



TENDER DOCUMENTS

MECHANICAL LAB EQUIPMENT

NUTECH/SCM/Mech Lab-2018/TD-009

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE
NATIONAL UNIVERSITY OF TECHNOLOGY (NUTECH)
Tender No: NUTECH/SCM/Mechanical Lab-2018/TD-009

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

1. Tender documents containing terms & conditions and detailed specifications of items can be downloaded from NUTECH web "<https://nutech.edu.pk/scm/>" wef **13-12-2018**.
2. Quotations shall be submitted as per requirement of the tender documents.
3. Bidders will be required to submit bank draft/PO equal to 4% of quoted value as Bid Bond in favor of National University of Technology (NUTECH).
4. Sealed bids with detailed specification should reach on the following address latest by **1100 hours on 11-01-2019**. Late submission will not be entertained.
5. Bids will be opened at **1130 hours on 11-01-2019** at SCM Office.

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



NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

INVITATION TO TENDER

Submission Date/Time 11-01-2019 at 11 00 hours

1. NUTECH desires to procure the list of item(s)/Store(s) as per **Annexure-A**. Interested bidders are requested to send their bids through courier or deliver at NUTECH under two separate sealed envelopes (placed together in third envelope), marked clearly, "**Technical Offer**" and "**Commercial Offer**", respectively to the undersigned, latest by or before above mentioned due date. If due to any unforeseen circumstances, NUTECH establishment remains closed, then the last date of submission will be extended to next working day.
2. Please also note that Technical Offer should contain Annexes-A & B duly filled in (supported with relevant technical literature /details/ catalogues etc). Commercial Offer will contain Annexure-C. Please ensure no space is left blank in the annexes.
3. Following must be noted for this IT (Invitation to Tender):-
 - a. Validity of offer will be 90 days
 - b. Delivery period will be 110 days
 - c. Tender(s) must be accompanied with a Bid Bond in agreement of faithful compliance of the conditions of Contract/Purchase Order. This amount will be equivalent to 4% of the total quoted value. In case of non-acceptance of any offer, the Bid Bond will be returned to the bidder by fastest possible means. The Bid Bond amount submitted by the successful bidder will however, be refunded on effective termination of Contract/ Purchase Order. (The Bid Bond will be forfeited in case of default by the bidder from his commitments made through his offer). Submission of Bid Bond is mandatory, otherwise your offer will be rejected.
 - d. 2 years warranty against 5% bank guarantee will be required from the successful bidders from the date of commissioning.
 - e. Rates should be quoted on free delivery basis at NUTECH Islamabad.
4. We reserve the rights to accept or reject any or all tenders as a whole or in part without assigning any reason whatsoever. The decision in this regard will be firm, final and binding on all bidders.

DD (Supply Chain Management)



NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANGEMENT OFFICE

TECHNICAL OFFER

Annex A

User Reference No. Mechanical Lab - 001 Date 07-12-18

Technical Specifications

Ser	Nomen	Description	Country of Origin	A/U	Qty Req	Bidder Compliance			Tech Scrutiny to be done by user	
						Yes	No	Alternate Offer	Accepted	Rejected
									Reason of Rejection	
1.	Hydraulic Bench with data acquisition system and following Modules and Accessories	Sump Tank: Material Fiber Glass or better, Capacity 130 liters minimum. Volumetric Tank: Material (Fiber Glass), Capacity 90 liters minimum Delivery Pump Material (Stainless Steel) Capacity 0-85 lpm The bench must be capable and meet operational requirement of the below mentioned modules and accessories.	USA, Canada, Europe, Japan, South Korea	No	4					

		<p>(a) Impact of Jet Apparatus</p> <p>(b) Pipe Friction Apparatus</p> <p>(c) Fluid Friction Measurement</p> <p>(d) Orifice Discharge Apparatus</p> <p>(e) Venturi Apparatus</p> <p>(f) Horizontal Osborne-Reynolds Apparatus</p>							
1(a)	Impact of Jet Apparatus	<p>Nozzle Diameter 6mm, 4mm</p> <p>Nozzle to target distance: 20mm</p> <p>Target Plate: (a) Flat Plate,</p> <p>(b) 90 degree cone,</p> <p>(c) 180 degree hemisphere, (d) 30 degree Flat</p> <p>Target Plates Diameter: 30mm</p> <p>Set of Weights: 5*5g, 5*10g, 5*20g, 4*50g, 4*100g, 2*200g</p> <p>All necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Diagram in the front panel with distribution of the elements similar to</p>	<p>USA,</p> <p>Canada,</p> <p>Europe,</p> <p>Japan,</p> <p>South Korea</p>	No	2				

		<p>the real one.</p> <p>Experimental Capabilities</p> <p>Demonstration of the principle of linear momentum.</p> <p>1- Study of the jet forces.</p> <p>2- Influence of flow rate and flow velocity.</p> <p>3-Influence of different deflection angles.</p>							
1(b)	<p>Fluid Friction in Pipes Apparatus</p>	<p>Diagram in the front panel with distribution of the elements similar to the real one.</p> <p>Pipes of different internal diameter, roughness and materials.</p> <p>Different types of valves (angle-seat, gate, diaphragm and ball).</p> <p>Different types of couplings (in-line strainer, elbows, sudden widening, sudden contraction, etc.).</p> <p>Special couplings: Pitot tube, Venturi tube and diaphragm with measuring plate.</p> <p>Pressure tapings with quick action</p>	<p>USA, Canada, Europe, Japan, South Korea</p>	No	2				

		<p>connections. Two water manometers, range: 0-1200 mm Two Bourdon manometers, range: 0 - 3bar One flow meter, range: 100-6000 l./h. Quick Coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities of Fluid Friction in Pipes Apparatus</p> <ol style="list-style-type: none">1- Determination of pressure loss due to friction in pipes made of different materials and with different diameters and roughness.2- Determination and comparison of pressure loss in different types of valves.3- Determination and comparison of pressure loss in different fittings.							
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		<p>4- Measurement of the flow with the Venturi tube and the Pitot tube.</p> <p>5- .Determination and comparison of the discharge coefficient determined in the Venturi tube and the Pitot tube.</p>							
1 (c)	<p>Energy Losses in Pipes</p>	<p>Water Storage: Elevated Cylinder Tank Apprx 1000 mm constant head Tank Capacity: 6 liters minimum (including level indicator), Bore (nominal): 5mm, To regulate flow rate needle valve must be included Quick coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities:-</p> <ol style="list-style-type: none"> 1. Head Loss Measurements 2. .Determination of Critical Reynolds Number 	<p>USA, Canada, Europe, Japan, South Korea</p>	No	2				

1 (d)	<p>Orifice Discharge Apparatus</p>	<p>Transparent cylindrical tank. Different type of interchangeable mouthpieces: diaphragm, colloidal, 2 of Venturi and cylindrical. Height of maximum load: 350-400 mm. Quick coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities Determination of the discharge, velocity and contraction coefficient of multiple geometries.</p>	<p>USA, Canada, Europe, Japan, South Korea</p>	<p>No</p>	<p>2</p>				
1 (e)	<p>Venturi Meter Apparatus</p>	<p>Manometer range: 0 to 300 mm of water. Number of manometer tubes: 8. Upstream diameter of the throat: 25 mm. Narrowing: Downstream: 21° Upstream: 10°</p> <p>Experimental Capabilities</p> <ol style="list-style-type: none"> 1. Demonstration of Venturi meter for use as water flow 	<p>USA, Canada, Europe, Japan, South Korea</p>	<p>No</p>	<p>2</p>				

		<p>meter.</p> <ol style="list-style-type: none"> 2. Demonstration of the pressure recovery at the divergent section. 3. Energy conversion in divergent/convergent pipe flow. 4. Recording the pressure curve in a Venturi nozzle 5. Recording the velocity curve in a Venturi nozzle 6. Determining the flow coefficient. 							
1(f)	Horizontal Osborne-Reynolds Apparatus	<p>Diagrams in front panels with similar distribution that the elements in the reality. Inner diameter: 16-20 mm. External diameter: 20-24 mm. Length: 750-800 mm. Water Supply Tank Capacity: 2.4-2.6 l. Tank with a valve and an injection needle, Having capacity: 0.4-0.6 l. Control valve to adjust the water flow in the experiments. Quick coupling. All the necessary pipe</p>	<p>USA, Canada, Europe, Japan, South Korea</p>	No	2				

		<p>clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities</p> <p>1.- Observation of laminar, transition and turbulent flows.</p> <p>2.- Association of laminar, transition and turbulent flows with their corresponding Reynolds number.</p> <p>3.- Observation of the parabolic velocity profile</p>							
2	<p>Hydrostatic Bench with data acquisition system and following Modules and Accessories</p>	<p>All metallic items Stainless steel Diagram in the front panel with distribution of the elements similar to the real one. Air pump, Water pump "Alcohol thermometer, range: -10 – 60 ° C. Hydrometer (0 – 65 Baumé, 0.600 – 2.000 Sp/gr). Capillary viscosimeter: 0.5 – 3 cp. Capillary viscosimeter: 2 – 10 cp. Capillary viscosimeter: 10 – 55 cp. Capillary viscosimeter: 55 – 300 cp. Three graduated</p>	<p>USA, Canada, Europe, Japan, South Korea</p>	No	2				

		<p> cylinders 250 ml glass. Cylinders graduated 1000 ml plastic. Two 650 ml glass beakers. Three glass elements for demonstration of free surface in static conditions. Bourdon manometer, range: 0 – 3 bar. Two “U” tube manometers, range: 0 – 450 mm. Module to study Archimedes’ Principle (lever balance with displacement vessel, bucket and cylinder). Weather Station: Barometer up to 1050 hPa. Thermometer:-40 – 60° C. Hygrometer: 0 – 100 %. Stop clock. Bleed valves and circuit selection valves. Module of capillarity in parallel plates. Module of tubular capillary tubes." </p> <p> The bench must be capable and should meet operational requirement of the </p>							
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		<p>below mentioned modules and accessories.</p> <p>a) Dead Weight Calibration Apparatus.</p> <p>b) Flow over Weirs Apparatus.</p> <p>c) Hydrostatic Pressure Apparatus.</p> <p>d) Metacentric Height Calculation Apparatus.</p> <p>Experimental Capabilities:- Ability to measure Surface tension, Capillarity, Buoyancy force, Hydrostatic pressure in liquids Total Pressure and Static Pressure Density of liquids</p>							
2(a)	Dead Weight Calibration Apparatus.	<p>Pressure manometer: Bourdon type. 0 – 3 bar.</p> <p>Set of masses of different weights.</p> <p>Piston diameter: 18-20 mm.</p> <p>Piston weight: 0.5 Kg"</p>	<p>USA, Canada, Europe, Japan, South Korea</p>	No	2				

2(b)	Flow over Weirs Apparatus	Scale of the level meter: 0 – 165 mm. Dimensions of the weirs: 170 x 240 x 40 mm. Neckline angle in the V-shape weir: 90°. Dimension of rectangular notch: 30 x 85 mm"	USA, Canada, Europe, Japan, South Korea	No	2				
2 (c)	Hydrostatic Pressure Apparatus.	Tank capacity: 5.5-6 L. Distance between suspended masses and the support point: 285 mm. Area of the section: 0.007-0.0010 m ² . Total depth of submerged quadrant:165 mm Height of support point on the quadrant: 100 mm. Set of masses of different weights	USA, Canada, Europe, Japan, South Korea	No	2				
2 (d)	Metacentric Height	Maximum angle: +/- 13. Corresponding lineal dimension: +/- 90 mm. Dimension of the float: length = 353 mm, width = 204 mm, total height = 480 mm.	USA, Canada, Europe, Japan, South Korea	No	2				
3	Wind Tunnel with Accessories, Data	Test Section: 300mm * 300mm * 600 mm Flow velocity: 0 to 36 m/s (Minimum) Measurement of lift and drag.							

	Acquisition System and Mounting Models	Lift $\pm 10N$, Drag $\pm 10N$.(Min) Boundary Layer and Wake Analysis Capability. Accessories:- Multi-Tube Manometer Angle Feedback Unit Differential Pressure Transducer 32-Way Pressure Display Unit Pitot-Static Traverse Fog or smoke Generator Data Acquisition System. Following models are to be included Sphere Drag Model Drag Model of Hemisphere Convex to Airflow Circular Plate Drag Model Square Plate Drag Model Cylinder Drag Model Streamlined Shape Drag Model Paraboloid Drag Model Drag Model of Hemisphere Concave to Airflow Wing with Flaps Drag Model Wing Model with NACA 0015 Profile	USA, Canada, Europe, Japan, South Korea	No	1				
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		<p>Wing Model with NACA 54118 Profile</p> <p>Wing Model with NACA 4415 Profile</p> <p>Dimpled Sphere Drag Model</p> <p>Set for Alternative Models Projects.</p> <p>Wake Survey Rake.</p> <p>Bernoulli Apparatus Model.</p> <p>Spring-mounted Wing Model.</p> <p>AIRBUS A-380 Airplane Model.</p> <p>F-16 Airplane Model.</p> <p>Force Measurement Interface and Sensors Model to Study the Boundary Layer in a Flat Plate.</p> <p>Accessory for Particle Image Velocimetry (PIV).</p> <p>Experimental Capability</p> <p>Lift and Drag calculation.</p> <p>Pressure Distribution</p> <p>Boundary Layer Analysis</p> <p>Wake Analysis.</p>							
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Special Instructions

Description	Bidder			Tech Scrutiny to be done by User		
	Yes	No	Alternate Offer	Accepted	Rejected	Reasons of Rejection
Environment Conditions (a) Temperature range: -05°C to +60°C (b) Relative humidity: 0-90% non-condensing						
Warranty period Two years from the date of commissioning. A warranty sticker is to be pasted on each item by the Supplier / OEM highlighting Name of Firm, Contract No and date, Description of Store and Warranty validity						
Training Notes Supplier will provide a set of handouts for training on operation and maintenance of the equipment						
Publications Supplier is to provide hard and soft copies (CD) of following manuals. (a) Operational / Maintenance manual: - Qty 01 with Equipment and additional Qty 02 for record purposes and should consist of following sections:- (1) Equipment Description /Operation:- (a)Specifications (b)Description (c)Operation (2) Servicing:- (a)Maintenance Schedule (b)Adjustment / test (c)Removal / Installation procedure (d)Tools Used (3) Trouble shooting guide (4) Cleaning requirements (5) Shipping and receiving (6) Storage requirements (b) IPB (Illustrated Parts Breakdown Manual) should have full parts description along with detailed diagrams (exploded view). (c) Experimental manuals which must contain the list and procedure of the experiments that equipment can perform.						

<p>Spares / Technical Support</p> <p>(a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years</p> <p>(b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided</p> <p>(c) Any software provided must have its license</p> <p>(d) Software upgrade support must be provided free of cost for ten years with renewed license at every upgrade</p> <p>(e) Supplier must also provide calibration service for at least five years after commissioning</p>						
<p>Additional Spare / Replaceable parts.</p> <p>(a) Replaceable spare / parts during scheduled inspections are to be identified and provided as per requirement along with equipment sufficient to cater five years consumption.</p> <p>(b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.</p>						
<p>Physical Inspection Criteria: 100% physical inspection of store will be carried out before commissioning of the equipment for following details:-</p> <p>(a) For physical damage, scratches and deformity.</p> <p>(b) Accessories /components as per contractual specifications.</p> <p>(c) Technical Manuals (Operation manual, user guide, IPBs).</p> <p>(d) Quality certificate and calibration certificate by the OEM</p> <p>(e) OEM certificate and verifiable documents by the supplier that store has been procured from certified source and is factory new and from latest production.</p> <p>(f) Brand name and country of origin.</p>						

<p>Commissioning</p> <p>(a) Commissioning of the equipment will be carried out by OEM rep at his own cost and risk at designated place at NUTECH.</p> <p>(b) Any special requirement for installation, operation and commissioning must be specified in the offer by the supplier.</p>						
<p>Training</p> <p>01 week OEM operational/ maintenance training at NUTECH</p>						
<p>Improvement and Safety Measures</p> <p>Any improvement and safety measures suggested by NUTECH during commissioning are to be resolved by the supplier / manufacturer at no extra cost.</p>						
<p>Liability of Supplier</p> <p>(a) OEM certificate of authorized dealership Supplier is to provide original OEM certificate of subject equipment bought directly from the manufacturer and being an authorized dealer.</p> <p>(b) In case the equipment supplied is not compatible with specifications, the supplier will be obliged to call his representatives at his own cost for consultation and corrective action</p>						
<p>Special Notes</p> <p>(a) Additional requirements for the maintenance of equipment (if any) must be intimated by the supplier in technical offer.</p> <p>(b) Supplier must provide the list of organizations using same equipment in Pakistan (if any).</p> <p>(c) Equipment must be a standard product of OEM available at web address of OEM.</p> <p>(d) In case of premature failure of the equipment, OEM has to replace / rectify the item free of cost. Required transportation charges would be borne by the supplier.</p>						

Firm Name_____
Signature_____
Name_____
Designation_____



NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

TECHNICAL OFFER

Annex B

User Reference No Mechanical Lab - 001 Date 07-12-18

Please fill in the following essential parameters:

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

General

GST No: _____ (Please enclose copy)

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

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

1. Advance payment 30% (Against valid bank Guarantee)
2. Payment after delivery, installation, commissioning, 70 %
3. Others

Details of Payment Recipient

(1) Name/Title: _____

(2) Address: _____

Signature: _____

Official Seal: _____

Name: _____

Designation: _____



NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

FINANCIAL OFFER

Annex C

User Reference No Mechanical Lab - 001 Date 07-12-18

Ser	Nomen	Description	Qty Req	A/U	Unit Price Rs,(excluding GST)	GST (If applicable)	Total amount (Rs)
1.	Hydraulic Bench with data acquisition system and following Modules and Accessories	<p>Sump Tank: Material Fiber Glass or better, Capacity 130 liters minimum.</p> <p>Volumetric Tank: Material (Fiber Glass), Capacity 90 liters minimum</p> <p>Delivery Pump Material (Stainless Steel) Capacity 0-85 lpm</p> <p>The bench must be capable and meet operational requirement of the below mentioned modules and accessories.</p> <p>(a) Impact of Jet Apparatus</p> <p>(b) Pipe Friction Apparatus</p> <p>(c) Fluid Friction Measurement</p> <p>(d) Orifice Discharge Apparatus</p> <p>(e) Venturi Apparatus</p> <p>(f) Horizontal Osborne-</p>	4	No			

		Reynolds Apparatus					
1 (a)	Impact of Jet Apparatus	<p>Nozzle Diameter 6mm, 4mm Nozzle to target distance: 20mm Target Plate: (a) Flat Plate, (b) 90 degree cone, (c) 180 degree hemisphere, (d) 30 degree Flat Target Plates Diameter: 30mm Set of Weights: 5*5g, 5*10g, 5*20g, 4*50g, 4*100g, 2*200g All necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench. Diagram in the front panel with distribution of the elements similar to the real one.</p> <p>Experimental Capabilities 1) Demonstration of the principle of linear momentum. 2). Study of the jet forces. 3) Influence of flow rate and flow velocity. Influence of different deflection angles.</p>	2	No			
1(b)	Fluid Friction in Pipes Apparatus	<p>Diagram in the front panel with distribution of the elements similar to the real one. Pipes of different internal</p>	2	No			

		<p>diameter, roughness and materials. Different types of valves (angle-seat, gate, diaphragm and ball). Different types of couplings (in-line strainer, elbows, sudden widening, sudden contraction, etc.). Special couplings: Pitot tube, Venturi tube and diaphragm with measuring plate. Pressure tapings with quick action connections. Two water manometers, range: 0- 1200 mm Two Bourdon manometers, range: 0 - 3bar One flow meter, range: 100- 6000 l./h. Quick Coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities of Fluid Friction in Pipes Apparatus</p> <p>(1) Determination of pressure loss due to friction in pipes made of different materials and with different diameters and roughness.</p>					
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		<p>(2) Determination and comparison of pressure loss in different types of valves.</p> <p>(3) Determination and comparison of pressure loss in different fittings.</p> <p>(4) Measurement of the flow with the Venturi tube and the Pitot tube.</p> <p>(5) Determination and comparison of the discharge coefficient determined in the Venturi tube and the Pitot tube.</p>					
1(c)	Energy Losses in Pipes	<p>Water Storage: Elevated Cylinder Tank Apprx 1000 mm constant head Tank Capacity: 6 liters minimum (including level indicator), Bore (nominal): 5mm, To regulate flow rate needle valve must be included Quick coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities:- (1) Head Loss Measurements</p>	2	No			

		(2) Determination of Critical Reynolds Number					
1 (d)	Orifice Discharge Apparatus	<p>Transparent cylindrical tank. Different type of interchangeable mouthpieces: diaphragm, colloidal, 2 of Venturi and cylindrical. Height of maximum load: 350-400 mm.</p> <p>Quick coupling.</p> <p>All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities</p> <p>Determination of the discharge, velocity and contraction coefficient of multiple geometries.</p>	2	No			
1 (e)	Venturi Meter Apparatus	<p>Manometer range: 0 to 300 mm of water. Number of manometer tubes: 8.</p> <p>Upstream diameter of the throat: 25 mm. Narrowing: Downstream: 21° Upstream: 10°</p> <p>Experimental Capabilities</p> <ol style="list-style-type: none"> (1) Demonstration of Venturi meter for use as water flow meter. (2) Demonstration of the pressure recovery at the divergent section. (3) Energy conversion in divergent/convergent pipe flow. 	2	No			

		<p>(4) Recording the pressure curve in a Venturi nozzle</p> <p>(5) Recording the velocity curve in a Venturi nozzle</p> <p>(6) Determining the flow coefficient.</p>					
1 (f)	<p>Horizontal Osborne-Reynolds Apparatus</p>	<p>Diagrams in front panels with similar distribution that the elements in the reality. Inner diameter: 16-20 mm. External diameter: 20-24 mm. Length: 750-800 mm. Water Supply Tank Capacity: 2.4-2.6 l. Tank with a valve and an injection needle, Having capacity: 0.4-0.6 l. Control valve to adjust the water flow in the experiments. Quick coupling. All the necessary pipe clips and tubing must be included and should be compatible with the hydraulic bench.</p> <p>Experimental Capabilities</p> <p>1.- Observation of laminar, transition and turbulent flows.</p> <p>2.- Association of laminar, transition and turbulent flows with their corresponding Reynolds number.</p>	2	No			

		3.- Observation of the parabolic velocity profile					
2	Hydrostatic Bench with data acquisition system and following Modules and Accessories	<p>All metallic items Stainless steel</p> <p>Diagram in the front panel with distribution of the elements similar to the real one.</p> <p>Air pump, Water pump</p> <p>"Alcohol thermometer, range: -10 – 60 ° C.</p> <p>Hydrometer (0 – 65 Baumé, 0.600 – 2.000 Sp/gr).</p> <p>Capillary viscosimeter: 0.5 – 3 cp.</p> <p>Capillary viscosimeter: 2 – 10 cp.</p> <p>Capillary viscosimeter: 10 – 55 cp.</p> <p>Capillary viscosimeter: 55 – 300 cp.</p> <p>Three graduated cylinders 250 ml glass.</p> <p>Cylinders graduated 1000 ml plastic.</p> <p>Two 650 ml glass beakers.</p> <p>Three glass elements for demonstration of free surface in static conditions.</p> <p>Bourdon manometer, range: 0 – 3 bar.</p> <p>Two "U" tube manometers, range: 0 – 450 mm.</p> <p>Module to study Archimedes' Principle (lever balance with displacement vessel, bucket and cylinder).</p>	2	No			

		<p>Weather Station: Barometer up to 1050 hPa. Thermometer:-40 – 60° C. Hygrometer: 0 – 100 %. Stop clock. Bleed valves and circuit selection valves. Module of capillarity in parallel plates. Module of tubular capillary tubes."</p> <p>The bench must be capable and should meet operational requirement of the below mentioned modules and accessories.</p> <ul style="list-style-type: none"> (a) Dead Weight Calibration Apparatus. (b) Flow over Weirs Apparatus. (c) Hydrostatic Pressure Apparatus. (d) Metacentric Height Calculation Apparatus. <p>Experimental Capabilities:- Ability to measure Surface tension, Capillarity, Buoyancy force, Hydrostatic pressure in liquids Total Pressure and Static Pressure</p>					
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		Density of liquids					
2 (a)	Dead Weight Calibration Apparatus.	Pressure manometer: Bourdon type. 0 – 3 bar. Set of masses of different weights. Piston diameter: 18-20 mm. Piston weight: 0.5 Kg"	2	No			
2 (b)	Flow over Weirs Apparatus	Scale of the level meter: 0 – 165 mm. Dimensions of the weirs: 170 x 240 x 40 mm. Neckline angle in the V-shape weir: 90°. Dimension of rectangular notch: 30 x 85 mm"	2	No			
2 (c)	Hydrostatic Pressure Apparatus.	Tank capacity: 5.5-6 L. Distance between suspended masses and the support point: 285 mm. Area of the section: 0.007-0.0010 m ² . Total depth of submerged quadrant: 165 mm Height of support point on the quadrant: 100 mm. Set of masses of different weights	2	No			
2 (d)	Metacentric Height	Maximum angle: +/- 13. Corresponding lineal dimension: +/- 90 mm. Dimension of the float: length = 353 mm, width = 204 mm, total height = 480 mm.	2	No			

3	Wind Tunnel with Accessories, Data Acquisition System and Mounting Models	<p>Test Section: 300mm * 300mm * 600 mm Flow velocity: 0 to 36 m/s (Minimum) Measurement of lift and drag. Lift $\pm 10\text{N}$, Drag $\pm 10\text{N}$.(Min) Boundary Layer and Wake Analysis Capability. Accessories:- Multi-Tube Manometer Angle Feedback Unit Differential Pressure Transducer 32-Way Pressure Display Unit Pitot-Static Traverse Fog or smoke Generator Data Acquisition System. Following models are to be included Sphere Drag Model Drag Model of Hemisphere Convex to Airflow Circular Plate Drag Model Square Plate Drag Model Cylinder Drag Model Streamlined Shape Drag Model Paraboloid Drag Model Drag Model of Hemisphere Concave to Airflow Wing with Flaps Drag Model Wing Model with NACA 0015 Profile Wing Model with NACA 54118 Profile</p>	1	No			
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		Wing Model with NACA 4415 Profile Dimpled Sphere Drag Model Set for Alternative Models Projects. Wake Survey Rake. Bernoulli Apparatus Model. Spring-mounted Wing Model. AIRBUS A-380 Airplane Model. F-16 Airplane Model. Force Measurement Interface and Sensors Model to Study the Boundary Layer in a Flat Plate. Accessory for Particle Image Velocimetry (PIV). Experimental Capability Lift and Drag calculation. Pressure Distribution Boundary Layer Analysis Wake Analysis.					
			TOTAL				

Total Value _____

GST _____

Gross Total Value _____

Bid Bond Ref _____

Firm Name _____ Signature _____ Name _____ Designation _____
