

BID DOCUMENT

NATIONAL COMPETITIVE BIDDING

FOR

SUPPLY, INSTALLATION, COMMISSIONING & MAINTENANCE OF
CIVIL ENGINEERING LABORATORY EQUIPMENTS FOR
I.K.G. PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA AND
ITS OTHER CONSTITUENT CAMPUSES (PUNJAB)

Bid No. : EdCIL/PROC/PTU-2017/LAB-BTECH-CIVIL/CIVREST-PKG1/1

PART-II- FINANCIAL BID



EdCIL (India) Limited

(A Govt. of India Mini Ratna Enterprises)

'EdCIL House', Plot No. 18A, Sector- 16A

NOIDA – 201301 (UP), INDIA

Tel: 0120 – 2512001-006, FAX: 0120-2515372

Dated: 13/06/2017

This document serially numbered from page number 01 to 38.

FINANCIAL BID
Instructions to Bidders

1. Financial Bid shall be submitted with full price details.

Financial Bid shall contain only the prices duly filled in as per the format given in Schedule of Rates provided in the tender document. Price bid should not have any Commercial and/or Technical stipulation in addition to, what is already given in Part I – Technical bid.

Financial Bid Standard Forms (Form-1, Form-2A and /or Form-2B) shall be used for the preparation of the price quote according to the instructions provided.

2. **The Bidder should quote for all the Laboratory items / equipments listed in this document. In case, the Bidder/s does not quote for all the Laboratory items/Equipments, the Bid shall be treated as incomplete and shall be rejected summarily.**
3. The Items / equipments to be supplied / delivered / installed / commissioned at various locations of IKGPTU Campuses is as shown in the enclosed Annexure VI. The rate shall be inclusive of all taxes, octroi, transportation (as per the location), packing, loading and unloading (as designated location), Insurance etc. and nothing shall be paid extra.
4. The bid shall be evaluated on total value of all Laboratory items/Equipments as shown in summary and supply order shall be placed to a bidder as a composite bid.
5. The prices quoted by the bidder shall be fixed for the quantity mentioned for the duration of the contract and shall not be subject to adjustment on any account. Price should be firm for any positive or negative variation in quantities up to 100%.
6. The changes displayed in the corrigendum/addendum to the bid documents, particularly with the financial bid should be attached with the financial bid submission, in the same packet, duly signed and stamped by the authorized signatory of the Bidder firm.

FINANCIAL BID SUBMISSION FORM

To:

Chief General Manager (EIS & EPS)
EdCIL (India) Limited
EdCIL House, 18 A, Sector-16 A
NOIDA – 201301 (U.P.), India

Dated: ____/____/2017

Dear Sir,

We, the undersigned, offer to provide "SUPPLY, INSTALLATION , COMMISSIONING & MAINTENANCE OF CIVIL ENGINEERING LABORATORY EQUIPMENTS" in accordance with your Request for Proposal dated ____/____/2017.

Our attached Financial Bid is for the amount of _____ *[Indicate the corresponding to the amount(s), currency(ies) {Insert amount(s) in words and figures}]*.

Please note that all amounts shall be the same as in Form-1. Our Financial Bid shall be binding upon by us subject to the modifications resulting from Contract negotiations, if any, up to expiration of the validity period of the Proposal.

We remain,

Yours sincerely,

Authorized Signature {In full and initials}:
Name and Title of Signatory:
In the capacity of:
Address:
E-mail:

FORM-1**SUMMARY OF FINANCIAL BID**

S. No.	Description	Amount (exclusive of Tax) (Rs.)	Tax (Rs.)	Amount (Inclusive of Tax) (Rs.)
A.	CIVIL ENGINEERING LABORATORY EQUIPMENTS (Form-2A and/or Form-2B)			
B.	Comprehensive Annual Maintenance (Annexure-IV)			
	Total (Rs.)			
Total Price Bid (exclusive of taxes) (in Words) (Rupees.....)				
Total Price of Bid (Inclusive of taxes) (In Words) (Rupees.....)				
Signature of bidder		.....	
Name & Address		..... ..... .....	
Note :	Date		.....
i)	<i>Discount or any other offers affecting the package price must be mentioned here only. Discount or any other offers affecting the package price mentioned at any other place of the bid will not be considered.</i>			
ii)	<i>In case of discrepancy between unit price and total price, the unit price shall prevail.</i>			
iii)	<i>Bids shall be evaluated based on total price without taxes.</i>			

**FORM-2A
(FINANCIAL BID)**

PRICE SCHEDULE FOR GOODS TO BE IMPORTED

ANNEXURE – I

Date:

Name of the Department:

Name of the Laboratory:

(A) Price Schedule: (Format used for imported items)

S.No.	Currency	Description and Specification of the Item	Qty. in Units	Unit Price	Agency Commission (If applicable)	Discount	Ex-works price	Packing + Handling + DOC + Inland Freight +Insurance	CIF price	Insurance + Freight	CIP Price	Total Price
			(a)	(b)	(c)	(d)	(e)=(b+c-d)	(f)	(g)=(e+f)	(h)	(i) = (g+h)	(j) = (i*a)
				(i) In Figures: (ii) In words:								

Total Price of Bid (In Words)	
Signature of bidder	.....
Name & Address	.....
Date	.....

Note:

1. *The above financial template should be strictly followed. Any deviation from the above template (in terms of description and specification of the item) may debar the bidder at sole discretion of EdCIL.*
2. *Discount or any other offers affecting the package price must be mentioned here only. Discount or any other offers affecting the package price mentioned at any other place of the bid will not be considered.*
3. *In case of discrepancy between unit price and total price, the unit price shall prevail.*
4. *Bids shall be evaluated based on total price including all charges as CIP Price.*
5. ***CIP - Carriage and Insurance Paid to (named place of destination):** The seller pays for the carriage of the goods up to the named place of destination and the seller is required to obtain insurance for the goods while in transit.*

FORM-2B

ANNEXURE-II

PRICE SCHEDULED FOR GOODS (INDIGENOUS / IMPORTED GOODS TO BE QUOTED IN INR)**Price Schedule: (Format used for indigenous items/ Imported Items).**

S.No.	Description and Specification of the Item	Qty. in Units	Unit Price in Rs.	Excise Duty % /Custom Duty	CST/ VAT %	Insurance other duties and taxes if any,	Packing and Inland Transportat ion	F.O.R Destination Price	Total Price in Rs. (Excluding Taxes)	Total Price in Rs. (Including Taxes)
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)=(b*a)	(i) = (g *a)
			(i)In Figures: (ii)In words:							
Total Price of Bid (In Words)										
Signature of bidder						.....			
Name & Address						.....			
Date						.....			
Note: <ol style="list-style-type: none"> <i>The above financial template should be strictly followed. Any deviation from the above template (in terms of description and specification of the item) may debar the bidder at sole discretion of EdCIL.</i> <i>Discount or any other offers affecting the package price must be mentioned here only. Discount or any other offers affecting the package price mentioned at any other place of the bid will not be considered.</i> <i>In case of discrepancy between unit price and total price, the unit price shall prevail.</i> <i>Bids shall be evaluated based on total price including all charges as F.O.R Destination Price.</i> 										

ANNEXURE – III**COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT PRICES SCHEDULE**

S. No.	Item Description	2 nd Yr.	3 rd Yr.	Total Comprehensive Annual Maintenance Contract for 2 years(2 nd year & 3 rd year) after warranty period of 1 year from the date of successful installation. (E= C+D)
A	B	C	D	E
1.	Equipment: Make: Model: Qty.: (Mention Total quantity from Annexure-VI)			
SUB-TOTAL(Rs.) (Carry forwarded to Summary)				
Sub-Total Price Bid (exclusive of taxes) (in Words) (Rupees.....)				
Sub-Total Price of Bid (Inclusive of taxes) (In Words) (Rupees.....)				
Signature of bidder			.....
Name & Address			..... .....
Note:	Date		.....
i)	Discount or any other offers affecting the package price must be mentioned here only. Discount or any other offers affecting the package price mentioned at any other place of the bid will not be considered.			
ii)	In case of discrepancy between unit price and total price, the unit price shall prevail.			
iii)	Bids shall be evaluated based on total price without taxes.			

Note:

- The above rates shall be included in computing the total cost of the equipments.**
- Agency to use separate sheet for each equipment/Item/package.**

ANNEXURE-IV

1	Concrete Mixer		
	<ul style="list-style-type: none"> • The mixer shall consist of a steel vessel mounted on a frame. • Capacity: 50 litres or better • Drum speed: 20 rpm or better • The vessel shall be tilted to any angle by a handle for mixing and discharge. • Blades should provided inside the vessel to mix the material thoroughly • The drum, handle and motor etc. shall be mounted on a steel frame • Wheels for carting away should be provided with mixer • Should provided with Power Electric Motor of 1 HP • Should be suitable for operation on 220V, 50Hz, Single Phase, AC supply 		
	2	VEE BEE CONSISTOMETER:	
		As per IS 1199: 1959 and 10510:1983	
		a) A vibrator table 380 mm long and 260 mm wide resting upon elastic supports	
		b) A metal pot open at both ends	
		c) A sheet metal cone, open at both ends- 30 cm high, bottom diameter 20 cm, and top diameter 10 cm	
		d) A standard iron rod: The standard iron shall be of 20mm diameter and 500 mm in length.	
	Suitable for operation on 415 V, 3 phase, 50 Hz, AC Supply.		
	3	COMPRESSION TESTING MACHINE:	
Automatic Compression Testing Machine Testing Machine 2000 kN Capacity with touch panel. Supplied with Displacement Sensor			
Parameter		Specification	
Load Least Count		0.1 kN or 1kN	
Standard		IS : 516/IS : 4031 : Part 6: 1988/ASTM C39 for concrete specimen.	
Software & Data acquisition		Capable of recording real time displacement and load by suitable Data acquisition system and relevant software	
Operation		Automatic Compression Testing Machine (HydraulicElectrically Operated)	
Capability of Testing		Cylinders: Dia. of 100 and 150 mm	
Piston diameter		Min 200 mm	
Piston Stroke		Min 50 mm	
Load Frame			
Parameter		Specification	
Capacity		Minimum of 2000 kN	
Day Light clearance		Min: 340 mm	

Horizontal clearance	Min :350 mm
Platens	Oil filled spherical seat
Size of platen	Min: 256 mm
Vertical clearance	Min: 350 mm
Safety against over travel	Proximity switch/ limit switch
Lower and Upper Platens	Min. dia. of 200 mm (or side for square)
Hydraulic Pumping System	
Parameter	Specification
• Motor	Suitable Servo Motor
• Power supply	220 V, Single Phase, 50 Hz
• Safety against over Load	Pressure Switch should be provided and Release switch should be provided to release load after sample failure
Microprocessor based Touch panel display & Control system	
Parameter	Specification
• Control Channel	Load/Stress
• Load ranges	0-2000 kN
• Least count	1 kN
• Supply input	220-240 VAC, 50 Hz.
• Control system provides the digital servo control, Ramp generation for the machine, data acquisition etc. for the continuous operation of the system	
• Facility to perform various operations such as TARE PROGRAMMING, START, STOP Etc. from touch panel display	
• Programmable rate of loading (Pace rate) and sample parameters (Shape	
• Automatic pace rate control as programmed in the controller	
• Microprocessor based touch panel graphic display to control the machine operation and display of data	
• Menu Driven Interface	
• Standalone system to operate the machine (Start, stop and hold) without computer	
• Fully automated operation to start, stop and hold loading with automatic pace rate control from 1-10 kN/sec..	
• Automatic release facility after sample failure	
• Automatic strength calculation and display	
• Automatic pace rate control at preset value with pace deviation bar.	
• On-Line display of Load and Peak load with recording of peak load along other sample details	
• Peak stress calculation based on sample type, shape and dimensions	
• Configurable Engineering Units for machine selection	
• Storing of results in user defined file with sample parameter and other details	
• Real time clock check to keep automatic track of the date, time and runs	
• Test results can be stored in the electronic unit with unique record no. and can be retrieved and transferred to USB drive for printing	
• Transmission of Data to computer through Ethernet/USB/RS232 Port.	

4	FLEXURAL TESTING MACHINE :	
	FLEXURAL TESTING MACHINE WITH IN HOUSE NABL CALIBRATION CERTIFICATE:	
	Capacity :100kN Flexure Testing Machine Electrically Operated to test flexural strength of concrete beams	
	Type of Pumping: Electrical	
	Loading Capacity: 0-100 kN	
	Least Count: 0.5kN	
	Type of Loading: Four Point	
	The bed of the testing machine shall be provided with two steel rollers, 38 mm in diameter, on which the specimen is to be supported.	
	These rollers shall be so mounted that the distance from centre to centre is 60 cm for 15.0 cm specimens or 40 cm for 10.0 cm specimens.	
	The load shall be applied through two similar rollers mounted at the third points of the supporting span that is, spaced at 20 or 13.3 cm centre to centre.	
	The load shall be divided equally between the two loading rollers.	
	Standard	IS:516, BS:1881 and ASTM C78
	Load application	Downward Movement
	Gauge	Bourdon tube type load gauge of range : 0 -100 kN x 0.5 kN
	<ul style="list-style-type: none"> A spacer is provided for testing different size of beams. 	
	<ul style="list-style-type: none"> Light weight, rugged high strength frame 	
	<ul style="list-style-type: none"> Double action hydraulic pump 	
	<ul style="list-style-type: none"> Self-aligning roller assembly 	
	<ul style="list-style-type: none"> Hydraulic jack provided with retraction spring 	
	<ul style="list-style-type: none"> For testing beams of 100X100X500mm and 150X150X 700mm. 	
	<ul style="list-style-type: none"> 220V, 50Hz, Single Phase 	
5	TENSILE TESTING MACHINE:	
	Tensile Testing Machine should have high Accuracy, Sensitivity, Reliability, Consistency and Repeatability. Machine should be Floor Mounted, Vertical type and Two Column Construction	
	Machine should be designed for determining the Tensile Strength and Elongation of a host of materials like Ferrous and Non Ferrous Materials, Cables & Conductors, Plastic, PVC, Rubber Specimens, Paper, Plywood Etc.	
	Machine should be capable for conducting Compression, Cross Breaking And Shear Tests.	
	Tensile Testing Machine should have Digital Indicator Systems With Pc And Printer.	
	Technical Specifications:	
	Capacity (kg (f)): 10000,	
	Least Count: 0.1 kg (f).	
	Traverse Speed: 25 and 12.5 (mm/ min).	
	Grip Separation: Minimum 25 mm & Maximum 500 mm	

II. STRUCTURAL ANALYSIS LAB

S.NO.	SPECIFICATIONS
1.	THREE HINGED ARCH APPARATUS optimum quality mild steel with the span of 100 cm and rise of 25 cm.
2.	ELASTICALLY COUPLED BEAM APPARATUS Mild steel beam: 2.5 cm x 3 mm
3.	BEHAVIOUR OF COLUMN AND STRUT APPARATUS Four spring steel columns 15 cm long and .5mm x 1cm in cross section are made and put along a vertical wooden board. These four columns have got different end conditions as below: <ul style="list-style-type: none"> • Both ends pinned • Both ends fixed • One end pinned and other fixed • One end fixed and other end free
4.	APPARATUS FOR VERIFICATION OF CLARKS MAXWELL RECIPROCAL THEORM Beam 100cm long and 1.25 cm x 4 mm in cross section with graduations at every 10cm along the length. It is supported on two knife edge supports 70cm apart with a 30cm overhang on one side. A dial gauge with 25mm travel (with a magnetic base) is supplied with the apparatus. Apparatus is supplied complete with a supporting stand and a set of weights.
5.	UNSYMMETRICAL BENDING APPARATUS
6.	ELASTIC PROPERTIES OF DEFLECTED BEAM APPARATUS <ul style="list-style-type: none"> • A mild steel beam 2.5 cm x 3 mm in cross section and 100 cm long is pinned to two supports 70 cm apart situated symmetrically.
7.	TWO HINGED ARCH APPARUTUS Span of 100cm and rise 25cm. Both ends are hinged but one of the ends is also free to move longitudinally. A dial gauge with 25mm travel (with magnetic base). Supply complete with a supporting stand and a set of weights.
8.	REDUNDANT JOINT APPARATUS Apparatus should consist of three suspension members (spring balances) of different stiffness which are jointed at a point to form the redundant joint. The upper end of the suspension members being tied in a position to a vertical wooden board. Arrangement is provided to apply a vertical load at the joint and to measure its horizontal and vertical displacement on a paper and also elongations and forces in the suspension members by the help of dial gauges. Two dial gauges with 25mm travel (with magnetic bases). Supply complete with a supporting stand and a set of weights.
9.	DEFLECTION OF TRUSS APPARATUS Apparatus should consist of 4 panels of a PRATT truss, each panel being 40cm in

	<p>horizontal direction and 30cm in vertical direction. Load can be applied on each panel point. All tension members are provided with detachable springs so as to obtain appreciable deformation of the member.</p> <p>Supply complete with a supporting stand and a set of weights.</p>
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III. TRANSPORTATION ENGINEERING LAB

Sl.No	Specification
1	CALIFORNIA BEARING RATIO APPARATUS
	California Bearing Ratio Test Apparatus, Motorized, Three Speed
	Ref: Standards: IS : 2720 (Part XVI), BS 1377; 1924; EN 13286-47/ ASTM D 1883; AASTHO T 193
	Salient Features should include: <ul style="list-style-type: none"> • Compact, bench top design • Rapid Platen Adjustment • Complete with stabilizing bar • Options for mechanical or electronic measurement
	Power Supply
	Suitable for operation on 220V, 50Hz, single phase, AC supply.
	Load Frame
	50 kN Capacity
	Three Speed
	1.5, 1.25 & 2.5 mm/min
	Mould
	Gun Metal 150mm ID x 175 mm H
	Extension Collar
	Gun Metal 150 mm ID x 50 mm high
	Penetration Piston Diameter
	50 mm face dia
	Circular Metal Spacer Disc, with detachable handle,
	148 mm dia x 47 mm high or better
	Annular Metal Weight
	147 mm dia with 53 mm dia central hole
	Dial Gauge
	25 mm travel, 0.01 mm least count
	Perforated Base Plate
	Adjustable Bracket for Penetration

	Perforated Plate with adjustable stem and lock nut
	Metal Tripod for Dial Gauge
	Cutting Collar
	Rammer 2.6 kg, 310 mm controlled drop
	Rammer 4.9 kg, 450 mm controlled drop
	Proving Ring Capacity 50 kN
2	LOS ANGELES ABRASION TESTING MACHINE:
	<ul style="list-style-type: none"> • Los Angeles Abrasion testing machine with Counter • Ref. Standards – IS:10070 • The machine should consist of a hollow cylinder, mounted on a sturdy frame on ball bearings. A detachable shelf which extends throughout the inside length of the drum catches.
	<ul style="list-style-type: none"> • The abrasive charge and does not allow it to fall on the cover. The drum is rotated at a speed of 30-33 rpm by an electric motor through a heavy duty reduction gear. Supplied complete with a tray for collection of the material
	<ul style="list-style-type: none"> • Instrument is supplied with the abrasive charge consisting of 12 cast iron spheres of 48 +/- 2 mm in diameter and each weighing between 390 and 455 g and a total of 12 numbers of spheres weighing 5 000 +/- 25 g
	<ul style="list-style-type: none"> • Power supply: 415V, 3 phase, 50 Hz, AC supply.
3	DUCTILITY TESTING MACHINE (ELECTRICALLY OPERATED):
	<ul style="list-style-type: none"> • Ductility Testing Machine with Digital Temp Indicator • Ref. Standards IS:1208, ASTM D113, AASHTO T 51
	<ul style="list-style-type: none"> • Should be designed for test three specimens simultaneously
	<ul style="list-style-type: none"> • The machine should consist of a carriage moving over a lead screw
	<ul style="list-style-type: none"> • Electric motor driven reduction gear unit
	<ul style="list-style-type: none"> • Entire assembly should mount with water bath completely encased in metal bound hardwood
	<ul style="list-style-type: none"> • Electric pump circulator and heater should be included
	<ul style="list-style-type: none"> • Temperature is controlled by digital temperature controller
	<ul style="list-style-type: none"> • Two rates of travel i.e. 5 cm/min and 1cm/min are provided

	<ul style="list-style-type: none"> • Power Supply: 220 V, 50 Hz, Single Phase, AC supply
	<ul style="list-style-type: none"> • Ductility Mould, with Base Plate - 4Nos
4	BITUMEN (CENTRIFUGE) EXTRACTOR (ELECTRICALLY OPERATED):
	<ul style="list-style-type: none"> • Centrifuge Extractor, Capacity 1500g Electrically Operated • Ref. Standards ASTM D 2172, AASHTO T-58, T-164, EN 12697-1
	<ul style="list-style-type: none"> • centrifuge extractor should be compact with inbuilt • Dimmer stat for speed variation from 0 rpm to 3600 rpm.
	<ul style="list-style-type: none"> • Each unit is supplied complete with a set of 25 Filter Paper Discs.
	<ul style="list-style-type: none"> • Power Supply: 220 V, 50 Hz, Single Phase, AC supply

IV. GEOTECHNICAL ENGINEERING LAB

S.No.	Specifications	
1.	PERMIABILITY TEST APPARATUS	
	Laboratory Permeability Apparatus	
	Ref. Standards IS:2720 (Part 17), IS:11209	
	For testing soil with coefficient of permeability in the range of 10 ⁻³ to 10 ⁻⁷ cm / sec and maximum particle size of 10 mm.	
	Supplied with the following:	
	Stand with three glass tubes of 6 mm, 10 mm and 20 mm dia approx.	
	Metallic Mould 100 mm dia x 127.3 mm height, 1000 ml volume.	
	Extension Collar 100 mm dia x 60 mm height.	
	Drainage Base Plate with a recess for Porous Stone and an Outlet Valve.	
	Metallic Clamping Ring	
	Drainage Cap with recess for a Porous Stone and fitted with Inlet Valve and Air Release Valve.	
	Dummy Plate to serve as False Bottom during compaction.	
2.	UNCONFINED COMPRESSION TESTING MACHINE	
	Unconfined Compression Tester for load measurement	
	Ref. Standards IS:2720 (Part 10), AASHTO T208	
	supplied with Load Frame 3 speed -50 kN,	
	Proving Ring, 2kN	
3.	DIRECT SHEAR TEST APPARATUS	
	Direct Shear Test Apparatus 2 kN capacity	
	Ref. Standards IS :11229, 2720 (Part 13)	
	Type of Shear : Direct / Residual Measurement	
	Operation : Motorized	
	Rates of Strain : 1.25, 0.625, 0.25, 0.125, 0.05, 0.025, (mm/min) 0.01, 0.005, 0.002, 0.001, 0.0004, 0.0002	
	Specimen Size : 60 x 60 x 25 mm	
	Supplied with the following:	
	Shear Box Assembly	
	Assembly should comprises of :	2 Nos.
	Halves of the Shear Box	

	Plane Gripper Plate	2 Nos.
	Perforated Gripper Plate.	2 Nos
	Porous Stone	2 Nos.
	Top Loading Pad	1 No.
	Base Plate	1 No.
	Shear Box Housing with two linear bearing cases with steer	1 No.
	Specimen Cutter	1 No.
	Surcharge Weights to attain normal stress of 3 kg/cm ²	1 Set
	This surcharge weight set comprises of following weights :	
	0.05 kg/cm ² :	4 Nos.
	0.10 kg/cm ² :	1 No.
	0.20 kg/cm ² :	1 No.
	0.50 kg/cm ² :	3 Nos.
	1.00 kg/cm ² :	1 No.
	Compression - Tension Proving Ring, 2 kN capacity	1 No.
	Dial Gauge 0-25 × 0.01mm	2 Nos.
4	TRIAXIAL TEST APPARATUS: Triaxial Shear Test Apparatus Load Frame, Motorized, 50 kN Capacity Multi rate of strain. Designed to accommodate Universal Triaxial Cell for testing soil specimens up to 100 mm in diameter. Triaxial Cell For 38mm specimen Suitable for lateral pressure up to 1000 kPa, the cell have four take off positions drilled in the base for cell pressure, pore water pressure, and for top and bottom drainage. Fitted with 3 no-volume change valves and one dead end plug. Cell is supplied complete with one loading pad, two porous stones, one sheath stretcher, one split sand former, 10 latex rubber sheaths and four sealing rings for 38 mm dia samples Rates of strain ranging minimum 0.00048 mm/min.	

	<p>Self Compensating Pressure Apparatus Double Chamber (oil/water type)</p> <p>Pressure range: 10-1000 kPa</p>
	<p>Electronic Data Acquisition System</p> <p>The four-channel micro controller based signal conditioning and touch panel display unit is suitable to measure Axial load, Pore/Back pressure, Vertical displacement and Volume change (optional) directly indicated in their respective engineering units during Triaxial Testing. The system receives the output signal from the sensors i.e. Load cell, Pore/Back pressure sensor, Displacement Sensor and Volume change (optional) sensor attached to the Triaxial shear Test apparatus. The data of all four channels of Triaxial Shear Test can be transferred to computer through RS-232/ Ethernet and can be online monitored.</p>
	<p>The Unit also provides the facility of online monitoring of data of all the sensors on Touch Panel Display provided at the front.</p> <p>Broadly the following facilities are incorporated in the system:-</p> <ul style="list-style-type: none"> • Touch panel is provided to perform various operations such as TARE, PROGRAMMING, START, STOP etc. • Independent Taring of each channel • Data transfer interval is programmable (between 10 second to 1 hour) • Automatic data saving on stop button. • There are 25 set results having a maximum of 200 data points per set can be stored in the electronic unit .The sample number can be programmed. • Online date and time of test will be stored along with the data. • On line (while the test is in progress) data transfer to the computer through RS232/ Ethernet port. <p>NOTE- The Electronic unit operates on 220VAC+ 10%, 50Hz</p>
	<p>Sensors Specification: -</p> <p>1. Load Cell:</p> <ul style="list-style-type: none"> • Capacity :10kN • Safe Over Load : 150% of rated capacity • Max. Over Load : 200% of rated capacity • Fatigue Range : 105 cycles. • Non Linearity : + 1% of rated cap. Or better • Hystresis : 0.5% of rated cap. Or better • Repeatability : 0.5% of rated cap. Or better • Creep Error : 0.1% of rated cap. Or better • Temp. Range : 10 C to 50 C.

	<ul style="list-style-type: none"> • Sensitivity Tolerance : + 0.1% (Calibration tolerance of Signal at nominal load) • Ultimate Overload : 400% of rated cap. • Input Resistance : > 340 ohm • Output Resistance : >300-500 ohm • Reference Temperature : 23 C
	<p>2. Pressure sensor for Back / Pore pressure:-</p> <ul style="list-style-type: none"> • Sensing Element : Foil type strain gauges in full bridge configuration. • Capacity : 2000 kPa • Maximum Overload : 150% of rated capacity • Device Linearity : + 1% of rated capacity • Hystresis : + 0.5% of rated capacity • Repeatability : + 0.2% of rated capacity • Terminal Resistance : 350 ohms nominal • Excitation Voltage : 5 volts DC. • Terminal Connection : 5-pin connector • Frequency Response : 0 - 50 Hz • Safe Temperature : 0 - 50 c
	<p>3. Linear Variable Differential Transformer (LVDT) Type:-</p> <ul style="list-style-type: none"> • Stroke : $\pm 20\text{mm}$ • Linearity Deviation : $\pm 1\%$ of rated capacity • Repeatability : $\pm 0.1\%$ of rated capacity • Hystresis : $\pm 0.5\%$ of rated capacity • Excitation : 2-volt rms 2 KHz sinusoidal • Sensitivity : 1 Mv/V/Mm • Safe Temperature Range : 0 - 50 C • Core Fixture : spring-loaded plunger
	<p>Software</p> <ul style="list-style-type: none"> • On-Line Tri-axial Data Acquisition Software • On-Line Data Transmission from Signal Conditioning Unit to Computer • Off-Line Tri-axial Data Analysis Software that does all the calculations of UC, UU, CU, CU bar & CD Triaxial Test. • Has option for manual as well as automatic recording of data. • Calculates Dry density, Moisture content, void ratio, degree of saturation, 100% saturation moisture content etc. • Display the following Plots (Graphical) <ul style="list-style-type: none"> a) Consolidation curve b) Stress- Strain Curve for every test c) Axial Strain vs Pore Pressure d) Effective Stress Ratio vs Axial strain e) A-parameter vs Axial strain f) p-q plot and gives the value of c and f in terms of effective Ratio g) Calculates the following: <ol style="list-style-type: none"> 1. Evaluates t_{100} 2. Strain rate depending upon the drainage condition for CD and CU test

	<p>Computer</p> <ul style="list-style-type: none">• Intel i5 processor, 500 GB HDD, 4 GB RAM, DVD R/W drive, Key Board, Optical Mouse, 6USB Ports, 19" LCD Monitor, SVGA Adaptor card• Printer <p>UPS 1kVA</p>
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TECHNICAL COMPLIANCE REPORT:

I. CONCRETE TECHNOLOGY LAB

1	Concrete Mixer		Numerical Values or other Specifications	Whether comply Yes/No
	• The mixer shall consist of a steel vessel mounted on a frame.			
	• Capacity: 50 litres or better			
	• Drum speed: 20 rpm or better			
	• The vessel shall be tilted to any angle by a handle for mixing and discharge.			
	• Blades should provided inside the vessel to mix the material thoroughly			
	• The drum, handle and motor etc. shall be mounted on a steel frame			
	• Wheels for carting away should be provided with mixer			
	• Should provided with Power Electric Motor of 1 HP			
	• Should be suitable for operation on 220V, 50Hz, Single Phase, AC supply			
2	VEE BEE CONSISTOMETER:			
	As per IS 1199: 1959 and 10510:1983			
	a) A vibrator table 380 mm long and 260 mm wide resting upon elastic supports			
	b) A metal pot open at both ends			
	c) A sheet metal cone, open at both ends- 30 cm high, bottom diameter 20 cm, and top diameter 10 cm			
	d) A standard iron rod: The standard iron shall be of 20mm diameter and 500 mm in length.			
	Suitable for operation on 415 V, 3 phase, 50 Hz, AC Supply.			
3	COMPRESSION TESTING MACHINE:			
	Automatic Compression Testing Machine Testing Machine 2000 kN Capacity with touch panel. Supplied with Displacement Sensor			
	Parameter	Specification		
	Load Least Count	0.1 kN or 1kN		
	Standard	IS : 516/IS : 4031 : Part 6: 1988/ASTM C39 for concrete specimen.		
	Software & Data acquisition	Capable of recording real		

		time displacement and load by suitable Data acquisition system and relevant software		
Operation		Automatic Compression Testing Machine (HydraulicElectrically Operated)		
Capability of Testing		Cylinders: Dia. of 100 and 150 mm		
Piston diameter		Min 200 mm		
Piston Stroke		Min 50 mm		
Load Frame				
Parameter	Specification			
Capacity	Minimum of 2000 kN			
Day Light clearance	Min: 340 mm			
Horizontal clearance	Min :350 mm			
Platens	Oil filled spherical seat			
Size of platen	Min: 256 mm			
Vertical clearance	Min: 350 mm			
Safety against over travel	Proximity switch/ limit switch			
Lower and Upper Platens	Min. dia. of 200 mm (or side for square)			
Hydraulic Pumping System				
Parameter	Specification			
• Motor	Suitable Servo Motor			
• Power supply	220 V, Single Phase, 50 Hz			
• Safety against over Load	Pressure Switch should be provided and Release switch should be provided to release load after sample failure			
Microprocessor based Touch panel display & Control system				
Parameter	Specification			
• Control Channel	Load/Stress			
• Load ranges	0-2000 kN			
• Least count	1 kN			
• Supply input	220-240 VAC, 50 Hz.			
• Control system provides the digital servo control, Ramp generation for the machine, data acquisition etc. for the continuous operation of the system				
• Facility to perform various operations such as TARE PROGRAMMING, START, STOP Etc. from touch				

	panel display		
	<ul style="list-style-type: none"> Programmable rate of loading (Pace rate) and sample parameters (Shape 		
	<ul style="list-style-type: none"> Automatic pace rate control as programmed in the controller 		
	<ul style="list-style-type: none"> Microprocessor based touch panel graphic display to control the machine operation and display of data 		
	<ul style="list-style-type: none"> Menu Driven Interface 		
	<ul style="list-style-type: none"> Standalone system to operate the machine (Start, stop and hold) without computer 		
	<ul style="list-style-type: none"> Fully automated operation to start, stop and hold loading with automatic pace rate control from 1-10 kN/sec.. 		
	<ul style="list-style-type: none"> Automatic release facility after sample failure 		
	<ul style="list-style-type: none"> Automatic strength calculation and display 		
	<ul style="list-style-type: none"> Automatic pace rate control at preset value with pace deviation bar. 		
	<ul style="list-style-type: none"> On-Line display of Load and Peak load with recording of peak load along other sample details 		
	<ul style="list-style-type: none"> Peak stress calculation based on sample type, shape and dimensions 		
	<ul style="list-style-type: none"> Configurable Engineering Units for machine selection 		
	<ul style="list-style-type: none"> Storing of results in user defined file with sample parameter and other details 		
	<ul style="list-style-type: none"> Real time clock check to keep automatic track of the date, time and runs 		
	<ul style="list-style-type: none"> Test results can be stored in the electronic unit with unique record no. and can be retrieved and transferred to USB drive for printing 		
	<ul style="list-style-type: none"> Transmission of Data to computer through Ethernet/USB/RS232 Port. 		
4	FLEXURAL TESTING MACHINE :		
	FLEXURAL TESTING MACHINE WITH IN HOUSE NABL CALIBRATION CERTIFICATE:		
	Capacity :100kN Flexure Testing Machine Electrically Operated to test flexural strength of concrete beams		
	Type of Pumping: Electrical		
	Loading Capacity: 0-100 kN		

	Least Count: 0.5kN			
	Type of Loading: Four Point			
	The bed of the testing machine shall be provided with two steel rollers, 38 mm in diameter, on which the specimen is to be supported.			
	These rollers shall be so mounted that the distance from centre to centre is 60 cm for 15.0 cm specimens or 40 cm for 10.0 cm specimens.			
	The load shall be applied through two similar rollers mounted at the third points of the supporting span that is, spaced at 20 or 13.3 cm centre to centre.			
	The load shall be divided equally between the two loading rollers.			
	Standard	IS:516, BS:1881 and ASTM C78		
	Load application	Downward Movement		
	Gauge	Bourdon tube type load gauge of range : 0 -100 kN x 0.5 kN		
	<ul style="list-style-type: none"> A spacer is provided for testing different size of beams. 			
	<ul style="list-style-type: none"> Light weight, rugged high strength frame 			
	<ul style="list-style-type: none"> Double action hydraulic pump 			
	<ul style="list-style-type: none"> Self-aligning roller assembly 			
	<ul style="list-style-type: none"> Hydraulic jack provided with retraction spring 			
	<ul style="list-style-type: none"> For testing beams of 100X100X500mm and 150X150X 700mm. 			
	<ul style="list-style-type: none"> 220V, 50Hz, Single Phase 			
5	TENSILE TESTING MACHINE:			
	Tensile Testing Machine should have high Accuracy, Sensitivity, Reliability, Consistency and Repeatability. Machine should be Floor Mounted, Vertical type and Two Column Construction			
	Machine should be designed for determining the Tensile Strength and Elongation of a host of materials like Ferrous and Non Ferrous Materials, Cables & Conductors, Plastic, PVC, Rubber Specimens, Paper, Plywood Etc.			
	Machine should be capable for conducting Compression, Cross Breaking And Shear Tests.			
	Tensile Testing Machine should have Digital Indicator Systems With Pc And Printer.			

	Technical Specifications: Capacity (kg (f)): 10000,		
	Least Count: 0.1 kg (f).		
	Traverse Speed: 25 and 12.5 (mm/ min).		
	Grip Separation: Minimum 25 mm & Maximum 500 mm		

II. STRUCTURAL ANALYSIS LAB

S.NO.	SPECIFICATIONS	Numerical Values or other Specifications	Whether comply Yes/No
1.	THREE HINGED ARCH APPARATUS optimum quality mild steel with the span of 100 cm and rise of 25 cm.		
2.	ELASTICALLY COUPLED BEAM APPARATUS Mild steel beam: 2.5 cm x 3 mm		
3.	BEHAVIOUR OF COLUMN AND STRUT APPARATUS Four spring steel columns 15 cm long and .5mm x 1cm in cross section are made and put along a vertical wooden board. These four columns have got different end conditions as below: <ul style="list-style-type: none"> • Both ends pinned • Both ends fixed • One end pinned and other fixed • One end fixed and other end free 		
4.	APPARATUS FOR VERIFICATION OF CLARKS MAXWELL RECIPROCAL THEORM Beam 100cm long and 1.25 cm x 4 mm in cross section with graduations at every 10cm along the length. It is supported on two knife edge supports 70cm apart with a 30cm overhang on one side. A dial gauge with 25mm travel (with a magnetic base) is supplied with the apparatus. Apparatus is supplied complete with a supporting stand and a set of weights.		
5.	UNSYMMETRICAL BENDING APPARATUS		
6.	ELASTIC PROPERTIES OF DEFLECTED BEAM APPARATUS <ul style="list-style-type: none"> • A mild steel beam 2.5 cm x 3 mm in cross section and 100 cm long is pinned to two supports 70 cm apart situated symmetrically. 		
7.	TWO HINGED ARCH APPARUTUS Span of 100cm and rise 25cm. Both ends are hinged but one of the ends is also free to move longitudinally. A dial gauge with 25mm travel (with magnetic base). Supply complete with a supporting stand and a set of weights.		

8.	<p>REDUNDANT JOINT APPARATUS</p> <p>Apparatus should consist of three suspension members (spring balances) of different stiffness which are jointed at a point to form the redundant joint. The upper end of the suspension members being tied in a position to a vertical wooden board. Arrangement is provided to apply a vertical load at the joint and to measure its horizontal and vertical displacement on a paper and also elongations and forces in the suspension members by the help of dial gauges.</p> <p>Two dial gauges with 25mm travel (with magnetic bases).</p> <p>Supply complete with a supporting stand and a set of weights.</p>		
9.	<p>DEFLECTION OF TRUSS APPARATUS</p> <p>Apparatus should consist of 4 panels of a PRATT truss, each panel being 40cm in horizontal direction and 30cm in vertical direction. Load can be applied on each panel point. All tension members are provided with detachable springs so as to obtain appreciable deformation of the member.</p> <p>Supply complete with a supporting stand and a set of weights.</p>		

III. TRANSPORTATION ENGINEERING LAB

Sl.No	Specification		Numerical Values or other Specifications	Whether comply Yes/No
1	CALIFORNIA BEARING RATIO APPARATUS			
	California Bearing Ratio Test Apparatus, Motorized, Three Speed			
	Ref: Standards: IS : 2720 (Part XVI), BS 1377; 1924; EN 13286-47/ ASTM D 1883; AASTHO T 193			
	Salient Features should include:	<ul style="list-style-type: none"> • Compact, bench top design • Rapid Platen Adjustment • Complete with stabilizing bar • Options for mechanical or electronic measurement 		
	Power Supply	Suitable for operation on 220V, 50Hz, single phase, AC supply.		
	Load Frame	50 kN Capacity		
	Three Speed	1.5, 1.25 & 2.5 mm/min		
	Mould	Gun Metal 150mm ID x 175 mm H		
	Extension Collar	Gun Metal 150 mm ID x 50 mm high		
	Penetration Piston Diameter	50 mm face dia		
	Circular Metal Spacer Disc, with	148 mm dia x 47 mm high or better		

	detachable handle,			
	Annular Metal Weight	147 mm dia with 53 mm dia central hole		
	Dial Gauge	25 mm travel, 0.01 mm least count		
	Perforated Base Plate			
	Adjustable Bracket for Penetration			
	Perforated Plate with adjustable stem and lock nut			
	Metal Tripod for Dial Gauge			
	Cutting Collar			
	Rammer 2.6 kg, 310 mm controlled drop			
	Rammer 4.9 kg, 450 mm controlled drop			
	Proving Ring Capacity 50 kN			
2	LOS ANGELES ABRASION TESTING MACHINE:			
	<ul style="list-style-type: none"> Los Angeles Abrasion testing machine with Counter Ref. Standards – IS:10070 The machine should consist of a hollow cylinder, mounted on a sturdy frame on ball bearings. A detachable shelf which extends throughout the inside length of the drum catches. 			
	<ul style="list-style-type: none"> The abrasive charge and does not allow it to fall on the cover. The drum is rotated at a speed of 30-33 rpm by an electric motor through a heavy duty reduction gear. Supplied complete with a tray for collection of the material 			
	<ul style="list-style-type: none"> Instrument is supplied with the abrasive charge consisting of 12 cast iron spheres of 48 +/- 2 mm in diameter and each weighing 			

	between 390 and 455 g and a total of 12 numbers of spheres weighing 5 000 +/- 25 g		
	<ul style="list-style-type: none"> Power supply: 415V, 3 phase, 50 Hz, AC supply. 		
3	DUCTILITY TESTING MACHINE (ELECTRICALLY OPERATED):		
	<ul style="list-style-type: none"> Ductility Testing Machine with Digital Temp Indicator Ref. Standards IS:1208, ASTM D113, AASHTO T 51 		
	<ul style="list-style-type: none"> Should be designed for test three specimens simultaneously 		
	<ul style="list-style-type: none"> The machine should consist of a carriage moving over a lead screw 		
	<ul style="list-style-type: none"> Electric motor driven reduction gear unit 		
	<ul style="list-style-type: none"> Entire assembly should mount with water bath completely encased in metal bound hardwood 		
	<ul style="list-style-type: none"> Electric pump circulator and heater should be included 		
	<ul style="list-style-type: none"> Temperature is controlled by digital temperature controller 		
	<ul style="list-style-type: none"> Two rates of travel i.e. 5 cm/min and 1cm/min are provided 		
	<ul style="list-style-type: none"> Power Supply: 220 V, 50 Hz, Single Phase, AC supply 		
	<ul style="list-style-type: none"> Ductility Mould, with Base Plate - 4Nos 		
4	BITUMEN (CENTRIFUGE) EXTRACTOR (ELECTRICALLY OPERATED):		
	<ul style="list-style-type: none"> Centrifuge Extractor, Capacity 1500g Electrically Operated Ref. Standards ASTM D 2172, AASHTO T-58, T-164, EN 12697-1 		
	<ul style="list-style-type: none"> centrifuge extractor should be compact with inbuilt Dimmer stat for speed variation from 0 rpm to 3600 rpm. 		

	<ul style="list-style-type: none">• Each unit is supplied complete with a set of 25 Filter Paper Discs.		
	<ul style="list-style-type: none">• Power Supply: 220 V, 50 Hz, Single Phase, AC supply		

IV. GEOTECHNICAL ENGINEERING LAB

S.No.	Specifications	Numerical Values or other Specifications	Whether comply Yes/No
1.	PERMIABILITY TEST APPARATUS Laboratory Permeability Apparatus Ref. Standards IS:2720 (Part 17), IS:11209		
	For testing soil with coefficient of permeability in the range of 10-3 to 10-7 cm / sec and maximum particle size of 10 mm.		
	Supplied with the following: Stand with three glass tubes of 6 mm, 10 mm and 20 mm dia approx.		
	Metallic Mould 100 mm dia x 127.3 mm height, 1000 ml volume.		
	Extension Collar 100 mm dia x 60 mm height.		
	Drainage Base Plate with a recess for Porous Stone and an Outlet Valve.		
	Metallic Clamping Ring		
	Drainage Cap with recess for a Porous Stone and fitted with Inlet Valve and Air Release Valve.		
	Dummy Plate to serve as False Bottom during compaction.		
	Porous Stone for Drainage Base Plate.		
	Porous Stone for Drainage Cap		
	Rubber Connection Tube 3m long, with Pinch Cock		
2.	UNCONFINED COMPRESSION TESTING MACHINE Unconfined Compression Tester for load measurement Ref. Standards IS:2720 (Part 10), AASHTO T208		
	supplied with Load Frame 3 speed -50 kN,		
	Proving Ring, 2kN		
	Dial Gauge, 0.01x25mm & Plain Platen with adaptor,		
	Split Mould and Rubber Sheath		
3.	DIRECT SHEAR TEST APPARATUS Direct Shear Test Apparatus 2 kN capacity Ref. Standards IS :11229, 2720 (Part 13)		
	Type of Shear : Direct / Residual Measurement		
	Operation : Motorized		
	Rates of Strain : 1.25, 0.625, 0.25, 0.125, 0.05, 0.025,(mm/min) 0.01, 0.005, 0.002, 0.001, 0.0004, 0.0002		

	Specimen Size : 60 x 60 x 25 mm			
Supplied with the following:				
Shear Box Assembly				
Assembly should comprises of : Halves of the Shear Box	2 Nos.			
Plane Gripper Plate	2 Nos.			
Perforated Gripper Plate.	2 Nos			
Porous Stone	2 Nos.			
Top Loading Pad	1 No.			
Base Plate	1 No.			
Shear Box Housing with two linear bearing cases with steer	1 No.			
Specimen Cutter	1 No.			
Surcharge Weights to attain normal stress of 3 kg/cm2	1 Set			
This surcharge weight set comprises of following weights :				
0.05 kg/cm2 :	4 Nos.			
0.10 kg/cm2 :	1 No.			
0.20 kg/cm2 :	1 No.			
0.50 kg/cm2 :	3 Nos.			
1.00 kg/cm2 :	1 No.			
Compression - Tension Proving Ring, 2 kN capacity	1 No.			
Dial Gauge 0-25 × 0.01mm	2 Nos.			
4	TRIAXIAL TEST APPARATUS: Triaxial Shear Test Apparatus Load Frame, Motorized, 50 kN Capacity Multi rate of strain. Designed to accommodate Universal Triaxial Cell for testing soil specimens up to 100 mm in diameter. Triaxial Cell For 38mm specimen Suitable for lateral pressure up to 1000 kPa, the cell have four take off positions drilled in the base for cell pressure, pore water pressure, and for top and bottom drainage. Fitted with 3 no-volume change valves and one dead end			

	<p>plug. Cell is supplied complete with one loading pad, two porous stones, one sheath stretcher, one split sand former, 10 latex rubber sheaths and four sealing rings for 38 mm dia samples</p>		
	<p>Rates of strain ranging minimum 0.00048 mm/min.</p>		
	<p>Self Compensating Pressure Apparatus Double Chamber (oil/water type)</p> <p>Pressure range: 10-1000 kPa</p>		
	<p>Electronic Data Acquisition System</p> <p>The four-channel micro controller based signal conditioning and touch panel display unit is suitable to measure Axial load, Pore/Back pressure, Vertical displacement and Volume change (optional) directly indicated in their respective engineering units during Triaxial Testing. The system receives the output signal from the sensors i.e. Load cell, Pore/Back pressure sensor, Displacement Sensor and Volume change (optional) sensor attached to the Triaxial shear Test apparatus. The data of all four channels of Triaxial Shear Test can be transferred to computer through RS-232/ Ethernet and can be online monitored.</p>		
	<p>The Unit also provides the facility of online monitoring of data of all the sensors on Touch Panel Display provided at the front.</p> <p>Broadly the following facilities are incorporated in the system:-</p> <ul style="list-style-type: none"> • Touch panel is provided to perform various operations such as TARE, PROGRAMMING, START, STOP etc. • Independent Taring of each channel • Data transfer interval is programmable (between 10 second to 1 hour) • Automatic data saving on stop button. • There are 25 set results having a maximum of 200 data points per set can be stored in the electronic unit .The sample number can be programmed. • Online date and time of test will be stored along with 		

	<p>the data.</p> <ul style="list-style-type: none"> On line (while the test is in progress) data transfer to the computer through RS232/ Ethernet port. <p>NOTE- The Electronic unit operates on 220VAC+ 10%, 50Hz</p>		
	<p>Sensors Specification: -</p> <p>1. Load Cell:</p> <ul style="list-style-type: none"> Capacity : 10kN Safe Over Load : 150% of rated capacity Max. Over Load : 200% of rated capacity Fatigue Range : 10⁵ cycles. Non Linearity : + 1% of rated cap. Or better Hystresis : 0.5% of rated cap. Or better Repeatability : 0.5% of rated cap. Or better Creep Error : 0.1% of rated cap. Or better Temp. Range : 10 C to 50 C. Sensitivity Tolerance : + 0.1% (Calibration tolerance of Signal at nominal load) Ultimate Overload : 400% of rated cap. Input Resistance : > 340 ohm Output Resistance : >300-500 ohm Reference Temperature : 23 C 		
	<p>2. Pressure sensor for Back / Pore pressure:-</p> <ul style="list-style-type: none"> Sensing Element : Foil type strain gauges in full bridge configuration. Capacity : 2000 kPa Maximum Overload : 150% of rated capacity Device Linearity : + 1% of rated capacity Hystresis : + 0.5% of rated capacity Repeatability : + 0.2% of rated capacity Terminal Resistance : 350 ohms nominal Excitation Voltage : 5 volts DC. Terminal Connection : 5-pin connector Frequency Response : 0 - 50 Hz Safe Temperature : 0 - 50 c 		
	<p>3. Linear Variable Differential Transformer (LVDT) Type:-</p> <ul style="list-style-type: none"> Stroke : ± 20mm Linearity Deviation : ± 1% of rated capacity Repeatability : ± 0.1% of rated capacity Hystresis : ± 0.5% of rated capacity Excitation : 2-volt rms 2 KHz sinusoidal Sensitivity : 1 Mv/V/Mm Safe Temperature Range : 0 - 50 C 		

	<ul style="list-style-type: none"> Core Fixture : spring-loaded plunger 		
	Software <ul style="list-style-type: none"> On-Line Tri-axial Data Acquisition Software On-Line Data Transmission from Signal Conditioning Unit to Computer Off-Line Tri-axial Data Analysis Software that does all the calculations of UC, UU, CU, CU bar & CD Triaxial Test. Has option for manual as well as automatic recording of data. Calculates Dry density, Moisture content, void ratio, degree of saturation, 100% saturation moisture content etc. Display the following Plots (Graphical) <ul style="list-style-type: none"> h) Consolidation curve i) Stress- Strain Curve for every test j) Axial Strain vs Pore Pressure k) Effective Stress Ratio vs Axial strain l) A-parameter vs Axial strain m) p-q plot and gives the value of c and f in terms of effective Ratio n) Calculates the following: <ul style="list-style-type: none"> 3. Evaluates t_{100} 4. Strain rate depending upon the drainage condition for CD and CU test 		
	Computer <ul style="list-style-type: none"> Intel i5 processor, 500 GB HDD, 4 GB RAM, DVD R/W drive, Key Board, Optical Mouse, 6USB Ports, 19" LCD Monitor, SVGA Adaptor card Printer UPS 1kVA		

ANEXURE-VI

DETAILS OF EQUIPMENTS TO BE SUPPLIED AT VARIOUS IKGPTU CAMPUSES:

S.No.	Name of the Equipment	Kapurthala	Batala	Hoshiarpur	Quantity
1. Concrete Technology Lab					
1	CONCRETE MIXER	1	1	1	3
2	VEE BEE CONSISTOMETER	1	1	1	3
3	COMPRESSION TESTING MACHINE	1	1	1	3
4	FLEXURAL TESTING MACHINE	1	1	1	3
5	TENSILE TESTING MACHINE	1	1	1	3
2. Structural Analysis Lab					
1	THREE HINGED ARCH APPARATUS	1	1	1	3
2	ELASTICALLY COUPLED BEAM APPARATUS	1	1	1	3
3	BEHAVIOUR OF COLUMN AND STRUT APPARATUS	1	1	1	3
4	APPARATUS FOR VERIFICATION OF CLARKS MAXWELL RECIPROCAL THEORM	1	1	1	3
5	UNSYMMETRICAL BENDING APPARATUS	1	1	1	3
6	ELASTIC PROPERTIES OF DEFLECTED BEAM APPARATUS	1	1	1	3
7	TWO HINGED ARCH APPARUTUS	1	1	1	3
8	REDUNDANT JOINT APPARATUS	1	1	1	3
9	DEFLECTION OF TRUSS APPARATUS	1	1	1	3
3. Transportation Engineering Lab					
1	CALAFORNIA BEARING RATIO APPARATUS	1	1	1	3
2	LOS ANGELES ABRASION TESTING MACHINE	1	1	1	3
3	DUCTILITY TESTING MACHINE (ELECTRICALLY OPERATED)	1	1	1	3
4	BITUMEN (CENTRIFUGE) EXTRACTOR (ELECTRICALLY OPERATED)	1	1	1	3
4. Geotechnical Engineering Lab					
1	PERMIABILITY TEST APPARATUS	1	1	1	3
2	UNCONFINED COMPRESSION TESTING MACHINE	1	1	1	3
3	DIRECT SHEAR TEST	1	1	1	3

	APPARATUS				
4	TRIAXIAL TEST APPARATUS	1	1	1	3
1	B.O.D INCUBATOR	1	1	1	3
2	BINOCULAR MICROSCOPE	1	1	1	3
3	DIGITAL SPECTRO PHOTO METER	1	1	1	3