DOCUMENT

Open Competitive Bid (OCB)

For

Supply and Installation of Equipments to the Fluid Mechanics Lab of Civil Engineering Department. At the three campuses of Rajiv Gandhi University of Knowledge Technologies

Proprietary & Confidential

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES
Ground Floor, Vindhya C4 Building,
IIIT-H Campus, Gachibowli
HYDERABAD- 500 032
Phone: 040-23001830

Proprietary & Confidential

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News paper advertisement

Tender Notice

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

Ground Floor, Vindhya C4 Building, IIIT-H campus, Gachibowli, HYDERABAD- 500 032
Phone: 040-23001830

Ref: RGUKT/Proc/Civil3/FML/T33/2013

Separate Sealed Tenders are hereby invited from reputed Manufacturers or Authorised dealers for supply and installation of equipments for the following labs of Civil Engineering Departments at the three campuses of RGUKT located at Basar (Adilabad District), Nuzvid(Krishna District) and RK Valley (YSR Kadapa District) of Andhra Pradesh:

i) Concrete Technology Laboratory
ii) Environment Laboratory
iii) Fluid Mechanics Laboratory

Last date of submission of tender along with EMD as specified in the bid document is on 16.03.2013 before 04.00 pm.

Interested parties can collect the Tender document for each laboratory separately from the office of the RGUKT from 06.03.2013 to 15.03.2013 against payment of Rs. 1,000/- towards the cost of Tender document fee (non-refundable) through D.D. drawn from any Nationalized Bank, in favour of "REGISTRAR, RGUKT" payable at Hyderabad. For further details, visit our website www.rgukt.in

Date: 06.03.2013

Sd/-
Registrar

Web document

Time schedule of various Short tender related events

Bid calling date	06.03.2013
Sale of document	From 06.03.2013 to 15.03.2013 up to 04:00 P.M
Pre bid meeting	11.03.2013 at 04.00PM
Bid closing date/time	16.03.2013 at 04:00 P.M.
Technical Bid Opening date/time	16.03.2013 at 04:30 P.M.
Price Bid opening date/time	18.03.2013 at 04:00 P.M.
Bid Document fee	Rs.1,000/-
Contact person	Registrar, RGUKT
Reference No	RGUKT/Proc/Civil3/FML/T33/2013

Note: Tender documents purchased bidders are only allowed to participate in Pre-Bid meeting.

Registrar,
RGUKT.

Web document

TENDER FORM

Not transferable

Reference. No. RGUKT/Proc/Civil3/FML/T 33/2013 Dated 06.03.2013

Subject: Invitation of Tenders for Supply, installation and commissioning of Fluid Mechanics Lab Equipments to the Civil Engineering Departments at three campuses of RGUKT located at Basara (Adilabad Dist), Nuzvid (Krishna Dist) and RK Valley (YSR Kadapa Dist) of Andhra Pradesh.

Last date and time for submission of the TENDER AT RGUKT, Vindhya-C4, IIIT Campus, Gachibowli, HYDERABAD **is 16.03.2013 up to 4:00PM**

Dear Sir/Madam,

A. RGUKT invites sealed tenders comprising technical bid and price bid separately from reputed manufacturers (or) authorized dealers for its three campuses located at Basara (Adilabad Dist), Nuzvid (Krishna Dist) and R K Valley (Kadapa Dist) of Andhra Pradesh.

B. The Tender form consists of 49 pages of which pages from 7 to 18 are instructions and page No.40 contains the format for financial bid. The duly completed Technical Bid together with a copy of the bid document (this tender) signed on all pages by the Bidders authorized signatory and the Price Bid should be kept in separate sealed covers. These sealed covers must be submitted in a sealed master envelope super scribed "Tender for Supply, Installation & Commissioning of Fluid Mechanics Lab Equipments to the Civil Engineering Departments at the three campuses of RGUKT. The last date for submission of bid is **16.03.2013 and closing time is 04:00 PM.**

C. The Sealed Tenders should be deposited in the Tender box kept in the office of Registrar, RGUKT, Hyderabad up to **04:00 P.M. on 16.03.2013.**

For any clarification and further details on the above tender please contact by Telephone No: 040-23001830 or Contact in Person during office hours.

Thanking you

Yours faithfully,
Registrar,

RGUKT.

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STATEMENT OF IMPORTANT LIMITS/VALUES RELATED TO BID

Item	Description
EMD	**Rs. 1,00,000/- by way of Demand Draft from any Nationalised Bank or by way of irrevocable bank guarantee from any Nationalised Bank only. DD/BG from other than Nationalised Banks will not be accepted.**
Bid Validity Period	90 days from the date of opening of Financial bid
EMD Validity Period	90 days from the date of opening of Financial bid
Warranty Period	3 years Comprehensive Warranty
Variation in quantities/number of residents	**± 40 %**
Period for furnishing performance Security Deposit	Within 10 days from date of receipt of award
Delivery Schedule	Bidder shall deliver the goods in one single lot within 30days from the date of award of the contract.
Performance security value	5% of contract value by way of irrevocable Bank Guarantee from any Nationalised Bank
Performance security validity period	38 months from award of contract (including 30 days of installation period)
Period for signing the order Acceptance	Within 7 days from date of receipt of notification of award

Payment terms	
On delivery at user site	Payment for goods and services shall be made in Indian rupees as follows. 1. 80% of payment will be paid after installation, commissioning 2. Balance 20% will be paid after 3 months after obtaining the satisfactory certificate from the Director, RGUKT IIITs.
Maximum Liquidated Damages for late deliveries	For delays:- If the supplier fails to deliver any (or) all of the goods or perform the services within the time period specified in the contract the purchaser shall without prejudice to its other remedies under the contract deduct from the contract price as liquidated damages a sum equivalent to 0.25% of the contract value per day until actual delivery or performance up to a maximum deduction of 10% of the delayed goods or services contract price. Once the maximum deduction is reached, the purchaser may consider the termination of the contract duly forfeiting the performance security etc.,

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ELIGIBILITY CRITERIA

5.1. This bid is open to all firms within India who are eligible to do business under relevant Indian laws as in force at the time of bidding, subject to meeting the pre-qualification criterion. They should provide list of customers of previous supply of similar/ same items to IITs, NIT's or Central Universities or any Academic Institute of National repute with contact details. Copies of orders received from the reputed firms on bidding firm need to be submitted.

5.2. The bidder should have servicing facility or work shop with in India so the provision of service is possible at a short notice and without incurrence of delay.

5.3. The Bidding firm should have minimum turnover as follows:

Bid Value offered against the tender call	**Last financial year's business turnover**
25 lakhs	50 lakhs
50 lakhs and above	1 crore

The bidder should have adequate experience in supply of such materials as required in the tender. Bidder should furnish proof of having supplied such materials as required in the tender in the previous financial year ending 31st March 2012 as mentioned above . A certificate indicating the Turn Over value details (in Rupees) of subject material, during the financial year 2011-12 (for the year ending 31.03.2012) from a Firm of Chartered Accountants must be enclosed (in original) as a proof for Turnover. The Turn Over of the subject Material must be separately indicated in the certificate.

5.4. The bidder should furnish satisfactory performance certificate from the parties concerned to whom bulk supplies were effected, in case such supplies were made. RGUKT may contact any such parties to elicit details**.**

5.5. Bidder should be registered under VAT Act/CST Act with the relevant State Sales Tax Authorities. He should furnish along with the bid document, the relevant VAT/CST Registration Document and PAN / TAN Card copies.

5.6. All bidders shall also include the following information and documents with their tenders (in the Technical bid cover)

5.6.1. Copies of original documents defining the constitution or legal status, place of registration, and principal place of business of the bidding firm/entity; written power of attorney of the signatory of the Bid to commit the Bidder.

5.6.2. Machinery/equipment owned by the bidder and number of employees.
5.6.3. Latest Income Tax returns and **VAT/ CST** Returns filed.
5.6.4. List of Present Clientele with contact addresses & telephone numbers.

5.7. All the certificates furnished along with technical bids should be attested by a Gazetted Officer, counter signed by bidder along with their seal.

The bidders must submit all relevant documentary evidence to support their claim for eligibility in placing bid. **The tenders received without the above documents will be rejected.**

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Requirement of Fluid Mechanics Lab equipments

Sl. No	Item	Qty Required
1.	Hydrology System with PC Compatibility	3
2.	Impact of a Jet	3
3.	Free and Forced Vortices	3
4.	Hydrostatics Pressure	3
5.	Metacentric Height	3
6.	Pipe Surge and Water hammer test set	3
7.	Groundwater flow apparatus	3
8.	Orifice and Jet flow	3
9.	Pump Test Set	3
10.	Turbine Test Set a. Computer Controlled Francis Turbine b. Computer Controlled Pelton turbine c. Computer Controlled Kaplan Turbine d. Axial flow impulse turbine	3
11.	Tilting flow channel	3
12.	Resonant Column Apparatus and Blender elements	3

Name of the Instrument and Specifications	No: of Instruments in each Campus	Total No: of Instruments
1. Hydrology System with PC Compatibility • A self contained floor standing apparatus should have 2m*1m Stainless steel tank, tiltable using a dual linked jacking system • The system shall consist of 8 Stainless steel spray nozzles with the dimension of 1/8 BLM 6.0 – 60 SS will be mounted on an adjustable height gantry • The hydrology system shall have to be equipped with two flow meters 3 Litre /min & 5 Litre /min to measure and adjust the inlet flows • The hydrology system shall contains an outlet tank allowing both water and sediment flow to be measured • Two French drains two well points and 20 manometer tapping points linked to a manometer bank shall be provided • The distance between two cylindrical well shall not exceed 600 mm and tapping space shall not exceed 100 mm. • The weir chute should be designed with minimal disturbance to the surface of the water and equipped with clear polythene skirt at the bottom • The system shall be supplied with large plastic sump tank plus a recirculating pump with 0.37 KW rating • The outlet tank shall be equipped with pressure relief valve to limit the system pressure to 3.0 bar • The shallow sand tank is fabricated from stainless steel for corrosion resistance. • Quality filter mesh have to be provided at each tapping in the sand tank floor • The equipment shall be capable to operate silica sand in the range of 1000 micron to 500 micron. • The tank should have the capacity to hold 500 kg of sand • The following range of models shall have to be provided along with Hydrology system a. Fabricated trays and rings: Circular open ended ring, 500 mm diameter x 60 mm high small square open ended ring, 300	1	3

mm x 300 mm x 60 mm high b. Closed ring with removable central clear plastic standpipe, 500 mm diameter x 60 mm c. High Large rectangular open ended ring, 1000 mm x 500 mm x 60 mm high d. Large rectangular closed ring with hole, 1000 mm x 500 mm x 60 mm e. Impermeable catchment: 1000 gauge Polythene sheet, sufficient to cover the catchment area. f. Permeable catchment: Sheets of absorbent material, sufficient to cover the catchment area. g. Model structures machined from solid PVC: Cylinder 25 mm diameter Rectangular bridge pier 25 mm wide, 75 mm long, 125 mm high Rounded bridge pier As above but with semicircular ends Streamlined bridge pier As above but with ends chamfered(60o.) • The equipment should be supplied with USB interface which can be used to measure both the water flow and the accumulation of sediment continuously using a PC. • The system should comes with educational data logging software incorporating help texts, graph, plotting etc • Experiment Capabilities: • Determination of run-off hydrographs from model catchments including multiple storms, moving storms, effect of reservoir storage and land drains • Construction of draw-down curves for one or two well systems in a sand • Hydraulic gradients in ground water flow .Investigation of model stream flow in alluvial material. • Formation of river features and development over time • Sediment transport, bed load motion, scour and erosion • This equipment should be designed to operate in the following environmental conditions.		

a. Altitude up to 2000 m; b. Temperature 5 °C to 40 °C; c. Maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C; d. The equipment should withstand Mains supply voltage fluctuations up to ±10 % of the nominal voltage;		
2. Impact of a Jet • Discharge nozzle inside shall be built with clear acrylic cylinder for easy view • Quick release fitting for easy connection to hydraulics bench • Diameter of Nozzle shall not exceed 8mm • Distance between nozzle & target plate shall not exceed 20mm • Diameter of target plate shall not exceed 36mm • The system should be provided with four target plates - 180° hemispherical target, 120° cone target , flat target & 30° target • The Hydraulic bench shall be designed as a portable and self-contained service module • The bench shall be constructed from light weight corrosion resistant plastic with wheels for mobility • The bench consist of centrifugal pump with maximum head of 21m water and maximum flow of 1.35 litres/sec • The motor rating shall be 0.37KW • The sump tank capacity shall be 250 litres with high flow volumetric tank of 40 litres and low flow volumetric tank of 6 litres • The Height of working surface shall be 1 metre above floor level • The bench shall comprises of stilling baffle which reduces turbulence and a remote sight tube with scale gives an instantaneous indication of water level • A dump valve operated by a remote actuator should help to drain measuredvolume of water to the sump in the base of the bench for recycling purpose	1	3
3. Free and Forced Vortices: • The Equipments should be provided with three	1	3

interchangeable orifices and paddle wheel to fit in base of tank • Provision to measure bridge with adjustable pointers and internal caliper to measure vortex dimensions • The equipments should supply with Pitot tubes for estimation of velocities in vortex • Quick release fittings for easy connection to hydraulics bench • Tank diameter shall not exceed 245mm • Height to over flow point should not exceed 180mm • Orifice diameters shall be exactly at 8,16 & 24mm • Distance from center: 0, 30, 50, 70, 90 and 110mm • The system with Pitot tubes should have measuring point at 15, 25 and 30mm radius • Inlet tubes Diameter should be 9 and 12.5mm • The Hydraulic bench shall be designed as a portable and self contained service module • The bench shall be constructed from light weight corrosion resistant plastic with wheels for mobility • The bench consist of centrifugal pump with maximum head of 21m water and maximum flow of 1.35 litres/sec • The motor rating shall be 0.37KW • The sump tank capacity shall be 250 litres with high flow volumetric tank of 40 litres and low flow volumetric tank of 6 litres • The Height of working surface shall be 1 metre above floor level • The bench shall comprises of stilling baffle which reduces turbulence and a remote sight tube with scale gives an instantaneous indication of water level • A dump valve operated by a remote actuator should help to drain measured volume of water to the sump in the base of the bench for recycling purpose		
4. Hydrostatics Pressure • The apparatus should consist of a transparent measuring container that is filled withwater for the experiments. • A scale should be provided on the tank to take the water levels with precision. • A counterbalanced tank which swivels on a bearing should be provided. • Apparatus for investigating the hydrostatic pressure in liquids • 400x500x360mm, 10kg	1	3

• Determination of the resulting compressionforce using weights on lever • Lever 250mm • Measuring tank with water level scale a. Set of weights: 1x 2.5N, 1x 2N, 2x 1N, 1x 0.5N b. Length of lever: 250mm c. Tank with angular scale: 90° d. Capacity: 2ltr e. Water level scale: 200cl		
5. **Metacentric Height** • For the study of stability of a floating body • A pontoon should be provided to float in a small tank having a transparent side. • Removable steel strips in the model for the purpose of changing the weight of the model. • Pendulum (consisting of a weight suspended to a long pointer) should be helpful to measure the angle of tilt n a graduated arc. • For tilting the ship model, a cross bar with two movable hangers should be provided on the model. • Pendulum and graduated arc are to be suitably fixed at the center of the cross bar. • A set of weights should be supplied with the apparatus. • Pontoon Size 400 x 200 mm x100mm high (approx.) with a Horizontal Guide Bar for sliding weight • Displacement without sliding weights 2.8 kg • Vertical sliding weight 550g • Horizontal sliding weight 193g • Water Tank Size 600 x 400 x 400 mm (approx.) • Front Window of Tank Made of Glass/Perspex • Mast height 400 mm • Maximum tilt $\pm 13^0$	1	3
6. **Pipe Surge and Water hammer test set** • A freestanding unit to demonstrate the phenomena of pipe surge and water hammer when connected to a Hydraulics Bench • Should includes two separate stainless steel test pipes, both 3m long, constant head tank, slow acting valve, fast acting valve etc • A transparent surge shaft (40 mm diameter and 800mm high) with scale allows transient water levels	1	3

to be observed and timed • Electronic sensors to measure pressure transients at two locations in the water hammer test pipe, one adjacent to fast acting valve and one half way along the test pipe • Pressure transients monitored using a PC using a USB connection from the pressure transducers (requires no external electrical supply) • Straight metal pipes should be used, rather than a coiled arrangement, to minimize distortion to the pressure profile • Required Capabilities: a. Demonstration of pipe surge resulting from slow deceleration of flow in a pipe b. Determination of the oscillatory characteristics of a surge shaft used to attenuate pipe surge c. Measuring the pressure profile characteristics associated with water hammer associated with rapid deceleration of flow in a pipe d. Comparison between theoretical and measured pressure profiles associated with water hammer e. Determination of the velocity of sound through a fluid in an elastic pipe • Should consist of two stainless steel test pipes connected to a constant head tank with the necessary connections to an Hydraulics Bench • The first test pipe should incorporates a transparent surge shaft and lever operated valve at the discharge end. An additional valve downstream should allow the flow through the test pipe to be varied before closing the lever operated valve. A scale should be provided on the surge shaft (Pipe surge demonstrations) • The second test pipe should incorporate a fast acting valve at the discharge end. An additional valve downstream should allow the flow through the test pipe to be varied before closing the fast acting valve. Should allow water hammer to be generated in a relatively short length of straight pipe because of the extremely short closure time achieved using a trigger actuator. (Water hammer demonstrations) • Electronic pressure sensors should be incorporated in tappings • The transient pressure waves can be analysed on the PC(supplied) using the software		

Test pipes:	Stainless steel, 20.2 mm inside diameter, nominally 3 m long		
Surge shaft:	Clear acrylic, 40 mm inside diameter, 800 mm high		
Head tank:	PVC, capacity 45 litres		
7. Groundwater flow apparatus • A bench-standing sand tank capable of demonstrating, on a small scale, the hydrological principles of ground water flow. • The unit should allow simple three dimensional flow situations to be set up quickly and measurements of piezometric levels taken at appropriate positions within the model under study. • It should be possess the following demonstration capabilities a. Hydraulic gradients in ground water flow, including the effect of permeability. b. Cone of depression for a single well in an unconfirmed aquifer. c. Abstraction from a single well in a confined aquifer. d. Cone of depression for two wells. e. De-watering of an excavation site using two wells. f. Draining of a polder or lake. • Should be capable to construct further model situations for study. • Other Requirments are: a. The sand tank must be of glass reinforced plastic b. A diffused water inlet/outlet with associated flow control valve should be provided at each end of the sand tank. c. Two wells with control taps in the base of the tank d. Nineteen tappings in the base of the tank arranged in a cruciform configuration connected to a multi-tube manometer on the side of the tank. A sliding cursor to measure of any level. Tank:- Length:990mm Width:490mm Depth: 235mm Mamometer:- Range:0to155mm		1	3

Calibrated: 1mm intervals • Experiment Capabilities: • Hydraulic gradient (Darcy's Law) resulting from groundwater flow between two potentials can be demonstrated visually. Levels in the piezometer tubes can plotted to show a linear profile. • Water flowing into a well creates a depression in the water table. The contour of the water table can be plotted using the levels in the Piezometer tubes. Results obtained can be compared with Depuit's or Thiem's formulae. • A profile of the water table can be obtained when using two wells simultaneously • A rectangular ring should be provided to form the sides of an excavation below the level of the water table. • A large rectangular ring should be used to create a polder or lake. Water flowing into a ditch near the wall should drain via the two wells.		
8. Orifice and Jet flow Plexiglass cylinder: capacity: approx. 13.5ltr Diameter of discharge nozzles: 1x 8mm,1x 4mm 8 trajectory probes, 420 mm maximum constant head, measuring cup. Dimensions:l x w x h : 865 x 640 x 700 mm	1	3
9. Pump Test Set • To demonstrate the operating characteristics (head-flow curves and efficiency) of a series of different types of pumps, each having a broadly similar input power. • The rig should accommodate both rotodynamic and positive displacement pumps, and should supply with the most common example of each type as standard (i.e. a centrifugal pump and a gear pump). • A range of other pump types should be available as accessories, (including axial, turbine, flexible impellor, diaphragm and plunger, plus a second centrifugal pump for series/parallel demonstrations). • Up to four pumps could be accommodated within the rig simultaneously for use within a single laboratory period, and each should be able to run without disconnecting any pipework or connections. Further pumps can also be interchanged straightforwardly. • As an option the unit should be able to be fitted with	1	3

two identical centrifugal pumps to allow simple series/parallel pump configurations to be demonstrated. • The equipment comprises a water reservoir, and five pump positions, (four active). Each pump position uses pipework and sensors optimised to the type of pumps it is intended for. • Each pump accessory should come on its own baseplate, assembled complete with all pipes, valves and fittings to allow it to be easily fitted • Other specifications: a. A self contained multi-pump test rig, containing all the services and instrumentation for determining the characteristic curves of different pumps at different speeds b. Should contains five different pump positions (4 active) c. Centrifugal pump and gear pump should be supplied as standard. d. Axial pump, flexible impellor pump, turbine pump, diaphragm pump, piston pump and a second centrifugal pump and all should be available as accessories e. Series/parallel pump demonstrationsshould be able to be performed with the second centrifugal pump option f. Control valve should be incorporated upstream of each pump (except axial pump) to demonstrate the effect of suction loss on performance g. Electronic torque measurement using a state of the art sensorless vector drive h. Electronic measurement of flow, pressure head and suction i. Optional volumetric flow measurement system for reciprocating pump j. Optional data logging and educational software. • The following should be the demonstration capabilities a. Determining the performance of different types of pumps at constant speed by producing a set of characteristic curves For rotodynamic pumps: ➢ Pressure head v flow		

- Power absorbed v flow
- Pump efficiency v flow

For positive displacement pumps:

- Flow v pressure head
- Power absorbed v pressure head
- Volumetric efficiency v pressure head

b. Determining the effect of speed on the performance of pumps
c. Understanding the difference between rotodynamic pumps and positive displacementpumps
d. Understanding the effect of system resistance
e. Investigating the effect of suction losses on a centrifugal pump
f. Demonstration of the effect of running two centrifugal pumps in series and parallel
g. Understanding the characteristics of a reciprocating pump

Instrumented Flow Capability	Instrumented Pressure Capability	Pump Options
300 L/min	20m	Centrifugal (as standard)
300 L/min	20m	- Flexible Impellor - Second Centrifugal for series/parallel operation
300 L/min	2m	- Axial
75 L/min	100m	- Gear (as standard)
75 L/min	100m	- Turbine or - Diaphragm or - Plunger

10. Turbine Test Set **a. Computer Controlled Francis Turbine** **b. Computer Controlled Pelton turbine** **c. Computer Controlled Kaplan Turbine** **d. Axial flow impulse turbine**		
a. Computer Controlled Francis Turbine • Francis runner surrounded by 6 guide vanes inside PVC volute with clear acrylic front panel for visualization • Guide vanes adjustable when turbine is running with scale to indicate degree of opening and clamp to prevent movement • Francis runner 60 mm diameter with 15 blades • Brake force determination using Prony type brake dynamometer • Inlet pressure gauge with range 0 to 2 bar • It should be Computer Controlled Unit, supplied with the Computer Control System, including: Control Interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the different parametersinvolved. • Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses. All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen • **Capabilities:** • Determining the operating characteristics, i.e. power, efficiency and torque, of a Francis Turbine at various speeds and guide vane openings • A tapering, spiral shaped volute conveys water to the runner via a ring of guide vanes that are adjustable in angle to vary the flow through the turbine • Power generated by turbine is absorbed by a Prony friction brake consisting of a pair of spring balances attached to a brake belt that is wrapped around a pulley wheel driven by the runner. The load on the turbine can be varied by tensioning both spring balances which increases the friction on the pulley	1	3

wheel

- The head of water entering the turbine should be able to be indicated on a Bourdon gauge and the speed of rotation to be measured using a non-contacting tachometer
- Tachometer to be supplied
- The volute of the Francis turbine should incorporate a transparent front cover for clear visualisation of the runner and guide vanes
-

Technical Details	
Item	value
peed range:	0 to 1000 RPM
ameter of Francis runner:	60 mm
umber of blades on nner:	12
umber of guide vanes:	6, adjustable from fully open to fully closed
nge of spring balances:	0 to 10 N x 0.1 N
nge of Bourdon gauge:	0 to 2 bar

- **Additional to be supplied:**
  -Computer Controlled Data Acquisition with the help of Data Management Software:
  -Should be compatible with actual Windows operating systems**.**
  -Computer aided learning software
  -Faults simulation system

b. Computer Controlled Pelton turbine — 1 — 3

- Should possess a small scale hydropower unit designed to demonstrate the operating principles of an impulse turbine.
- A transparent guard allowing excellent visibility of the pelton wheel operation.
- Mounted on a dedicated service unit.
- The runner itself should be mounted in a clear acrylic enclosure to allow maximum visibility of the

workings. • Should connects to a PC via the service unit and a USB interface device • Specific requirements: a. Determining the characteristics of the turbine, including the relationships of volume flow rate, head, torque produced, power output and efficiency to rotational speed. b. Comparison of throttle control and spear valve control of the speed of a Pelton Turbine c. Pelton turbine: Speed range: 0-3000 r.p.m. Torque: 20N (maximum). Number of buckets: 16. Drum radius: 30 mm. d. Brake: Pulley diameter: 60mm. Effective radio: 50mm e. Water pump, computer controlled: Maximum pressure: 7 bar. Maximum water flow: 80l./min at 5.4 bar. Electrical power: single-phase, 220V. f. Pressure sensor: 0 to 100 psi (0 to 6.7 bar). g. Load cell: 0-2 Kg. Force sensor: 0-20N (maximum h. Flow sensor: 0 to 150 l./min. i. Speed sensor: 0-20000 r.p.m. • Water transparent tank, capacity: 100 l. approx.Pressure sensor should be placed at the water inlet of the turbine to measure the admission pressure. • A band brake connected to a load cell varying the load given to the turbine by means of a connection device. • A sensor to determine the turbine velocity. • It should be Computer Controlled Unit, supplied with the Computer Control System, including: Control Interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the different paramenters involved. • Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses. All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors		

values and their responses are placed in only one computer screen		
c. Computer Controlled Kaplan Turbine • Functional model of Kaplan turbine, with a distributor with adjustable guide vanes that permits to control the water flow in the turbine: • Turbine diameter: 52 mm. • Velocity range: 0-1000 r.p.m. approx. • Number of blades of the turbine: 4. • Number of adjustable guide vanes of the distributor: 8. • Braking system. • Load cell:0-2 Kg. • Force sensor: 0-20 N (maximum). • Water pump, computer controlled. • Water transparent tank, capacity 100 l. approx. • Pressure sensor: 0 to 100 psi. • Flow sensor: 0 to 150 l./min. • Speed sensor • It should be Computer Controlled Unit, supplied with the Computer Control System, including: Control Interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the different paramenters involved. • Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses. All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen	1	3
d. axial flow impulse turbine • The turbine rotor should have 45 blades on a mean blade circle diameter of 45mm. • Both the blade inlet angle and outlet angle is of 40 degrees. • The rotor should be fitted with a stainless steel shroud ring. • The stator should houses two corrosion resistant ball bearings with double shields forlifetime lubrication, and four independently controllable nozzles.	1	3

• Each nozzle should have an outlet diameter of 2mm and discharges at 20 degrees to the plane of rotation. • The turbine should develop approximately 38W at 4500rpm when supplied with 14 litresper minute of water at 270kPa. The load speed approximately 9000rpm • Capabilities: • A small scale hydropower unit designed to demonstrate the principles of design and operation of an axial flow impulse turbine • One of a family of three turbines, each capable of being mounted on a self-contained service unit available as an essential accessory. • Equipped with electronic measurement sensors for inlet pressure, rotational speed and brake force. • To be linked to a PC • 45mm diameter rotor. • Stator housing four independently controlled nozzles.		
11. Tilting flow channel • A glass sided tilting flume with fabricated all stainless steel bed. • Completely self-contained and comprising the working section, moulded inlet and discharge tanks, a series of sump tanks, a pump, an electronic flow meter, a jacking system and a control console. • The channel section should be fully glazed with large clear panels of toughened glass coupled with careful design of the side support profiles to provide excellent visibility and allow flow visualisation of the full working height of the flume. • The overall strength and rigidity of the design should allow excellent stability figures to be achieved and must eliminates the need to provide adjusting screws or to perform periodic setting up of the flume to maintain its specification. • No underframe or support structure other than jacks is necessary. • Instrument rails are to be provided along the entire working length of the channel and a continuous scale calibrated in millimetres is provided along the length of one of the rails. Adjustable screws should allow the track to be set level and true. • Excellent velocity profiles must be able to be achieved in the working section by careful shaping of	1	3

the inlet tank and by the incorporation of stilling and smoothing devices • Operating water levels are to be maintained by an overshot tilting weir located in the discharge tank. • Water circulation should be by a centrifugal pump mounted beneath the channel, drawing water from a series of interconnected non-corroding sump tanks mounted on the floor and running alongside the flow channel. All interconnecting pipes and fittings must be of non-corroding materials. • The flow should be regulated using a manually adjusted valve. Flow rate should be measured using an electro-magnetic flow meter and displayed on a digital readout located on the control console. • The control console should be mounted on a pedestal and located in a convenient position for the installation, such that it is easily accessible and the flow rate can be read whilst adjusting the valve. • The emergency stop button and the pump controls should be available • A computer control and data logging package should be provided • The channel can be tilted using a jacking system - a single jacking station on 5m channel • A slope indicator should be provided. • Technical Details: • Width: 300mm • Depth: 450mm Length: 3m • Walls: Toughened glass Bed: Exclusively fabricated from stainless steel End tanks: GRP (Glass Reinforced Plastic) Sump tanks & pipework: PVC (Polyvinylchloride) & PE (polyethylene) Pump: Close coupled centrifugal Flow regulation valve: Hand wheel operated butterfly +ve slope: 1:40 max (1.4°) -ve slope: 1:200 max (0.28°) Flow meter: Electro-magnetic Maximum flow rate 30 Litres/sec Bed stability: <1.0mm (typical) at 400mm water depth Side wall stability: <0.5mm (typical) at 400mm water depth		

12. Resonant Column Apparatus and Blender elements
Resonant Column:
 	
• Fully automated
• Current driven
• Available tests:
  o Torsion
  o Flexure
  o Damping
• Specimen sizes available
  o 50 mm x 100 mm
  o 70 mm x 140 mm
  o Custom
• The Resonant column apparatus is used to excite one end of a confined solid or hollow cylindrical soil specimen.
• The specimen is excited in torsion or flexure by means of an electromagnetic drive system.
• Once the fundamental resonant frequency is established from measuring the motion of the free end, the velocity of propagating wave and the degree of material damping and derived.
• The shear modulus or young's modulus is then obtained from the derived velocity and density of the sample
• RCA used for control and data acquisition of the RCA apparatus.
• The software allows testing to occur via a simple, user-friendly interface.
• The tests that may be performed using the RCA Software
  o Resonance in torsion
  o Resonance in flexure
  o Damping ratio in flexure and torsion
• Technical Specifications:
  o Standard cell capable of 1MPa gaseous cell pressure
  o Electromagnetic drive system incorporating precision would coils and composite sintered neodymium iron boron "rare-earth" magnets
  o Trans-conductance current driven amplifier
  o Inner cell for silicon oil
  o Energisation mode of coils is switchable by software to provide torsional and bending
  o Internal LVDT for measurement of simple deformation
  o Internally mounted counter-balanced accelerometer
	1	3

○ 1 off trans-conductance current driven drive amplifier ○ 1 off high speed 16 bit data acquisition control card with associated RCA control box/ interface panel ○ 3 off calibration weights and calibration bars provided of differing stiffness to enable calibration of system to value ○ 1 off computer controlled proportional gas valve to control cell pressure from software ○ Back Pressure by GDS Standard pressure/volume controller ○ Options for environmental temperature chamber and an axial loading actuator and frame ○ Standard specimen sizes 50mm x 100mm x 70mm x 140mm <u>Bender Element System:</u> • S and P Velocity • Dedicated software • 2 Million samples/sec • The Bender Element system enables easy measurement of the maximum shear modulus of a soil at small strains in a triaxial cell. • The measurement of soil stiffness at very small strains in the laboratory is difficult due to insufficient resolution and accuracy of load and displacement measuring devices. • The capability exists to regularly carry out measurements of small strain stiffness in the triaxial apparatus using local Strain transducers. • The Bender elements are bonded to a standard insert. It has 2 advantages • Elements are manufactured to allow both S and P waves testing to be performed • The length of the bender element that protrudes in to the soil has been optimized without compromising the power transmitted by or received to the elements. • This allows the equipment to achieve maximum at its tip whilst only protruding into the material by a reasonable distance. • The bender elements systems connects directly in to a master box which in turn connects to a PC running bender elements control software. • Technical Specifications: ○ Data acquisition speed: = 2,000,000 samples/second,		

simultaneous sampling of both source and received signals o Resolution of data acquisition: = 16 bit o Connectivity of control box: = USB o Available grain ranges for data acquisition: = from x 10 to x500 o Titanium Inserts for reduced weight		

7. General Requirements & Qualification Criteria

- Bidding Firm offering the product should have ISO 9001 Accreditation certification.
- Bidding Firm, offering the product, should have supplied similar type of test systems for a several years to government establishments, defense organizations & National higher learning institutions like IITs, IISC etc., in India
- Bidding Firm offering the product should submit list of supplies made by it, during last two years with complete contact details of the end users such as phone number, fax number, e-mail ID etc. It should submit copies of order placed by such organizations and user certificates for goods of same/similar nature.
- Bidding Firm offering the Product should have a Local Service Support Facility, preferably in Hyderabad, and should submit address and contact details
- Bidding Firm should give an Undertaking that, un interrupted service support will be given for a minimum period of 10 years with unbroken availability of spares supply.
- Bidding Firm should give an undertaking that, the Software upgrades if any, during the warranty period of three year, should be supplied free of charge
- Bidding Firm should offer pre-dispatch inspection free of charge at their factory premises for 2 users for 3 days and post installation training at our three laboratories in different campuses to 2 users for 5 days.

Web document

NOTE

A complete set of bidding documents may be purchased by interested bidders from the RGUKT contact person upon payment of the bid document price which is non-refundable. Payment of bid document price should be by demand draft drawn from any Nationalized Bank only in favour of "Registrar, Rajiv Gandhi University of Knowledge Technologies" and payable at Hyderabad (India).

- **Tender documents purchased bidders are only allowed to participate in Pre-Bid meeting.**