechanical Servoactuation, no need of compressed air or hydraulic power supply for the vertical force - Maximum Dynamic Load: 15 kN - Maximum Static load: 10 kN - Robust, high-strength and compact 2 column reaction frame. =- Capable to accept triaxial cell for sample up to 100 mm diameter =- Complete test automation of all stages using a high sensitivity closed loop P.I.D. feedback (up to 10kHz). =- Standard and user defined wave shapes programmable by the user matching the on-site measurements (earthquakes) =- Transducers calibration and verification controlled by software =- Manual and automatic emergency shut off functions =- Air reservoir provided with two servo-valves for cell and back pressure control =- compact Dynamic Controller connected to the PC via Ethernet communication link (100Mbit/s) - 16 bit ADC input channels for transducers (16 channels) - Multivoltage - Multifrequency		No	1				

			power supply 230 50 Hz or 110 V, 60 Hz **Transducers** 25kN capacity submersible load cell Axial displacement transducer +/- 25mm Pressure transducer 0-1000 kPa, De airing block suitable for banded triaxial cells **Automatic volume change apparatus allowing remote flow control.** **Triaxial cell** Banded triaxial cell for up to 70mm dia. Sample sizes : - Maximum working pressure up to 3500 kPa =- Five inlet points for top/bottom drainage, cell pressure and pore pressure =- Quick coupling for two drainage lines on the base =- Vacuum attachment to be used with Vacuum top cap for extension tests **Accessories for 50 mm dia sample** Pedestal 50mm diameter two pore pressure ports for 70mm triaxial cell Vacuum top cap 50mm diameter with 2 drainage tubes Disc perspex 50mm diameter Pair of porous disc 50mm diameter Rubber membrane 50mm diameter x 200mm long (pack of 10) O ring 50mm diameter (pack of 10)							

			Membrane placing tool for 50mm samples O Ring placing tool for 50mm samples Two part split mould for 50mm diameter sample Filter drains (pack of 50) for 50mm samples Filter discs for 50mm dia sample (pack of 100) Hand sampler complete of cutter, dolly and receiver for 50mm samples Two parts split former with vacuum attachment for 50mm sample **Pressure system** Nylon tubing 6mm bore x 8mm outside diameter, 10 metre length Bladder air/water interface with 1000kPa banded chamber. Triaxial panel two way pressure gauge and hand pump. Outlets for two pressures Air compressor and air filter **De airing system** Air drying unit. For use with Silica gel with indicator Silica gel with indicator. 1000 g De airing water tank, 23l capacity. Easy internal cleaning system. Valve panel for use with de-airing tank Portable vacuum pump, free air displacement 75 l/min, ultimate vacuum 0.1 mbar. 230V/50-60Hz/1Ph Rubber tube dia 6,5 x 12,5mm, 2m long for vacuum pump. Nylon tubing 6mm bore x 8mm outside diameter, 10 metre length Flaring tool							

LOT 9. ROCK MECHANICS LAB. Make: Italy, Germany, Canada, Australia only										
55	-	Rock Piks and Hardness Scale	• Rock pick pointed tip	-	No	1				
			• Rock pick chisel edge			1				
			• Compensation device for up to 4 Wheatstone bridges			1				
			• with 1/4 or 1/2 bridge setup							
			• Strain gauge application kit			1				
			• Connecting terminals. 50 pairs sheet			1				
			• Strain gauge 9,53 mm gauge length. (pack of 5)			1				
			• Strain gauge 20 mm gauge length. (pack of 10)			1				
			• Strain gauge 30 mm gauge length. (pack of 10)			1				
56.	-	Rock index apparatus	• Digital rock strength index apparatus.	-	No	1				
			• Battery operated.							
			• Set of lower and upper platen 52 mm dia with spherical seat for compression test on concrete Microcors			1				
57.	-	Rock hammer	• Rock classification hammer	-	No	1				
			• ASTM universal rock cradle for testing rock cores conforming to ASTM			1				
LOT 10. CEMENT TESTING LABORATORY Make: Italy, Germany, Canada, Australia only										
58	-	Le Chatelier soundness kit	• Le Chatelier soundness kit	-	No	1				
			• Le Chatelier water bath. 220-240V/50-60Hz/1ph			1				
			• Le chatelier flask			1				
59	-	Sparula	Chattaway spatula	-	No	1				
60	-	Prism mould	Two gang prism mould 25x25x285 mm to ASTM C490 for expansion test of cement	-	No	1				
61.	-	Blain apparatus	Blaine apparatus EN196/6	-	No	1				
62	-	Manometer	Manometer liquid 250 ml bottle	-	No	1				

		liquid								
63.	-	Reference Cement	Reference cement according to EN 196.6 and ASTM C204 - pack of 5 g.	-	No	1				
64.	-	Filter paper Imported/ USA	Filter paper for apparatus 62-L0041/A. Dia. 12,6mm Pack of 100 pcs.	-	No	1				
65.	-	Flow table	Flow table Supplied complete with flow mould, hopper and tamper. Conforming to ASTM C230. 230V, 50Hz, 1ph.	-	No	1				
66.	-	Sand	Reference sand to EN 196. 32 bags, tot. 43,20 Kg.	-	No	1				
LOT 11. SURVEYING LABORATORY Make: Italy, Germany, Canada, Australia only										
67.	-	SOKKIA SET65 Electronic Total Station	, 1" reading, 5" Accuracy, memory 24,000 points, double sided display, distance range 3000 meter, Alpha numeric key board, all keys are backlight and glow brightly, so you can see exactly what you are doing, even when working in low light conditions with standard accessories. Along with: (i) - Single Prism Target Set. (ii) - Aluminum Heavy Duty Tripod (Imported).	-	No	1				
68.	-	SOKKIA CX-105C Electronic Total Station -	Laser Pointer, (It takes distance with Prism), 1"reading ,5"accuracy, double side display, distance range with single prism : 5000 meter , with triple prisms : 6000meter, with reflective sheet : 500meter , Guide Light, internal memory 10,000 points + USB, flash memory slot, built in area calculation system, automatic dual axis compensator, with standard accessories (Made in Japan). Along with: (i) - Single Prism Target Set.	-	No	1				

			(ii) - Aluminum Heavy Duty Tripod (Imported).							
69.	-	- SANDING STS752L Electronic Total Station	1" Reading, 2" accuracy, distance range 5000 meter, alphanumeric key board, double side display, magnification 30X, with battery & charger in standard accessories. Along with: (i) - Single Prism Target Set. (ii) - Aluminum Heavy Duty Tripod (Imported).	-	No	1				
70.	-	MATO MTS-805 \ SOKKIA Software Electronic Total Station -	1" reading, 5"accuracy, double sided display, distance range with prism 3500 meter, Battery & charger, memory 50,000 Points, original carrying case in standard accessories.	-	No	1				
71.	-	SANDING Electronic Digital Theodolite	SANDING ET-05 Electronic Digital Theodolite, 1" reading, 5" accuracy, double sided display, with standard accessories.	-	No	1				
72	-	Laser Level -	Laser Level, with standard accessories.	-	No	1				
73.	-	Hand Held Laser Distance Meter -	Hand Held Laser Distance Meter, Area Calculation. Easy to use small & handy measuring with laser fast, simple and innovative saves time.	-	No	4				
74.	-	Strain Gauge (Must be Compatible with the Data Acquisition System Required at Item 75)	• 20 mm gauge length. [pack of 10]	-	No	1				
			• 30 mm gauge length. [pack of 10]	-		1				
			• 60 mm gauge length. [pack of 10]			1				
			• 120mm gauge length. [pack of 10]			1				
			• Adhesive and catalyst agent to glue the strain gauge to the specimen.			1				
75.	-	Load Cell (Must be Compatible with	• 50 Ton class 1 to EN ISO 376. Supplied complete with carryng case.			4				

		the Data Acquisition System Required at Item 75)	• 100 Ton kN class 1 to EN ISO 376. Supplied			2				
			• 200 ton class 1 to EN ISO 376. Supplied			1				
76.	-	Linear Variable Transducer (Must be Compatible with the Data Acquisition System Required at Item 75)	Linear potentiometric transducer, 25 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector			4				
			Linear potentiometric transducer, 50 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector			6				
			Linear potentiometric transducer, 100 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector			2				
77.	-	Data Acquisition system	Data Acquisition system with 32 channels extendable 128 channels. Strain controlled quarter bridge Data Acquisition System should be able to accommodate Strain gauges, LVDTs, Load Cells, and other transducers.			1				
78.	-	Accelerometer	Three dimensional accelerometer +-2g capacity, noise filtration,			12				

			Acquisition system Low impedance, voltage mode • Quartz-shear sensing elements • Ultra-low base strain • Minimal thermal transient response • Lightweight, hermetically sealed titanium case • Conforming to CE Complete in all respects.							
79.	-	Balance China	Digital Top Loading Balance Capacity 6kg x 0.1gm including rechargeable battery	-	No	1				
Items to be Procured from China										
80.	-	Balance China	Electric Plate Form Balance Capacity 60kg x 10gm including rechargeable battery	-	No	1				
81.	-	Lab. Oven China	Digital Thermostatically Controlled General purpose Laboratory Oven Capacity 240 Liters, 220V 50HZ 1PH	-	No	1				
82.	-	Thermometer China	Digital Dial Thermometer Range 0 to 300°C, with collar	-	No	1				
83.	-	Temperature Measurement China	Glass Thermometer for Concrete Range 0 to 200°C	-	No	5				
84	-	Lab. Oven China	Digital Thermostatically Controlled Laboratory Oven Capacity 240 Liters 220V-50HZ 1PH	-	No	1				
85.	-	Thermometers China	Digital Dial Thermometer with collar for Oven	-	No	10				
86.	-	Digital Balance China	Digital Electronic Top Loading Balance, Capacity 15kg x 1gm, 220V-50Hz -1PH	-	No	1				
87.	-	Digital Balance China	Digital Plate Form Balance, Capacity 100kg x 10gm 220V-50Hz -1PH	-	No	1				
88.	-	Vernier Caliper China	• Digital Vernier Caliper 12"	-	No	1				
89.	-	Specific Gravity	• Specific Gravity Bottle 25ml	-	No	10				

		Apparatus China	• Specific Gravity Bottle 50ml			10				
			• Specific Gravity Bottle 100ml			10				
			• Evaporating Dish, 150mm Dia x 45mm Depth			10				
			• Plastic Limit set including, Lod Comparator, • Spatula 200mm Blade and Glass Plate 12" x 12" x 0.5"			10				
90.	-	Balance China	Digital Top Loading Balance Capacity 30kg x 1gm	-	No	1				
91.	-	Thermometer China	• Glass thermometer -10 + 50c	-	No	1				
			• Spare U-tube glass manometer for L0041/A			1				
Items to be Procured Locally										
92.	-	Thermometer Local	Dial Thermometer 0 to 300°C	-	No	1				
93.	-	Sampling Tray Local	Galvanized Sampling Tray Size 18" x 18" x 3"	-	No	12				
94.	-	Scoop Local	Aluminium Scoop	-	No	1				
95.	-	Sample container Local	Sample Container Approximately 2.5 Liters	-	No	1				
96	-	Splitter Local	• Sample Splitter 38mm	-	No	1				
			• Sample Splitter 50mm			1				
97.	-	Polythene Bag Local	Polythene Bag Size Approximately 1m x 450mm	-	Pkt	2kg				
98.	-	Sand Absorption Set Local	Sand Absorption Cone & Tamper	-	No	1				
99.	-	Temping Rod Local	Tamping Rod 16mm dia x 600mm long Hemispherical at both ends c/w set of 12 abrasive charges	-	No	1				
100.	-	Sampling tray Local	Galvanized Sample Tray, Size 12" x 12" x 2"	-	No	1				
101.	-	Sieve Shaker Local	Electromagnetic sieve shaker for sieves up to 315 mm dia. 230V, 50-60Hz, 1ph.	-	No	1				
102.	-	Sieve Brush Local	Sieve Brush	-	No	1				
103.	-	Thermometer Local	Digital Thermometer, -50°C to 1000°C	-	No	1				

			complete with probes							
104.	-	Marshal Test Specimen Local	• Digital Automatic Marshal Compactor for 4" dia and 6" dia sample • c/w Hammers and Moulds 220V-50HZ - 1PH	-	No	1				
			• Standard Proctor Mould	-		4				
			• Modified Proctor Mould	-		4				
			• Paper Disc for Marshal Sample (Pack of 100)	-		1				
105.	-	Spatula Local	Spatule 200mm Approximately	-	No	1				
106.	-	Scoop Local	Aluminium Scoop Large size	-	No	1				
107.	-	Gloves Local	Heat Resistive Gloves	-	No	1				
108.	-	Universal Extruder Local	Universal Extender for 4" and 6" Dia sample	-	No	1				
109.	-	Softening Point Local	Ring and ball apparatus to EN 1427 and ASTM D36	-	No	1				
110.	-	Air Entrainment Local	• Air Entrainment c/w carrying case	-	No	4				
			• Compacting Bar			4				
			• Soft Headed Mellet			4				
111.	-	Sampling Tray Local	• Galvanized Sampling Tray Size 18" x 18" x 3"	-	No	10				
			• Galvanized Sampling Tray Size 24" x24" x 3"			10				
112.	-	Sample Container Local	Sample Container, Approximately 2.5 Liters	-	No	10				
113.	-	Sample Splitter Local	• Sample Splitter (38mm sampling) complete with tray	-	No	4				
			• Sample Splitter (50mm sampling) complete with tray			4				
114.	-	Polythene Bag Local	Large Polythene Bag, Approximately 1m x 450mm (Per kg)	-	No	50				
115.	-	Temping Rod Local	Tamping Rod 16mm dia x 600mm long Hemispherical at both end	-	No	1				
116.	-	Sample Container Local	Sample Container 2.5 Liter Capacity	-	No	10				
			Sample Container 0.5 Liter Capacity			10				

117.	-	Sampling Tray Local	Sample Tray (Galvanized) Size 18" x 18" x3"	-	No	20				
118.	-	Scoop Local	Aluminium Scoop, Small Size	-	No	1				
			Aluminium Scoop, Large Size			1				
119.	-	Trowel Local	Trowel	-	No	1				
120.	-	Knife Local	Trimming Knife	-	No	1				
121.	-	Straight Edge Local	Straight Edge 300mm	-	No	1				
122.	-	Melting Pot Local	Electric Melting Pot, Thermostatically Controlled 220V 50HZ 1PH	-	No	1				
123.	-	Soil Classification Local	• Liquid Limit Device with Grooving Tool	-	No	10				
			• Digital General Purpose Laboratory Oven, Capacity 240 Liter 220V - 50HZ 1PH			1				
			• Digital Dial Thermometer, Range 0 to 300°C			10				
			• Galvanized Sampling Tray, Size 12" x 12" x 2"			10				
			• Un-numbered Moisture Tin, Capacity 90 grams (Approx.)			20				
			• Wash Bottle, Plastic 500ml			5				
			• Spatula 100mm Blade			5				
			• Spatula 200mm Blade			5				
124.	-	Shrinkage Limit Set Local	Shrinkage Limit Set c/w prong plate, Shrinkage dish and glass cup	-	No	10				
125.	-	Sieve Brush Local	Sieve Brush	-	No	1				
126.	-	Sampling Tray Local	Galvanized Sampling Tray Size 24" x 24" x 3"	-	No	1				
127.	-	Sample Splitter Local	• Sample Splitter of 7mm , (Approx.) opening c/w tray	-	No	1				
			• Sample Splitter of 15mm , (Approx.) opening c/w tray			1				
			• Sample Splitter of 30mm ,			1				

			(Approx.) opening c/w tray							
			• Sample Splitter of 50mm ,(Approx.) opening c/w tray			1				
128.	-	Dry Density & Moisture Relationship Local	• Standard Compaction Mould	-	No	10				
			• Standard Compaction Rammer			10				
			• Modified Compaction Mould			10				
			• Modified Compaction Rammer			10				
129.	-	Soaking tank Local	Soaking Tank, Size 3 Ft x 5 Ft	-	No	1				
130.	-	CBR Mould Local	CBR Mould 6" Dia c/w Collar and Perferated Base	-	No	6				
131.	-	Swell plate Local	Swell Plate (Brass)	-	No	6				
132.	-	Surcharge Weight Local	Surcharge Weight (Anular) Surcharge Weight (Slotted)	-	No	6				
133.	-	Tripod Local	Aluminium Tripod Attachmend	-	No	6				
134.	-	Swell Dial Gauge Local	Penetration / Swell Dial Gauge, 10mm x 0.01mm	-	No	6				
135.	-	Spare Disc Local	Spare Disc	-	No	2				
136.	-	Bulk density apparatus Local	Apparatus for measurement of bulk density of cement	-	No	1				
137.	-	Glass plate Local	Glass plate 210 x 185 x 6 mm	-	No	1				

Special Instructions

Description	Bidder			Tech Scrutiny to be done by User		
	Yes	No	Alternate Offer	Accepted	Rejected	Reasons of Rejection
Environment Conditions (a) Temperature range: 05^{o}C to +45^{o}C (b) Relative humidity: 0-70% non-condensing						
Warranty period Two years from the date of commissioning.						
Training Notes Supplier will provide a set of handouts for training on operation and maintenance of the equipment						
Publications Supplier is to provide hard and soft copies (CD) of following manuals. (a) **Operational / Maintenance manual**: - Qty 01 with Equipment and additional Qty 02 for record purposes and should consist of following sections:- (1)**Equipment Description /Operation**:- (a)Specifications (b)Description (c)Operation (2)**Servicing**:- (a)Maintenance Schedule (b)Adjustment / test (c)Removal / Installation procedure (d)Tools Used (3) Trouble shooting guide (4) Cleaning requirements (5) Shipping and receiving (6) Storage requirements (b) **IPB** (Illustrated Parts Breakdown Manual) should have full parts description along with detailed diagrams (exploded view). (c) **Experimental manuals** which must contain the list and procedure of the experiments that equipment can perform.						
Spares / Technical Support (a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years (b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided						

(c) Any software provided must have its license (d) Software upgrade support must be provided free of cost for 10 x years with renewed license at every upgrade (e) Supplier must also provide calibration service for at least 5 x years after commissioning						
Additional Spare / Replaceable parts. (a) Replaceable spare / parts during scheduled inspections are to be identified and provided as per requirement along with equipment sufficient to cater five years consumption. (b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.						
Physical Inspection Criteria: 100% physical inspection of store will be carried out before commissioning of the equipment for following details:- (a) For physical damage, scratches and deformity. (b) Accessories /components as per contractual specifications. (c) Technical Manuals (Operation manual, user guide, IPBs). (d) Quality certificate and calibration certificate by the OEM (e) OEM certificate and verifiable documents by the supplier that store has been procured from certified source and is factory new and from latest production. (f) Brand name and country of origin.						
Commissioning (a) Commissioning by OEM rep at his own cost and risk at designated place at NUTECH. (b) Any special requirement for installation, operation and commissioning must be specified in the offer by the supplier.						
Training 01 week OEM operational/ maintenance training at NUTECH						
Improvement and Safety Measures Any improvement and safety measures suggested by NUTECH during commissioning are to be resolved by the supplier / manufacturer at no extra cost.						
Liability of Supplier (a) OEM certificate of authorized dealership Supplier is to						

provide original OEM certificate of subject equipment bought directly from the manufacturer and being an authorized dealer. (b) In case the equipment supplied is not compatible with specifications, the supplier will be obliged to call his representatives at his own cost for consultation and corrective action						
Special Notes (a) Additional requirements for the maintenance of equipment (if any) must be intimated by the supplier in technical offer. (b) Supplier must provide the list of organizations using same equipment in Pakistan (if any). (c) Equipment must be a standard product of OEM available at web address of OEM. (d) In case of premature failure of the equipment, OEM has to replace / rectify the item free of cost. Required transportation charges would be borne by the supplier.						

Firm Name_____
Signature_____
Name_____
Designation_____

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

TECHNICAL OFFER

Annex B

User Reference No **Civil Lab Eqpt-002**___ Date: **21-01-2019**

Please fill in the following essential parameters:

1. Validity of Offer:_____ Days (Should not be less than 90 days)
2. Delivery Period:_____ Days (After Placement of order)
3. Country of Origin:_____
4. Warranty/Guarantee: _____ Months from the date of final acceptance of the stores.

General

GST No: _____ (Please enclose copy)

NTN/CNIC: _____ (if exempted, please provide valid exemption certificate)

Payment Terms: (Mandatory to mention) (Please tick/ mention the desired payment term/ mode)

1. 50 % advance payment (Against valid bank Guarantee)
2. 50% Payment during delivery / installation /commissioning /user satisfaction certificate

Details of Payment Recipient

(1) Name/Title: _____

(2) Address:_____

Signature: _____

Official Seal: _____

Name: _____

Designation: _____

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

FINANCIAL OFFER

Annex C

User Reference No **Civil Lab Eqpt-002** Date: **21-01-2019**

Ser	Part No	Nomen/ Experiment	Description	A/U	Qty Req	Unit Price (Rs) (excluding GST)	GST (if applicable)	Custom Duty (Rs) (If applicable)	Total Gross price per unit (Rs)	Total Amount of total Qty (Rs)
1.	-	HYDRAULIC BENCH	Hydraulic bench with two variable speed pumps. Must include Constant Head Inlet Tank Variable Head Outlet tank Feed Block Manometer with high pressure reading and digital display capability Hook Gauge and Scale The bench must be capable and meet operational requirement of the below mentioned modules and accessories.	No	1					
	1a	FLOW OVER WEIRS	WEIRS – Compatible with the hydraulic bench. Understanding the use of weirs to regulate or measure the flow of water is both useful and interesting. Offer two products comprising of sets of weirs. The Weirs are mounted on the location studs provided at the end of the flow channel in the bench, and depth of	No	1					

			water is measured with the hook gauge.							
	1b	ORIFICE EXPERIMENT	ORIFICE EXPERIMENT - ADVANCED Compatible with the hydraulic bench. Four different orifices with different shapes (square and triangular) and different entry profiles to round orifices (Board Mouthpiece and Bell mouthed). Determination of the discharge coefficient Comparison of time for emptying a vessel	No	1					
	1c	PUMP TEST SET	Compatible with the hydraulic bench Speed display with one Wattmeter. Pump arrangement (2 variable speed pumps & speed displays) and Wattmeter. This bench is equipped with 2 variable speed electric motors each driving a centrifugal pump which enables each pump to be run over its full speed range individually or in a parallel or series arrangement. Suitable associated pipework and valuing arrangements are supplied to allow easy operation of both pumps in either series or parallel configurations. This allows the approximate doubling of discharge flow and head when operating in parallel and series modes respectively. Suction and delivery pressures can be varied by means of the inlet and outlet valves on the P6100 Hydraulics Bench and displayed on a bourdon pressure gauge. Flow measurement is measured via calibrated weir or stepped volumetric measuring tank supplied with P6100 Hydraulics	No	1					

			Bench. A Wattmeter is included to measure the electrical input to the pumps. PUMP PERFORMANCE 42 litres per minute against 5 metres head. Maximum head of 20 metres of water at zero flow.							
	1d	Bernoulli Apparatus	A dye injection system is provided which allows for a single filament of dye to be introduced into the entrance to the convergent section to enable laminar and turbulent flow regimes to be demonstrated. The differential head across the test section can be varied from zero up to a maximum of 450 mm. The test section is manufactured from acrylic sheet. The convergent divergent duct is symmetrical about the centre line with a flat horizontal upper surface into which the eleven static pressure tappings are drilled. The lower surface is at an angle of 4° 29'. The width of the channel is 6.35 mm. The height of the channel at entry and exit is 19.525 mm and the height at the throat is 6.35 mm. The static tappings are at a pitch of 25 mm distributed about the centre and therefore about the throat	No	1					
2.	-	FREE & FORCED VORTEX Apparatus	FREE AND FORCED VORTEX APPARATUS Free and Forced Vortex Apparatus for the study of the shape of 'free and forced vortices' consists of a 250 mm diameter cylindrical, transparent vessel 180 mm depth, having two pairs of diametrically opposed inlet tubes of 9.0 mm and 12.5 mm diameter. The 12.5 mm diameter inlet tubes which are angled at 15° to the diameter, so that a swirling	No	1					

			motion is imparted to the liquid entering the vessel, are used as entry tubes for the free vortex experiment. A smooth outlet is centrally positioned in the base of the vessel and a set of push-in orifices of 24, 16, 12 and 8 mm diameter is supplied to reduce the outlet diameter to a suitable value. The profile of the vortex formed at the top of the vessel is determined by a gauge, housed on a diametrically mounted bridge piece, which measures the diameter of the vortex at various depths. This gives the co-ordinate points required to plot the vortex profile. The forced vortex is created in the vessel described above by using as the inlet the 9 mm bore tubes which are angled at 60° to the diameter. The input water from these tubes impinges on a simple two blade paddle which acts as a stirrer/flow Straightener. The water 'leaves' the vessel via the 12.5 mm diameter angled tubes which are used as the 'entry' tubes for the free vortex experiment. The two bladed paddle rotates on a vertical shaft supported by a bushed plug, in the hole used as the outlet for the free vortex experiment, and located at the top by a suitable hole in the bridge piece fitting across the diameter of the vessel. This bridge piece also houses the probes required to determine the co-ordinates of the vortex profile to be measured.							
3.	-	FLOW CHANNEL	FLOW CHANNEL - 2.5M The 2.5 m and 5 m Flow Channel apparatus comprising flow straightening section at inlet complete with set of	No	1					

			glass beads mounted on stand with spirit level micrometer level adjustment screw, set of weirs including sharp crested, overshot weir, triangular hump section weir, broad crested weir, hydraulic jump sluice gate and water supply pipe. Outlet flow controlled by undershot weir							
4.	-	LAMINAR FLOW TABLE	HELE SHAW APPARATUS TWO DIMENSIONAL POTENTIAL FLOW APPARATUS Based on the well-known Hele Shaw experimental method. This unit provides a parallel laminar water flow field to allow a full study of the low Reynolds number flow patterns around submerged models representing cylinder, aero foils, bluff bodies, knife edge weirs etc. or through various passages such as valve bodies, nozzles etc. Four independently controlled sinks and sources permit the study to be extended to more complex problems involving fluid removal or addition at discrete points in the potential flow. The apparatus is equipped with multiple dye injection to provide flow visualization. Alternative passage and submerged models can be easily cut from the flexible sheet material supplied. A supply of de-aerated water improves the quality of the experiment	No	1					
5.	-	PELTON WHEEL	PELTON WHEEL Pelton Wheel consists of a model Pelton Wheel mounted on a base plate and fitted with a friction dynamometer as illustrated in Fig. 2 overleaf. The design of the Pelton Wheel follows typical industrial	No	1					

			practice with a horizontal shaft, single horizontal jets produced by a single nozzle fitted with a needle or spear regulator, and a wheel fitted with multiple (16) elliptical ridged buckets at a mean diameter of 100 mm. The nozzle is positioned in the same plane as the wheel and arranged so that the jet of water impinges tangentially on to the buckets. The friction dynamometer consists of a 60mm diameter brake wheel fitted with a fabric brake band. The brake band is tensioned by a weight hanger and masses with the fixed end being secured via a spring balance to the support frame.							
6.	-	PERMEABILITY TANK	PERMEABILITY TANK Permeability Apparatus provides the basis for experimental studies of permeability, seepage and drainage, flow nets, lateral and uplift pressures, and the stability of slopes utilizing simulated two dimensional hydraulic models, with integral dye injector system, de-colorizing filter and variable speed pump control. Permeable Medium comprising 150 kg of washed and graded high silica sand containing particle sizes 0.2 mm to 1.0 mm. FEATURES □ Two-dimensional permeability tank □ Stainless steel mesh end baffles □ Independently adjustable supply and drain header □ Models of impermeable sheet piling and foundation slab □ Permeable dam toe-filter □ Fourteen pressure tapings and	No	1					

			multitube manometer □ Dye injection system for tracing flow patterns and activated carbon de-colourising filter □ Scratch resistant toughened glass front and rear sides							
7.	-	TORSIONAL VIBRATIONS APPARATUS	TORSIONAL VIBRATIONS APPARATUS This unit imparts simple harmonic motion to the torsion shaft and comprises an electric motor with closed-loop speed control driving a crank mechanism with phase control by a differential gear unit. Crank angle is read directly from the phase angle dial, while crank speed is shown on an analogue meter in the Frequency Control Unit which contains all the electronic equipment for the closed-loop speed control over the frequency range 0 - 10 Hz. □ HYDRAULIC DAMPING UNIT A semi-rotary, silicone fluid viscous damper with coefficient adjustable from 0.1 to 1.4 Nm/rad/s with calibrated knob. □ TRANSDUCER UNIT Two precision angular motion transducers are provided and can be clamped adjacent to any of the bearing housings. They comprise carbon film potentiometers and are connected to a bridge circuit with its own trim control and power supply. The output is adequate to drive an oscilloscope or thermal array recorder with a gain of 0.05 V/ cm. □ TORSION SHAFT AND INERTIA DISCS One torsion shaft is provided. This	No	1					

			is of steel approximately 6.3 mm diameter but it can be replaced by any round bar in the diameter range 5 to 8 mm. Three sizes of inertia disc are provided and the largest has a groove around the periphery and scale calibrated in radians. Torsional Vibration Apparatus comprising D section tubular steel bed with feet for bench mounting, bearing housing (4) furnished with hollow spindle and fitted chuck and flange, inertia discs (2 plain, 1 divided) torsion shaft, geared drive assembly with differential crank mechanism, hydraulic damping unit, transducer units (2) and frequency control unit. Weight: 40kg Length: 1.6m, Width: 0.2m, Height: 0.4m, Net.							
8.	-	Extension & COMPRESSION OF SPRINGS	EXTENSION & COMPRESSION OF SPRINGS Wall mounted apparatus (for loading spiral springs in either tension or compression with direct gravitational loads) with accurately divided scale and vernier. Supplied complete with four compression and four extension springs each approximately 18 cm long (7") long.	No	1					
9.	-	FRICTION ON AN INCLINED STEEL PLANE	INCLINED PLANE/SLIDING FRICTION APPARATUS The robust apparatus is of all metal construction with an Inclinable 90 cm ground steel plane furnished with course and fine angular adjustment which is determined with the use of a clinometer. Weight carriers of 8 different sliding frictional materials are included together with load masses.	No	1					
10.	-	ENERGY OF	ENERGY OF FLYWHEEL Energy of Flywheel apparatus is an	No	1					

		FLYWHEEL	extremely robust and versatile unit comprising of the main flywheel, the mass of which can be varied by adding and removing two rings and one disc, and mounted on a heavy duty stand suitable for mounting. The unit also includes a vibrating arm to enable traces to be drawn on a paper strip positioned on the circumference of the flywheel. The fully assembled flywheel, which measures 300 mm in diameter and is 75 mm wide, is fitted with a special antifriction bearing. The assembly, of overall dimensions 450 mm long by 400 mm wide by 360 mm high, is supplied complete with paper roll, bottle of ink, spare vibrator brush, ink feed brush and length of cord, but without masses and hanger.							
11.	-	CENTRIPETAL FORCE APPARATUS	CENTRIPETAL FORCE APPARATUS Bench mounted frame carrying a 300 mm diameter turntable and two pairs of masses mounted on radius rods, together with a control box incorporating a variable speed electric drive complete with tachometer.	No	1					
12.	-	ACCELERATION APPARATUS	ANGULAR ACCELERATION APPARATUS The apparatus consists essentially of a low inertia circular disc mounted onto a vertical axle that can be rotated under the action of a falling mass. The low inertia circular disc, which is 300 mm diameter and 50.8 mm thick, is manufactured from plywood and is keyed to a 12 mm diameter by 305 mm long stainless steel axle. A 50 mm diameter pulley is	No	1					

			attached to the axle. The circular disc and axle are mounted with the axle vertical between pivots, one on the base and one on a radial brace from a vertical pillar. The upper surface of the circular disc is scribed with circles of 100 mm, 150 mm, 200 mm and 250 mm diameter and two holes are provided on each circle as sites to locate additional inertia discs. Four inertia discs are provided, each disc is 50 mm diameter by 15 mm and is manufactured from brass with a mass of 250 gm. A spring steel vibrator, fitted with a fine brush, is supported from the base on a block so that it vibrates at a natural frequency of 5 Hertz. The brush is attached to the vibrator by a hollow screw which allows its position to be readily adjusted so that it draws a fine line on a paper strip fastened to the cylindrical rim of the circular disc. A 10 gram mass hanger and a set of brass masses of 3 off 50 gm, 2 off 20 gm and 1 off 10 gm are provided to accelerate the system via a 1/16" cord passing over a pulley mounted on the vertical pillar and fastened to the pulley on the circular disc axle. A release mechanism is provided which will simultaneously release the vibrator and the circular.							
13.	-	HOOK'S LAW	LINEAR VIBRATION APPARATUS A 1 kg thrust vibration generator - stroke 2.54 mm and combined oscillator/drive amplifier unit, 3 Hz to 50 Hz in one range, with experimental accessories; amplitude indicator with drive assembly, double cantilever with 12	No	1					

			magnetic load units, suspension gantry with measuring scale and spring mass system with 6 load units, all contained in an aluminum carrying case.							
14.	-	FLOOR MTD FRAME	FLOOR MTD FRAME LOAD CELL DISPLAY	No	1					
15.	-	PORTAL FRAME	PORTAL FRAME	No	1					
16.	-	Structures Platform with Module of BENDING OF BEAMS	STRUCTURES PLATFORM Structures Platform should be able to support various other optional Structures Experiment Modules. Made from precision, slotted aluminium extrusions and steel endplates, this module should be able to form a sturdy, rigid, stable and strong experiment platform for easy assembly and to fit on any standard desktop, it speeds up and simplifies setting up of experiments. Adjustable feet are required to ensure the platform is level before use. Easy-to-read scales on each side of the platform is required to help students to position the parts of their experiment precisely, and removes the need for an additional rule. The Platform must include the USB Interface Plug and Play 'Hub' to simplify connections. The Hub converts signals from the sensors on each experiment module to USB data	No	1					

			format for computer display and data acquisition. Manufacutrer must have used LabVIEWTM from National Instruments to create user-friendly data acquisition software that works with each of the optional / additional Experiment Modules. The data acquisition (DAQ) software should be able to experiment data to the universal comma separated value format (CSV) for use in spreadsheet and many other software applications. **Bending of Beam** **EXPERIMENTS AND TOPICS** 5. Stress and strain relationship. 6. Strain gauges as instruments. 7. Finding the neutral axis by experiment and calculation. How the beam cross-section dimensions affect the second moment of area (I value) and neutral axis.							
17.	-	THREE HINGED ARCH	**EXPERIMENTS AND TOPICS** 8. Horizontal reaction due to a varying single point load on a statically determinate structure. 9. Horizontal reaction due to a moving single point load on a statically determinate structure. 10. Horizontal reactions due to a uniformly distributed load on a statically determinate structure. 11. Influence lines and superposition.	No	1					

			12. Lines of thrust in an arch. 13. Graphical construction of a bending moment diagram for point loads. 14. Maximum bending moments due to a load on an arch. • Works with user-friendly software made using LabVIEWTM from National Instruments. • Direct reading of horizontal reaction for quick and simple experiments Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
18.	-	SHEARING FORCE APPARATUS	**EXPERIMENTS AND TOPICS** 6. Shear force at the cut due to a varying single point load. 7. Shear force at the cut due to a moving single point load. 8. Shear force at the cut due to a uniformly distributed load. 9. Influence lines and superposition Works with user-friendly software made using LabVIEWTM from National Instruments. 10. Direct reading of shear force at the 'cut' for quick and simple experiments. This product must include a uniformly distributed load (UDL) that may be applied across the span of the Beam for comparison of results with a single point load. The load cell also needs to connect to the USB Interface Hub of the Structures Platform for computer display and	No	1					

			data acquisition. Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
19.	-	BENDING MOMENT APPARATUS	**EXPERIMENTS AND TOPICS** 9. Bending moment at the cut due to a varying single point load. 10. Bending moment at the cut due to a moving single point load. 11. Bending moment at the cut due to a uniformly distributed load. 12. Influence lines and superposition. **Additional Experiments** 13. Show that shear centre can be outside beam section boundaries. 14. Shear centre of an unsymmetrical section. 15. Horizontal and vertical deflection in symmetrical and unsymmetrical sections at different loads and load angles. 16. Using Mohr's circle to find Principal Axes and Second Moments of Area. Direct reading of bending moment at the 'cut' for quick and simple experiments. Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.	No	1					
20	-	FORCES IN	**EXPERIMENTS AND TOPICS**	No	1					

.		A TRUSS	8. Strain Gauges as instruments. 9. Forces within and deflections of: 10. A truss structure that is statically determinate. 11. A truss structure that is statically indeterminate. 12. Member forces by the Method of Joints and Method of Sections. 13. Member forces by the use of the strain energy method. 14. Advantages and disadvantages of both versions of the truss. Must use Strain Gauge Amplifier and multiple strain gauges for measurement of force in each member of the truss. Must include following items M. Strain Gauge Amplifier, 16 input N. Pinned and roller supports O. Additional Upright P. Trammel Arm with Digital Indicator of resolution 0.001 mm Q. Load Cell of maximum capacity 650 N R. Pre-assembled truss of five joint bosses and eight square-section members S. Three cables for computer display and data acquisition T. Inclinometer U. Hexagon tools for fixings V. Storage Tray W. Simulation Software X. User Guide							

			Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.							
21		Semi-automatic compression machine Double Chamber 600/15 kN cap. for testing cement, mortar.	Semi-automatic compression machine Double Chamber 600/15 kN cap. for testing cement, mortar, resin, hydraulically bound mixtures and other materials. Conforming to EN 196-1, 1015-11, 12390-5, 12390-6, 1338, 13286-41, 993-5, ASTM C109, C348, C496, C293, C78 using the suitable accessories. - Compression platens 165mm diameter x 30mm thickness - Digital readout unit - LCD display 4x20 characters and 6 keys membrane keyboard - Load measurement: pressure transducer on 600 kN chamber, high accuracy load cell on 15kN chamber - LAN port for PC connection and USB port for easy data storage on pen-drive - Integrated printer available on request - Dayligths: vertical 345/205 mm; horizontal 265/- mm - Piston travel 50/30mm - Limit switch preventing pistons overtravel - Load measurement accuracy: class 1 to EN 12390-4 / class A to ASTM E74 starting from from 10% of full scale for both chambers; special calibration from 6kN for 600kN chamber and from 0.75kN for 15kN chamber available on request - Supplied complete with traceable	No.	1					

			calibration certificate for load measurement accuracy 230V/50-60Hz/1Ph							
22.	-	DEFLECTION OF BEAMS	EXPERIMENTS AND TOPICS 14. Beam bending formula and structural 'stiffness'. 15. Deflection due to point loads and UDLs (uniformly distributed loads). 16. How beam fixings affect deflection of: 17. Simply Supported beams 18. Fixed or 'Encastre' beams 19. Cantilever beams 20. Propped Cantilever 21. Shape of a deflected beam. 22. Beam length and deflection. 23. Beam material and deflection—the Elastic (Young's) Modulus. 24. Beam cross-section and deflection—the Second Moment of Area ('I' value) 25. Pure Bending of a beam. 26. Reciprocal Theorem (Maxwell-Betti). Must be Modular System, in order to be used with Structures Frame mentioned at Item no. 16.	No	1					
23.	-	UNIVERSAL TESTING MACHINE (2000 KN)	Automatic Computerized Universal Testing Machine, 2000 kN capacity, HPU 200 power unit, for tensile/transverse/bend and re-bend tests on steel and compression/flexural/indirect tensile tests on concrete and other materials. 380V/50Hz/3ph. The machine is conforming to the following Standards: EN ISO 6892, EN 15630, ASTM A370, EN ISO							

			7500-1 (class 1 from 20 kN to 2000 kN). System includes:- Upper and lower hydraulically operated jaws - High precision load cell for load measurement -PC and complete software package for different test types;f-Five set of grippers for rounds from 12 mm to 78 mm diameter; -Four set of grippers for flats up to 72 x 100 mm (thickness x width);-Transverse test attachment with roller supports dia.70 x 200 mm (max span 900 mm) and 2 loading rollers dia. 80 mm and 60 mm.Applications: The machine can perform (with the suitable accessories): Tensile tests on steel rounds up to 78 mm dia., flats up to 72 x 100 mm, wire strands up to 15.2 mm dia. and electro welded steel grid; Transverse and Bend and re-bend tests on steel specimens; Shear test on rounds; Compression tests on concrete cubes and cylinders; Flexural test on concrete beams; Indirect tensile test on cylinders, cubes and paving blocks; Determination of the Modulus of Elasticity of concrete; many others tests on Rock, Masonry units, Refractories, etc. with the suitable accessories available on request. Main features:-Sturdy four-columns test frame with 850 mm vertical daylight (for compression and tensile tests) and 850 mm horizontal clearance; -Piston travel: 300 mm;-Max distance between tensile grips: 550mm (+ 300mm piston travel);-Motorized crosshead for easy and fast (270 mm/min) adjustment of the vertical daylight by push button panel;-load measurement by High								

			precision load cell providing high accuracy from 1% of f.s. Include load cells for Mechanical testing 0-500KN. Load cells for testing concrete and civil materials 500-1000kn up to 2000KN;-Hydraulic gripping system operated by push button panel; -Front open crosshead for easy insertion of tensile specimens; -PC controlled. Completely automatic test execution with closed-loop P.I.D. control; -Compact ergonomic design (with small footprint) advanced control console housing hydraulic pack, electronic and PC; -Optional control of a second frame. Hydraulic group -Dual stage pump: centrifugal low pressure for fast approach (max. flow rate 9 l/min) automatically switching to radial multi- piston high pressure (max. flow rate 3.2 l/min) for loading;-Max piston speed (no load condition): 100mm/min;-Oil flow control by servo-controlled proportional valve;-AC motor 3000 W; -Maximum working pressure 650 bar; -Oil temperature controlled by air cooling system; -Console cabinet lined with soundproofing material for operator's comfort. Hardware and firmware -Effective resolution 131.000 points; -Load resolution [kN]: 0.02 kN -Crosshead displacement resolution[mm]: 0.01 mm; -Control frequency 250 Hz; -Sampling rate 500 Hz; -6 channels (one dedicated to crosshead displacement) to							

			measure elongation /displacement/strain with potentiometric, conditioned LVDT and magnetostrictive transducers; -4 channels for strain measurements with strain gauges; -2 channels for load sensors: load cell and load cell/pressure transducer of possible second frame; -simple multi-sensors connection and calibration file selection; -digital linearization of the calibration curve. Software package: The machine is supplied complete with RTM (Real Time Management) user interface environment allowing remote control of the complete system for automatic test execution according to the selected test type, calculation of results, graphical and numerical management of data. The following software modules are available: *UTS Software (included) for steel tensile testing under load/stress control and crosshead separation control. *DATAMANAGER software (included) for compression, flexure and indirect tensile test on concrete, cement specimens and other construction materials. *E-MODULE software (on request) for Poisson ratio and Young Modulus determination on concrete. ACCESSORIES: *Electronic universal extensometer to measure the elongation of wires, steel rebars and round steel specimens - Measuring base: 50 to 200 mm - Linearity: better than +- 1%							

			- Max. travel: 10 mm *Compression device. Includes: upper and lower platens dia. 216mm and spherical seat. *Shear test accessory. Including: - Small double shear test device with 5 sets of bushes for samples of dia. 5mm, 8mm, 12mm, 16mm and 20mm. - Big double shear test device with 5 sets of bushes for samples of dia. 25mm, 30mm, 35mm and 40mm.							
24		Fully Automatic Flexure Machine	High stiffness flexural frame, 350 kN capacity EN 1339 | EN 1340 | EN 12390-5 | ASTM C78 | ASTM C293 | ASTM C1550 | EN 14488-5 | ASTM C1609 | ASTM C1018 350 kN cap. High rigidity flexural frame, complete with load cell and connection kit for separate control console (Displacement Controls). High rigidity (200 kN/mm), especially suitable for testing FRC and sprayed concrete Double testing mode: parallel and orthogonal For testing different kind of specimens (beams, flagstones, slab) Suitable for testing Round panel dia.800 mm to ASTM C1550 Max span between lower rollers: 1.5m Load measurement by high precision load cell Piston return by counterweights Piston travel limit switch Include set of spacers to reduce the vertical daylight by: 50mm, 100mm and 150mm							

			Max cap. kN: 350 Load sensor: Load cell Horizontal clearance [mm]: 900 istance between upper rollers (adjustable) From 100 to 500mm, or single roller Distance between lower rollers - Parallel testing mode (adjustable) From 150 to 800mm Distance between lower rollers - Orthogonal testing mode (adjustable) From 850 to 1500mm Piston travel mm 130 Overall dimensions (lxwxh) mm 1150x 1600 x 1550 Weight approx. kg 520 CONSOL Console Must have Following • Large graphic capacitive color 7” display, 800 x 480 pixel • Dual user interface via console display or PC with software • LinK-lab integration package for connection with bar code readers, balances, calipers, etc. • Variable speed permanent magnet DC motor • For superior performances at low load rates and low load value. Soft platen-to-specimen contact for better accurate speed control from the very beginning of the ramp • Active control of up to 4 frames by selection via display/PC (no manual operation/valve). • ASTM C39 full conformity (initial pause for specimen alignment, double load rate option, height/diameter correction factor, final calculation of effective load								

			rate applied, peak sensitivity in %) • Oversampling function increasing the sampling rate when specimen is approaching the failure for better identification of peak value > 524,000 points high-resolution/stability analogue channels > 6 channels to be factory configured: ・2 channels for load sensors ・4 channels for load or displacement/strain sensors > Control frequency 250 Hz > Sampling frequency 250 Hz > 7”, 800 x 480 pixel, 16 M colors, icon-driven capacitive sensing touchscreen graphic display > Unlimited storage capacity for test data on internal 8 GB SD card > USB port for teste data storage on external USK memory stick > Ethernet port for PC / internet / network communication > Optional integrated graphic printer including Load-Time plot > RS 232 port for data downloading in ASCII format > Manufacturer should have possibility to upgrade the system to Wi-Fi or GSM module for future upgrade if required • Serial printer on the control panel allowing load/time plot. • Software package for displacement controlled tests allowing: • Automatic calculation of test results according to EN 14651, 14488-3, 14488-5, UNI 11039-2, ASTM C1550,								

			C1609, C947, UNE 83515 • 8 test pre-set testing procedures according to the above Standards • Customizable test procedure allowing desired loading history • Possibility to change in real time the test parameters: target load/displacement, control variable, test speed. Data saving rate 250/sec							
25.	-	Seive Analysis	• Pan and cover 200 mm dia	No	1					
	-		• 200 mm dia ISO (BS,UNI) sieve op.75 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.150 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.212 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.300 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.425 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.600 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.850 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.1,18 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.1,7 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.2,36 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.3,35 mm		1					
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm		1					
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm		1					

	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm		1					
	-		• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm		1					
	-		• 300 mm dia ISO(NF,DIN) sieve op.20mm		1					
	-		• 300 mm dia ISO sieve op.37,5mm		1					
	-		• 300 mm dia ISO(NF,DIN) sieve op.50mm		1					
	-		• 300 mm dia ISO(NF,DIN) sieve op.63mm		1					
	-		• 300 mm dia ISO(NF,DIN) sieve op.75mm		1					
	-		• Pan and cover 300 mm dia		1					
	-		• Sieve Brush		1					
26	-	Flakiness and Elongation	• Flakiness Gauge	No	1					
			• Elongation Gauge		1					
			• Flakiness sieves test set		1					
			• Set of 14 aggregate grids to EN 933-3. Opening mm:2.50 - 3,15 - 4 - 5 - 6.3 - 8 - 10 - 12.516 - 20 - 25 - 31.5 - 40 -50		1					
			• Aggregate shape gauge [ALD]		1					
27.	-	Density Measurer	Bulk Density Measure 1L, 2L, 5 L and 10 Liters	No	1					
28.	-	Chemical Tests for Sulphate and Chloride	Measuring Cylinder 100ml	No	1					
			• Measuring Cylinder 500ml		1					
			• Glass Beaker 600ml		2					
			• Volumetric Flask 1000ml with stoper		1					
			• Bulb Pipette 50ml Capacity		1					
			• Wash Bottle Polythene 500ml		2					
			• Regeant Bottle 1000ml Capacity		1					
			• Electronic Top Loading Balance, Capacity 30kg x 1gm		1					
29.	-	Asphalt Laboratory Binder	1500 g cap. digital centrifuge extractor. Speed control up to 3600 r.p.m. 230V, 50-	No	1					

		Content	60Hz, 1ph.							
30.	-	Sieve Analysis	• Sample Splitter with opening 30mm	No	1					
	-		• Sample Splitter with opening 50mm		1					
	-		• Pan and cover 200 mm dia		1					
	-		• 200 mm dia ISO (BS,UNI) sieve op.75 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.150 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.212 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.300 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.425 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.600 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.850 microns		1					
	-		• 200 mm dia ISO (BS) sieve op.1,18 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.1,7 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.2,36 mm		1					
	-		• 200 mm dia ISO (BS) sieve op.3,35 mm		1					
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm		1					
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm		1					
	-		• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm		1					
	-		• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm		1					
	-		• 300 mm dia ISO(NF,DIN) sieve op.20mm		1					
	-		• 300 mm dia ISO sieve op.37,5mm		1					
			• 300 mm dia ISO(NF,DIN) sieve		1					

			op.50mm							
			• 300 mm dia ISO(NF,DIN) sieve op.63mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.75mm		1					
			• Pan and cover 300 mm dia		1					
31.	-	Mortar Mixer	• Mortar mixer complete with stainless steel beater and bowl 5 litres cap. 230V, 50Hz, 1ph.	No	1					
			• Heating mantle for 5 litres cap. bowl. 230V, 50-60Hz, 1ph.		1					
32.	-	Marshal Machine	Bench compression testing machine with motorised ram, two-column structure and adjustable crossbeam. Loading capacity: 50kN Clearance between columns: 270mm Test speed: 50.8 mm/min [Marshall test] Ram travel: 120mm Power rating: 750W, Supplied with load ring 30kN capacity with peak hold function, complete with 0.001 mm resolution dial gauge [fully conforming to the standards]. 230V, 50Hz, 1ph	No	1					
33.	-	Flash tester	Cleveland flash tester. CE model with protection.230V/50-60Hz/1ph	No	1					
34.	-	Muffle Furnace	Muffle furnace 1100°C max temperature 230V/50-60Hz/1PH Stainless steel oven tongs	No	1 1					
35.	-	Penetration Test	• Semiautomatic digital penetrometer with micrometer vertical adjustment and digital penetration measurement. 230V, 50-60Hz, 1ph.	No	1					
			• Saybolt thermometer 19-27° C		1					
			• Transfer dish with support		1					
			• Sample cup dia 55x35 mm. Kit of 6.		1					
			• Aluminium cup dia 70x45 mm.		1					
			• Set of 6 Verified penetrometer needle		1					
			• Penetrometer needle.		1					

			• Set of 3 Water temperature controller for penetration test, complete with heating and cooling controller. 230V/50-60Hz/1ph		1						
36.	-	Hot plate	Hot plate only with cartering/ protection device for 81-B145/C 230V/50-60Hz/1Ph.	No	1						
37.	-	Digital Balance	420g x 0.001g resolution digital balance, under balance weighing facility, RS232 serial output, battery [rechargeable] and mains operated, complete with DKD calibration certificate. 230V/50Hz/1ph	No	1						
38.	-	Digital Balance	Digital Electronic Balance Capacity 30kg Resolution: 1gram	No	1						
39.	-	Preparation of Test Specimen	• 1. Cube Mould (Cost Iron) Size 6" x 6" x 6"	No	24						
			• Cube Mould (Cost Iron) Size 4" x 4" x 4"		12						
			• Beam Mould Size 150mm x 150mm x 750mm		3						
			• Compacting Bar		1						
			• Mould Oil (25 kg)		1						
			• Wire Brush		1						
			• Steel Float		1						
			• Electric Motorized Mixer for 1/2 bag concrete		1						
			• Aluminium Scoop Large size		1						
			• Galvanized Sample Tray 48" x 44" x 4" (Approximately)		1						
			• Transportation / storage container Approx. 20 Liters		6						
			• Large caring Tank of size 3 feet x 2.5 feet x 5 feet		1						
40.	-	Vibrating Table	Vibrating table 1250x625 mm with retaining edges. Supplied complete with 2 vibrating units, clamping	No	1						

			device for the moulds and waterproof CE pedal switch. 230V/50Hz/1Ph							
41.	-	Density of Hardened Concrete	Buoyancy Balance 15kg x 1g, c/w frame, tank and cradle	No	1					
42.	-	Sieve Analysis	• Pan and cover 200 mm dia	No	1					
			• 200 mm dia ISO (BS,UNI) sieve op.75 microns		1					
			• 200 mm dia ISO (BS) sieve op.150 microns		1					
			• 200 mm dia ISO (BS) sieve op.212 microns		1					
			• 200 mm dia ISO (BS) sieve op.300 microns		1					
			• 200 mm dia ISO (BS) sieve op.425 microns		1					
			• 200 mm dia ISO (BS) sieve op.600 microns		1					
			• 200 mm dia ISO (BS) sieve op.850 microns		1					
			• 200 mm dia ISO (BS) sieve op.1,18 mm		1					
			• 200 mm dia ISO (BS) sieve op.1,7 mm		1					
			• 200 mm dia ISO (BS) sieve op.2,36 mm		1					
			• 200 mm dia ISO (BS) sieve op.3,35 mm		1					
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm		1					
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm		1					
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.10mm		1					
			• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.20mm		1					
			• 300 mm dia ISO sieve op.37,5mm		1					
			• 300 mm dia ISO(NF,DIN) sieve		1					

			op.50mm							
			• 300 mm dia ISO(NF,DIN) sieve op.63mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.75mm		1					
			• Pan and cover 300 mm dia		1					
43.	-	Pocket penetrometer	Heavy duty pocket penetrometer Pocket penetrometer, range 0-5 MN/m2	No	1					
44.	-	Paraffin wax	Paraffin wax 1000 g	No	20					
45.	-	Sieve Analysis	• Pan and cover 200 mm dia	No	1					
			• 200 mm dia ISO (BS,UNI) sieve op.75 microns		1					
			• 200 mm dia ISO (BS) sieve op.150 microns		1					
			• 200 mm dia ISO (BS) sieve op.212 microns		1					
			• 200 mm dia ISO (BS) sieve op.300 microns		1					
			• 200 mm dia ISO (BS) sieve op.425 microns		1					
			• 200 mm dia ISO (BS) sieve op.600 microns		1					
			• 200 mm dia ISO (BS) sieve op.850 microns		1					
			• 200 mm dia ISO (BS) sieve op.1,18 mm		1					
			• 200 mm dia ISO (BS) sieve op.1,7 mm		1					
			• 200 mm dia ISO (BS) sieve op.2,36 mm		1					
			• 200 mm dia ISO (BS) sieve op.3,35 mm		1					
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.5,0mm		1					
			• 300 mm dia ISO(UNI,NF,DIN) sieve op.6,3mm		1					
			• 300 mm dia ISO(UNI,NF,DIN)		1					

			sieve op.10mm							
			• 300 mm dia ISO(BS,NF,DIN) sieve op.14mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.20mm		1					
			• 300 mm dia ISO sieve op.37,5mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.50mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.63mm		1					
			• 300 mm dia ISO(NF,DIN) sieve op.75mm		1					
			• Pan and cover 300 mm dia		1					
46.	-	Sodium	Sodium Hexametaphosphate, (Pack of 1kg)	No	1					
47.	-	Sieve Shaker	Electromagnetic sieve shaker for sieves up to 315 mm dia. 230V, 50-60Hz, 1ph.	No	1					
48.	-	Digital Balance	Top Pan Digital Balance 4100G X 0.1G	No	1					
49.	-	Hydrometer Method	• Hydrometer particle size test set to ASTM D422 -	No	2					
			• Constant temperature water bath. 230V/50Hz/Ph		2					
			• Soil hydrometer 152/H		2					
			• Soil hydrometer 151/H		2					
50.	-	Chemical Analysis	• Measuring Cylinder 250ml	No	10					
			• Measuring Cylinder 500ml		10					
			• Volumetric Flask 1000ml		10					
			• Quantab chloride titrator type 1175 pack of 40 strips		10					
			• Quantab chloride titrator type 1176 pack of 40 strips		10					
			• Sulphate test strips. (pack of 100)		10					
51.	-	Filter Paper Imported/USA	Whatman Filter Paper 15cm (Pack of 100)	No	1					
52.	-	Permeability Apparatus	• Constant head permeability cell 75 mm dia.	No	1					
			• Stand with 3 manometer tubes		1					

			• Constant level tank		1					
			• Tamping rod dia 8 x 300 mm		1					
53.	-	Falling head permeability	• Falling head permeability cell	No	1					
			• Stand with 4 manometer tubes		1					
			• Soaking reservoir							
			• Vacuum control panel for permeameters		1					
			• De airing water tank, 7l capacity. Easy internal cleaning system.		1					
54.	-	**Automatically PC controlled dynamic triaxial system with 15kN electromechanical servoactuation. Supplied complete with PC control and 16 channels data acquisition unit and software.**	Should covers the determination of the modulus and damping properties of soils in either intact or reconstituted states by either load or stroke controlled cyclic triaxial techniques. The system should also perform traditional triaxial tests such as UU, CU and CD as well as more advanced tests such as stress paths and K0. Features: =- Electromechanical Servoactuation, no need of compressed air or hydraulic power supply for the vertical force - Maximum Dynamic Load: 15 kN - Maximum Static load: 10 kN - Robust, high-strength and compact 2 column reaction frame. =- Capable to accept triaxial cell for sample up to 100 mm diameter =- Complete test automation of all stages using a high sensitivity closed loop P.I.D. feedback (up to 10kHz). =- Standard and user defined wave shapes programmable by the user matching the on-site measurements (earthquakes) =- Transducers calibration and verification controlled by software =- Manual and automatic	No	1					

			emergency shut off functions =- Air reservoir provided with two servo-valves for cell and back pressure control =- compact Dynamic Controller connected to the PC via Ethernet communication link (100Mbit/s) - 16 bit ADC input channels for transducers (16 channels) - Multivoltage - Multifrequency power supply 230 50 Hz or 110 V, 60 Hz **Transducers** 25kN capacity submersible load cell Axial displacement transducer +/- 25mm Pressure transducer 0-1000 kPa, De airing block suitable for banded triaxial cells **Automatic volume change apparatus allowing remote flow control.** **Triaxial cell** Banded triaxial cell for up to 70mm dia. Sample sizes : - Maximum working pressure up to 3500 kPa =- Five inlet points for top/bottom drainage, cell pressure and pore pressure =- Quick coupling for two drainage lines on the base =- Vacuum attachment to be used with Vacuum top cap for extension tests **Accessories for 50 mm dia sample** Pedestal 50mm diameter two pore pressure ports for 70mm triaxial cell Vacuum top cap 50mm diameter with 2 drainage tubes							

			Disc perspex 50mm diameter Pair of porous disc 50mm diameter Rubber membrane 50mm diameter x 200mm long (pack of 10) O ring 50mm diameter (pack of 10) Membrane placing tool for 50mm samples O Ring placing tool for 50mm samples Two part split mould for 50mm diameter sample Filter drains (pack of 50) for 50mm samples Filter discs for 50mm dia sample (pack of 100) Hand sampler complete of cutter, dolly and receiver for 50mm samples Two parts split former with vacuum attachment for 50mm sample **Pressure system** Nylon tubing 6mm bore x 8mm outside diameter, 10 metre length Bladder air/water interface with 1000kPa banded chamber. Triaxial panel two way pressure gauge and hand pump. Outlets for two pressures Air compressor and air filter **De airing system** Air drying unit. For use with Silica gel with indicator Silica gel with indicator. 1000 g De airing water tank, 23l capacity. Easy internal cleaning system. Valve panel for use with de-airing tank Portable vacuum pump, free air displacement 75 l/min, ultimate vacuum 0.1 mbar. 230V/50-60Hz/1Ph Rubber tube dia 6,5 x 12,5mm, 2m							

			long for vacuum pump. Nylon tubing 6mm bore x 8mm outside diameter, 10 metre length Flaring tool							
55.	-	Rock Piks and Hardness Scale	• Rock pick pointed tip	No	1					
			• Rock pick chisel edge		1					
			• Compensation device for up to 4 Wheatstone bridges		1					
			• with 1/4 or 1/2 bridge setup							
			• Strain gauge application kit		1					
			• Connecting terminals. 50 pairs sheet		1					
			• Strain gauge 9,53 mm gauge length. (pack of 5)		1					
			• Strain gauge 20 mm gauge length. (pack of 10)		1					
			• Strain gauge 30 mm gauge length. (pack of 10)		1					
56.	-	Rock index apparatus	• Digital rock strength index apparatus.	No	1					
			• Battery operated.							
			• Set of lower and upper platen 52 mm dia with spherical seat for compression test on concrete Microcors		1					
57.	-	Rock hammer	• Rock classification hammer	No	1					
			• ASTM universal rock cradle for testing rock cores conforming to ASTM		1					
58.	-	Le Chatelier soundness kit	• Le Chatelier soundness kit	No	1					
			• Le Chatelier water bath. 220-240V/50-60Hz/1ph		1					
			• Le chatelier flask		1					
59.	-	Sparula	Chattaway spatula	No	1					

60.	-	Prism mould	Two gang prism mould 25x25x285 mm to ASTM C490 for expansion test of cement	No	1					
61.	-	Blain apparatus	Blaine apparatus EN196/6	No	1					
62.	-	Manometer liquid	Manometer liquid 250 ml bottle	No	1					
63.	-	Reference Cement	Reference cement according to EN 196.6 and ASTM C204 - pack of 5 g.	No	1					
64.	-	Filter paper Imported/ USA	Filter paper for apparatus 62-L0041/A. Dia. 12,6mm Pack of 100 pcs.	No	1					
65.	-	Flow table	Flow table Supplied complete with flow mould, hopper and tamper. Conforming to ASTM C230. 230V, 50Hz, 1ph.	No	1					
66.	-	Sand	Reference sand to EN 196. 32 bags, tot. 43,20 Kg.	No	1					
67.	-	SOKKIA SET65 Electronic Total Station	, 1” reading, 5” Accuracy, memory 24,000 points, double sided display, distance range 3000 meter, Alpha numeric key board, all keys are backlight and glow brightly, so you can see exactly what you are doing, even when working in low light conditions with standard accessories. Along with: (i) - Single Prism Target Set. (ii) - Aluminum Heavy Duty Tripod (Imported).	No	1					
68.	-	SOKKIA CX-105C Electronic Total Station -	Laser Pointer, (It takes distance with Prism), 1”reading ,5”accuracy, double side display, distance range with single prism : 5000 meter , with triple prisms : 6000meter, with reflective sheet : 500meter , Guide Light, internal memory 10,000 points + USB, flash memory slot,	No	1					

			built in area calculation system, automatic dual axis compensator, with standard accessories (Made in Japan). Along with: (i) - Single Prism Target Set. (ii) - Aluminum Heavy Duty Tripod (Imported).							
69.	-	- SANDING STS752L Electronic Total Station	1" Reading, 2" accuracy, distance range 5000 meter, alphanumeric key board, double side display, magnification 30X, with battery & charger in standard accessories. Along with: (i) - Single Prism Target Set. (ii) - Aluminum Heavy Duty Tripod (Imported).	No	1					
70.	-	MATO MTS-805 \ SOKKIA Software Electronic Total Station -	1" reading, 5"accuracy, double sided display, distance range with prism 3500 meter, Battery & charger, memory 50,000 Points, original carrying case in standard accessories.	No	1					
71.	-	SANDING Electronic Digital Theodolite	SANDING ET-05 Electronic Digital Theodolite, 1" reading, 5" accuracy, double sided display, with standard accessories.	No	1					
72.	-	Laser Level -	Laser Level, with standard accessories.	No	1					
73.	-	Hand Held Laser Distance Meter -	Hand Held Laser Distance Meter, Area Calculation. Easy to use small & handy measuring with laser fast, simple and innovative saves time.	No	4					
74.	-	Strain Gauge (Must be Compatible with the Data Acquisition System	• 20 mm gauge length. [pack of 10]	No	1					
			• 30 mm gauge length. [pack of 10]		1					
			• 60 mm gauge length. [pack of 10]		1					
			• 120mm gauge length. [pack of 10] • Adhesive and catalyst agent to glue the strain gauge to the specimen		1					

		Required at Item 75)								
75.	-	Load Cell (Must be Compatible with the Data Acquisition System Required at Item 75)	• 50 Ton class 1 to EN ISO 376. Supplied complete with carryng case.	No	4					
			• 100 Ton kN class 1 to EN ISO 376. Supplied		2					
			• 200 ton class 1 to EN ISO 376. Supplied		1					
76.	-	Linear Variable Transducer (Must be Compatible with the Data Acquisition System Required at Item 75)	Linear potentiometric transducer, 25 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector		4					
			Linear potentiometric transducer, 50 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector		6					
			Linear potentiometric transducer, 100 mm travel • Input voltage: 10 V DC • Output: from 0 to 10 V DC • Repeatability: better than 0.002 mm • Accuracy: better than 0.002 mm 6 pin connector		2					
77.	-	Data Acquisition	Data Acquisition system with 32 channels extendable 128 channels.		1					

		system	Strain controlled quarter bridge Data Acquisition System should be able to accommodate Strain gauges, LVDTs, Load Cells, and other transducers.							
78.	-	Accelerometer	Three dimensional accelerometer +-2g capacity, noise filtration, Acquisition system Low impedance, voltage mode • Quartz-shear sensing elements • Ultra-low base strain • Minimal thermal transient response • Lightweight, hermetically sealed titanium case • Conforming to CE Complete in all respects.		18					
79.	-	Balance China	Digital Top Loading Balance Capacity 6kg x 0.1gm including rechargeable battery	No	1					
80.	-	Balance China	Electric Plate Form Balance Capacity 60kg x 10gm including rechargeable battery	No	1					
81.	-	Lab. Oven China	Digital Thermostatically Controlled General purpose Laboratory Oven Capacity 240 Liters, 220V 50HZ 1PH	No	1					
82.	-	Thermometer China	Digital Dial Thermometer Range 0 to 300°C, with collar	No	1					
83.	-	Temperature Measurement China	Glass Thermometer for Concrete Range 0 to 200°C	No	5					
84.	-	Lab. Oven China	Digital Thermostatically Controlled Laboratory Oven Capacity 240 Liters 220V-50HZ 1PH	No	1					
85.	-	Thermomete	Digital Dial Thermometer with collar	No	10					

		rs China	for Oven							
86.	-	Digital Balance China	Digital Electronic Top Loading Balance, Capacity 15kg x 1gm, 220V-50Hz -1PH	No	1					
87.	-	Digital Balance China	Digital Plate Form Balance, Capacity 100kg x 10gm 220V-50Hz -1PH	No	1					
88.	-	Vernier Caliper China	• Digital Vernier Caliper 12"	No	1					
89.	-	Specific Gravity Apparatus China	• Specific Gravity Bottle 25ml	No	10					
			• Specific Gravity Bottle 50ml		10					
			• Specific Gravity Bottle 100ml		10					
			• Evaporating Dish, 150mm Dia x 45mm Depth		10					
			• Plastic Limit set including, Lod Comparator, • Spatula 200mm Blade and Glass Plate 12" x 12" x 0.5"		10					
90.	-	Balance China	Digital Top Loading Balance Capacity 30kg x 1gm	No	1					
91.	-	Thermometer China	• Glass thermometer -10 + 50c	No	1					
			• Spare U-tube glass manometer for L0041/A		1					
92.	-	Thermometer Local	Dial Thermometer 0 to 300°C	No	1					
93.	-	Sampling Tray Local	Galvanized Sampling Tray Size 18" x 18" x 3"	No	12					
94.	-	Scoop Local	Aluminium Scoop	No	1					
95.	-	Sample container Local	Sample Container Approximately 2.5 Liters	No	1					
96.	-	Splitter Local	• Sample Splitter 38mm	No	1					
			• Sample Splitter 50mm		1					
97.	-	Polythene	Polythene Bag	Pkt	2kg					

		Bag Local	Size Approximately 1m x 450mm							
98.	-	Sand Absorption Set Local	Sand Absorption Cone & Tamper	No	1					
99.	-	Temping Rod Local	Tamping Rod 16mm dia x 600mm long Hemispherical at both ends c/w set of *12 abrasive charges*	No	1					
100.	-	Sampling tray Local	Galvanized Sample Tray, Size 12" x 12" x 2"	No	1					
101.	-	Sieve Shaker Local	Electromagnetic sieve shaker for sieves up to 315 mm dia. 230V, 50-60Hz, 1ph.	No	1					
102.	-	Sieve Brush Local	Sieve Brush	No	1					
103.	-	Thermometer Local	Digital Thermometer, -50°C to 1000°C complete with probes	No	1					
104.	-	Marshal Test Specimen Local	• Digital Automatic Marshal Compactor for 4" dia and 6" dia sample • c/w Hammers and Moulds 220V-50HZ - 1PH	No	1					
			• Standard Proctor Mould		4					
			• Modified Proctor Mould		4					
			• Paper Disc for Marshal Sample (Pack of 100)		1					
105.	-	Spatula Local	Spatule 200mm Approximately	No	1					
106.	-	Scoop Local	Aluminium Scoop Large size	No	1					
107.	-	Gloves Local	Heat Resistive Gloves	No	1					
108.	-	Universal Extruder Local	Universal Extender for 4" and 6" Dia sample	No	1					
109.	-	Softening Point Local	Ring and ball apparatus to EN 1427 and ASTM D36	No	1					
110.	-	Air Entrainment	• Air Entrainment c/w carrying case	No	4					
			• Compacting Bar		4					

		Local	• Soft Headed Mellet		4					
111.	-	Sampling Tray Local	• Galvanized Sampling Tray Size 18" x 18" x 3"	No	10					
			• Galvanized Sampling Tray Size 24" x24" x 3"		10					
112.	-	Sample Container Local	Sample Container, Approximately 2.5 Liters	No	10					
113.	-	Sample Splitter Local	• Sample Splitter (38mm sampling) complete with tray	No	4					
			• Sample Splitter (50mm sampling) complete with tray		4					
114.	-	Polythene Bag Local	Large Polythene Bag, Approximately 1m x 450mm (Per kg)	No	50					
115.	-	Temping Rod Local	Tamping Rod 16mm dia x 600mm long Hemispherical at both end	No	1					
116.	-	Sample Container Local	Sample Container 2.5 Liter Capacity	No	10					
			Sample Container 0.5 Liter Capacity		10					
117.	-	Sampling Tray Local	Sample Tray (Galvanized) Size 18" x 18" x3"	No	20					
118.	-	Scoop Local	Aluminium Scoop, Small Size	No	1					
			Aluminium Scoop, Large Size		1					
119.	-	Trowel Local	Trowel	No	1					
120.	-	Knife Local	Trimming Knife	No	1					
121.	-	Straight Edge Local	Straight Edge 300mm	No	1					
122.	-	Melting Pot Local	Electric Melting Pot, Thermostatically Controlled 220V 50HZ 1PH	No	1					
123.	-	Soil Classification Local	• Liquid Limit Device with Grooving Tool	No	10					
			• Digital General Purpose		1					

			Laboratory Oven, Capacity 240 Liter 220V - 50HZ 1PH							
			• Digital Dial Thermometer, Range 0 to 300°C		10					
			• Galvanized Sampling Tray, Size 12" x 12" x 2"		10					
			• Un-numbered Moisture Tin, Capacity 90 grams (Approx.)		20					
			• Wash Bottle, Plastic 500ml		5					
			• Spatula 100mm Blade		5					
			• Spatula 200mm Blade		5					
124.	-	Shrinkage Limit Set Local	Shrinkage Limit Set c/w prong plate, Shrinkage dish and glass cup	No	10					
125.	-	Sieve Brush Local	Sieve Brush	No	1					
126.	-	Sampling Tray Local	Galvanized Sampling Tray Size 24" x 24" x 3"	No	1					
127.	-	Sample Splitter Local	• Sample Splitter of 7mm , (Approx.) opening c/w tray	No	1					
			• Sample Splitter of 15mm , (Approx.) opening c/w tray		1					
			• Sample Splitter of 30mm , (Approx.) opening c/w tray		1					
			• Sample Splitter of 50mm ,(Approx.) opening c/w tray		1					
128.	-	Dry Density & Moisture Relationship Local	• Standard Compaction Mould	No	10					
			• Standard Compaction Rammer		10					
			• Modified Compaction Mould		10					
			• Modified Compaction Rammer		10					
129.	-	Soaking tank Local	Soaking Tank, Size 3 Ft x 5 Ft	No	1					
130.	-	CBR Mould Local	CBR Mould 6" Dia c/w Collar and Perforated Base	No	6					
131.	-	Swell plate Local	Swell Plate (Brass)	No	6					
132.	-	Surcharge Weight Local	Surcharge Weight (Anular) Surcharge Weight (Slotted)	No	6					

133.	-	Tripod Local	Aluminium Tripod Attachmend	No	6					
134.	-	Swell Dial Gauge Local	Penetration / Swell Dial Gauge, 10mm x 0.01mm	No	6					
135.	-	Spare Disc Local	Spare Disc	No	2					
136.	-	Bulk density apparatus Local	Apparatus for measurement of bulk density of cement		1					
137.	-	Glass plate Local	Glass plate 210 x 185 x 6 mm		1					
TOTAL										

Firm Name_____
Signature_____
Name_____
Designation_____

Bid Bond Ref_____ GST _____ Custom Duty _____

Total Gross Value of total Qty_____

(Bid Bond be attached with Annex C. Copy of Bid Bond be attached with

Technical offer without showing its value. Exposure of bid bond may result in rejection of offer.