

**INDIAN INSTITUTE OF TECHNOLOGY GOA**

At Goa Engineering College Campus

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GSTIN: 30AABAI1653D1ZF

PAN: AABAI1653D

TAN: BLRI08261B

**Enquiry No: IITGOA/2019-20/026**

**Date: 24/10/2019**

IIT Goa invites sealed quotations in two bid form for the supply of below mentioned items.

Sl. No.	Description of Item	Qty
1	Hydraulic bench <b>(Detailed Specifications Attached)</b>	02 Nos.
2	Demonstration of Bernoulli's principle <b>(Detailed Specifications Attached)</b>	01 No.
3	Osborne – Reynolds apparatus <b>(Detailed Specifications Attached)</b>	01 No.
4	Friction in pipe flow <b>(Detailed Specifications Attached)</b>	01 No.
5	Calibration of flow meters <b>(Detailed Specifications Attached)</b>	01 No.
6	Stability of floating bodies <b>(Detailed Specifications Attached)</b>	01 No.

**Terms and conditions:**

1. Quotation must be valid for at least 90 days.
2. The GSTIN should invariably be mentioned in your offer.
3. Kindly attach a compliance certificate along with the technical quote.
4. The vendor should be an internationally reputed OEM, or should be an authorised dealer of an internationally reputed OEM.
5. In the last 5 years, the vendor should have supplied at least 10 fluid-thermal laboratory teaching equipment to CFTIs, IITs, IISERs and other Govt. of India organizations. Out of these 10 supplies, at least 2 should have been supplied to IITs.
6. Vendor must attach the reference list of supplies in last 5 years with contact details (Name, Phone, email address) of at least 5 users.
7. Bidders should quote only their standard equipment that have been previously installed in other academic institution. For each equipment, a list of maximum 5 institutes in India (preferably CFTI) to which it has been supplied should be specified.

8. Bidders should compulsorily quote for all the items specified in the tender enquiry. IIT Goa shall issue the purchase order to the technically qualified eligible bidder whose bid has been determined as the aggregate lowest evaluated financial bid.
9. Prices:
  - I) **For Import Supplies:**
    - a) It is mandatory to quote prices in FOB basis only.
    - b) In case of multiple options of same product, bidders are requested to quote only one best option and not multiple options.
    - c) Payment terms: 90% payment by letter of credit and balance 10% will be paid by wire transfer after satisfactory installation and commissioning.
  - II) **For Indigenous Supplies:**
    - a) In case of multiple options of same product, bidders are requested to quote only one best option and not multiple options.
    - b) Payment terms: Within 30 days after the delivery and installation of the item at IIT GOA.
10. Delivery and installation should be made within 6 weeks of getting a confirmed order.
11. The suppliers shall provide the banking details along with their quote on their letterhead duly signed and stamped.
12. Quotations shall be submitted in two parts;
  - 1) **Part – I (Technical)** should contain all the technical details and specification of the product. It should contain unpriced bid along with terms and conditions, compliance certificates, proprietary certificates (if applicable), any other certificates/details etc. This envelope should be marked as “Technical Bid”
  - 2) **Part -II (Financial)** The financial bid of the above item should be in a sealed envelope marked as “Financial Bid” and should contain financial terms and conditions.
13. For any clarification, you may kindly contact Dr. Y. Sudhakar (E-mail: [sudhakar@iitgoa.ac.in](mailto:sudhakar@iitgoa.ac.in) and Stores & Purchase Department (email: [purchase@iitgoa.ac.in](mailto:purchase@iitgoa.ac.in)) till 01/11/2019.
14. All sealed quotations must reach to the Assistant Registrar (Stores & Purchase), IIT Goa, at Goa College of Engineering Campus, Farmagudi, Ponda, Goa, 403 401 by 17.00 Hrs on or before 14/11/2019.

**Sd/-**  
**Asst. Registrar (S&P)**

## Detailed technical specifications of items

### A. Hydraulic bench

The hydraulic bench needs to provide a controlled recirculating closed circuit water supply and accurate flowmeter for fluid mechanics experiments (items B, C, D, and E) as listed below. Once filled with water, the bench should need no external water supply.

1. Storage tank capacity should be at least 100 litres.
2. Maximum dimension should not exceed 1300 mm in any direction.
3. An appropriate submersible/centrifugal pump is to be provided to maintain the flow rate mentioned.
4. Pump capacity at least upto 45 Litres per minute.
5. It should have a mechanism to adjust flow rate.
6. It should have a provision to measure nominal flowrate.
7. It should be a mobile unit, with lockable wheels for stable operation.
8. It should either have a digital display, or comes with a stopwatch to measure flow rate.
9. All necessary pipe connections should be supplied.
10. It should have a rim around the top to contain excess water.
11. Tank should be made of robust corrosion resistant plastic material.
12. It should be supplied with a comprehensive user guide.

### B. Demonstration of Bernoulli's principle

This instrument enables to study the Bernoulli's theorem by measuring the complete static head distribution for flow through a transparent Venturi tube.

1. No of pressure tappings should be at least 8.
2. Angle of convergent portion should be less than 20 degrees.
3. Angle of the divergent portion should be less than 10 degrees.
4. Manometer tube range should be at least 0—300 mm.
5. It should have a provision to adjust flow rate.
6. The tender should specify the operating range of flow rate, and within this range, the flow must be smooth with minimal pressure oscillations as observed in the manometer.
7. The manometer range (specified in point 5) should be compatible with the rage given in point 7. If necessary, manometers with higher range should be provided.
8. The manometer panel should have a scale behind the manometer tubes for direct reading of the water levels in the tubes.
9. It should be compatible with the hydraulic bench given in item A.
10. It should be able to be fitted on top of the hydraulic bench
11. It should have a transparent working section.
12. Working section should be made of robust corrosion resistant plastic material.
13. It should be supplied with a comprehensive user guide.

### **C. Osborne-Reynolds apparatus**

This item is intended to reproduce the classic experiments conducted by Professor Osborne Reynolds concerning the nature of laminar and turbulent flow in flows through a pipe. It should provide visualization of laminar, turbulent, and transitional flows using ink or die.

1. Water tank capacity should be at least 2 Liters.
2. Tank for ink/die should be at least 100 ml.
3. Length of pipe should be more than 500 mm.
4. Diameter of pipe should be approximately 10mm.
5. Inlet should have been designed carefully to ensure laminar flow. Moreover, additional provision (for example glass beads) should be provided to limit the inlet turbulence level to a very low value.
6. It should have ink/die injection system for flow visualization.
7. The working section should be transparent for easier visualization.
8. It should have a provision to control flow rate.
9. It should be made of robust non-corrosive material.
10. It should ensure correct operation in laminar, transition, and turbulent Reynolds number regime.
11. It should be compatible with the hydraulic bench given in item A.
12. It should be fitted on top of the hydraulic bench.
13. It should be supplied with a comprehensive user guide.

### **D. Friction in pipe flow**

The aim of this apparatus is to measure pressure losses due to fluid friction in smooth and rough pipes in both laminar and turbulent regime. With the help of experimental results, the student will be able to reproduce part of the Moody diagram from measurements on straight pipe. Additionally, we measure pressure losses in pipe bendings and fittings.

1. At least four different horizontal circular pipes should be provided, out of which one should be artificially roughened. The internal diameters of the pipes should be in the range 5 mm to 32mm. The dimensions and the flow rate should be in such a way that the experiments can be conducted in laminar flow regime at least in one pipe.
2. The net dimension of the experimental setup should not exceed 3 meters.
3. The following configuration should be provided to measure pressure losses at bends and fittings: 90° elbow, 90° smooth bend, sudden contraction, and sudden contraction.
4. Provision to measure and control flow rate, and appropriate provision to measure pressure drop.
5. For straight pipes, the equipment should be able to provide pressure losses in laminar as well as the turbulent flow regime.
6. It should have a provision (for example isolating valve) to select the measurement on a particular pipe without disconnecting or draining the system.
7. It should be compatible with the hydraulic bench given in item A.
8. It should be supplied with a comprehensive user guide.

### **E. Calibration of flow meters**

This item is intended to compute coefficient of discharge for measuring volume flow rate through a straight pipe using Venturimeter, and orifice meter. This can be done by comparing values measured using these meters against a reference value provided by the hydraulic bench (Item A).

1. The range of accurate volume flow rate should be at least 10 liters/minute. The operating range of volume flow rate should be specified in the tender.
2. There should be a provision to control flow rate.
3. It should be provided with manometers to measure pressure drop. The manometers should be attached with appropriate scales for easy reading of values. The manometer range should be compatible with the flow rate measurement range provided in point 2 above.
4. It should be made of robust non-corrosive plastic material.
5. It should be a single setup consisting of both flow measuring meters. Provision (for example isolating valve) should be provided to select the measurement on a particular device without disconnecting or draining the system
6. It should be compatible with the hydraulic bench given in item A.
7. It should be fitted on top of the hydraulic bench.
8. It should be supplied with a comprehensive user guide.

### **F. Stability of floating bodies**

The equipment should enable investigation of the stability of floating bodies by measuring their metacentric height.

1. It should have a water tank with at least the following size: 450 mm (length), 350 mm (width), and 120 mm (depth).
2. Three floating bodies of rectangular, triangular, and semi-circular bottom should be provided. The size of the floating body should be at least 280mm (length), 130 mm (width), and 80 mm (depth).
3. The floating bodies and the experimental setup should be designed in such a way that the metacentre can be varied from stable to unstable equilibrium, and all necessary components should be provided for demonstrating this.
4. It should be provided with an inclinometer for direct observation of the angle of heel.
5. It should be made of robust, corrosion-resistant plastic material.
6. It should be supplied with a comprehensive user guide.