

राष्ट्रीय प्रौद्योगिकी संस्थान, मिजोरम  
NATIONAL INSTITUTE OF TECHNOLOGY, MIZORAM

(An Institute of National Importance under Ministry of HRD, Govt. of India)

CHALTLANG, AIZAWL: MIZORAM – 796012,

Phone No. 0389- 2341236/ 2341699

Fax: 0389-2341774

Web: www.nitmz.ac.in

Email: nit\_mizoram@nitmz.ac.in

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Ref. No.: NIT-MZ/TENDER/01-A/2014

Date: 29<sup>th</sup> January 2014

**NOTICE INVITING TENDER FOR SUPPLY & INSTALATION OF  
LABORATORY EQUIPMENTS FOR MECHANICAL ENGINEERING  
DEPARTMENT**

***Fluid Mechanic***

Last date for receiving Tender documents: **25<sup>th</sup> February 2014 before 3:00 PM**

Date/Time for Opening of Tech. Bids: **25<sup>th</sup> February 2014 at 3.30 PM**

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**Ref. No.: NIT-MZ/TENDER/02-A/2013**

**Date: 20<sup>th</sup> May 2013**

**NOTICE INVITING TENDER (NIT)**

National Institute of Technology-Mizoram is one of the ten new NITs established by Ministry of Human Recourse Development, Government of India, New Delhi in the year 2010 at Aizawl, Mizoram to impart education, training and research in Science, Technology and Management leading to award of B. Tech., M. Tech., MBA and Ph.D degrees. This institute is fully financed and governed by Ministry of Human Recourse Development, Government of India.

Sealed Tenders are invited from eligible Manufacturers/Developers or their Authorized Dealers for supply & Installation of Machines as per details at **ANNEXURE-IV, in Two Bids** to reach the undersigned on or before **25<sup>th</sup> February 2014 before 3:00 PM**. Date/Time for Opening of Tech. Bids: **25<sup>th</sup> February 2014 at 3.30 PM**. After evaluation of Technical Bids, Financial Bids of the successful bidders will be opened on later date which will be notified in the Institute website. Venue of bid opening: **NIT Mizoram, Aizawl**.

Sl. No.	Reference No.	Items	Qty	EMD (Rs.) in the form of DD only. (Refundable)	Tender Document Fee (Rs.) in the form of DD only. (Non-Refundable)
01.		<b>Supply &amp; Installation of Equipments for Fluid Mechanics Lab on turnkey basis to be installed at NIT, Mizoram, Aizawl</b>	<b>One Package</b>	<b>@2%</b>	<b>1,000.00</b>

**Note:** Demand Draft must be in favor of “**Director, NIT Mizoram**” Payable at **Aizawl**.

## **General Instructions for the Bidders:**

01. Quotations will have to be submitted in TWO Bids i.e. **Technical Bid and Financial Bid, in hard copy as well as in soft copy (soft copy must be in MS word 2007 provided in separate CDs for Technical Bid and Financial Bid). Both hard copy and soft copy of Technical Bid should be in one sealed envelope specifically mentioning “Technical Bid” on the cover of the envelope similarly for Financial Bid also, both hard copy and soft copy of must be in one sealed envelope specifically mentioning “Financial Bid” on the cover of the envelope.** Further these two sealed Bids must be kept inside one big sealed envelope before submitting it.

The address of the firm submitting the quotation and the Officer to whom the quotation is addressed must appear distinctly on sealed covers. Further, on sealed cover, the following are to be written:

QUOTATION FOR SUPPLY & INSTALLATION OF **“EQUIPMENT FOR FLUID MECHANIC LABORATORY OF MECHANICAL ENGINEERING DEPARTMENT AT NIT MIZORAM”**.

02. **Submission of Compliance Certificate:** Duly filled and signed Compliance Certificates (as per formats at **Annexure I (A & B)**) are must with the Technical bid.

03. **Bid not transferable:** The bid documents are not transferable and the seal and signature of the authorized official of the firm must appear on all the papers and envelopes submitted.

## **QUALIFICATION REQUIREMENTS**

01. The Bidder should be a Original Equipment Manufacturer (OEM) Or a firm of reputation having sufficient expertise and experience in the subject tender with sound warranty / service support capability and authorization from Manufacturer/Distributor.

02. **The Bidder has to Quote for all the items in the Fluid Mechanics Lab, Bidders who do not Quote for all the items are subject to be disqualified.**

## **TERMS & CONDITIONS:**

01. **Rates:** Rates quoted in the **Price Bid** should be **on DOOR DELIVERY NIT Mizoram basis**, as per details below:

<b>Sl. No.</b>	<b>Particulars</b>	<b>Rate</b>
I	Basic Price (per unit) including Packing, Forwarding, Freight, Insurance, Installation & demonstration charges inclusive	
II	Taxes(pl. give break up)	
III	Grand Total for the item on door delivery at NIT Mizoram	

Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.

02. **Validity of Quotation:** Quoted rates must be valid for **90 days** from the date of quotation.
03. **Warranty:** The quoted equipment and components must be warranted for a minimum of one Year or period specified against the item from date of Installation.
04. **Literature a must:** All the quotations must be supported by the printed technical leaflet/literature and the specifications mentioned in the quotation must be reflected/ supported by such printed technical leaflet/literature. The model and specifications quoted should **invariably be highlighted** in the leaflet/literature for easy reference.
05. **After Sales Service:** Vendors should clearly state the available nearest after sales service facilities in the region, without which their offers will be rejected.
06. **Dealership Certificate:** Dealers or Agents quoting on behalf of Manufacturer must enclose valid dealership certificate.
07. **Earnest Money Deposit:**

Refundable earnest money deposit (EMD) of @2% of the Quoted Value through demand draft drawn in favor of “The Director, National Institute of Technology Mizoram”, payable at Aizawl, will have to accompany the technical Bid. The EMD of unsuccessful bidders shall be returned after award of contract. EMD of the successful bidder will be released on submission of the Performance Guarantee. Offers received without Earnest Money or valid Certificate shall be summarily rejected.

08. **Performance Bank Guarantee (PBG):** In case of items with order value of Rupees five lakhs (INR 5,00,000/-) and above, the successful bidder shall furnish an unconditional PBG (as per format at **Annexure II**) for 5% of the Purchase Order value from a scheduled Bank of India, after receiving the purchase order. Where the PBG is obtained by a foreign bank, it shall be got confirmed by a Schedule Indian bank and shall be governed by Indian Laws and be subject to the jurisdiction of courts at Aizawl. The PBG shall guarantee that,

- (a) The Vendor guarantees satisfactory operation of the Equipment & components against poor workmanship, bad quality of materials used, faulty designs and poor performance.
- (b) The Vendor shall, at his own cost, rectify the defects/replace the items supplied, for defects identified during the period of guarantee.
- (c) This guarantee shall be operative from the date of installation till 60 days after the warranty period.

09. **Delivery:**

- a) **Time Limit:** Maximum within 12 Weeks from the date of issue of this purchase order.
  - b) **Safe Delivery:** All aspects of safe delivery shall be the exclusive responsibility of the vendor. At the destination site, the package will be opened only in the presence of NIT user/representative and vendor's representative. The intact condition of the package and the seal/indicators for not being tampered with shall form the basis for certifying the receipt in good condition.
  - c) **Insurance:** The supplier is to establish 'All Risk Transit Insurance' coverage till door delivery at NIT Mizoram.
  - d) **Part Delivery:** Acceptance of part delivery shall be a prerogative of the institute.
  - e) **Penalty for delay in delivery:** The date of delivery should be strictly adhered to otherwise the Director, NIT Mizoram reserves the right not to accept delivery in part or full.
10. **Genuine Pricing:** Vendor is to ensure that quoted price for the particular item is not more than the price quoted to any other customer in India, particularly to IITs/NITs and other Government Organization. Copy of the latest price list for the quoted item, applicable in India, must be enclosed with the offer.
11. **Conditional tenders not acceptable:** All the terms and conditions mentioned herein must be strictly adhered to by all the vendors. Conditional tenders shall not be accepted on any ground and shall be rejected straightway. Conditions mentioned in the tender bids submitted by vendors will not be binding on NIT Mizoram.
12. **Road Permit:** NIT, Mizoram will provide Road Permit to the Vendors of outside Mizoram.
13. **VAT deduction at source:** In case of supply within Mizoram, VAT deduction at source, as per Order/ notification of the Govt. of Mizoram will be applicable.
14. **Late and delayed tender:** Late and delayed tender will not be considered. In case any unscheduled holiday occurs on the prescribed closing/opening date the next working day shall be the prescribed date of closing/opening.

15. **Payment:** 100% payment within 30(Thirty) days after receipt of the material in full, satisfactory installation, training and acceptance.

16. **Payment for Imported Goods:** By an irrevocable letter of Credit at CIF/CIP Kolkata value negotiable through any overseas branch of State Bank of India/any Schedule Bank of India.

**Note:** Please note LoC will not be opened unless and until Letter of Acknowledgement in original is received at NIT, Aizawl, Mizoram, directly from the principal (Even in case of firms having subsidiary office in India).

### 17. ADDITIONAL TERM FOR IMPORTED GOODS

Following term besides the fore mentioned terms will be applicable in case of foreign purchases:

**Rates:** Prices quoted must be for destination including freight and insurance charges inclusive of free delivery up to the door of department/centre NIT, Mizoram premises, as per details below:

Sl. No.	Particulars	Rate
I	Basic Price (per unit) including Packing, Forwarding, Freight, Insurance, Installation & demonstration charges inclusive	
II	Custom Duty (Approximate)	
III	Grand Total for the item on door delivery at NIT Mizoram	

18. **Free Maintenance & Service for 20 Years:** An agreement is to be executed between the Institute & the **Manufacturer/Distributor/Dealer** for providing **Free Maintenance & Service for 20 Years** after expiry of the Warranty Period of the equipment by the Manufacturer/Distributor/Dealer (Preferably from the Manufacturer) within 30 Days from the day of Complain. The cost of the Spare parts required for the service and maintenance will be paid by the Institute along with the To & Fro charges (The cheapest mode of Travel).

18. **Enquiry during the course of evaluation not allowed:** No enquiry from the bidder(s) shall be entertained during the course of evaluation of the tender till final

decision is conveyed to the successful bidder(s). However, the Purchase Committee or its authorized representative may make enquiries/seek clarification from the bidders. In such a case, the bidder must extend full co-operation. The bidders may also be asked to arrange demonstration of the offered items, in a short period of notice.

19. The acceptance of the quotation will rest solely with the Director, NIT Mizoram, who in the interest of the Institute is not bound to accept the lowest quotation and reserves the right to himself to reject or partially accept any or all the quotations received without assigning any reasons.

**20. Force Majeure:**

If the performance of the obligation of either party is rendered commercially impossible by any of the events hereafter mentioned that party shall be under no obligation to perform the agreement under order after giving notice of 15 days from the date of such an event in writing to the other party, and the events referred to are as follows:

- i. Any law, statute or ordinance, order action or regulations of the Government of India,
- ii. Any kind of natural disaster, and
- iii. Strikes, acts of the Public enemy, war, insurrections, riots, lockouts, sabotage.

**21. Applicable Law:**

(a) The contract shall be governed by the laws and procedures established by Govt. of India and subject to exclusive jurisdiction of Competent Court and Forum in Aizawl only.

(b) Any dispute arising out of this purchase shall be referred to the Director NIT Mizoram, and if either of the parties hereto is dissatisfied with the decision, the dispute shall be referred to the decision of an Arbitrator to be appointed by the Director of the Institute. The decision of such Arbitrator shall be final and binding on both the parties.

22. **Training:** The vendor will provide free training at NIT Mizoram after Successful installation of the Machines/equipments.

**Sd/**

Encl.: **ANNEXURE-I, ANNEXURE-II, ANNEXURE-III & ANNEXURE-IV**

**A. COMPLIANCE CERTIFICATE FOR NIT TERMS**  
**(To be enclosed in the Technical bid)**

<b>Sl. No.</b>	<b>NIT Terms and Conditions</b>	<b>Yes/No</b>
01	<b>Rate</b> quoted as per instruction	
02	<b>AMC rate</b> after warranty provided	
03	<b>Validity</b> of quoted rate for 90 days agreed	
04	<b>EMD</b> submitted (appropriate certificate enclosed)	
05	<b>PBG</b> term agreed	
06	<b>Payment</b> term agreed	
07	<b>Delivery terms</b> agreed	
08	<b>Warranty period</b> agreed	
09	<b>Literature:</b> Printed Literature provided	
10	<b>Dealership</b> / distributorship certificate (in case of dealers/agents) provided	
11	<b>Sales Service:</b> address of after Sales Service centre in India (for imported goods)/ in the region provided	
12	<b>Manufacturer</b> certificate provided	
14	<b>Applicable law</b> terms agreed	

Signature with Seal:.....

Vendor: M/s.....



**B. COMPLIANCE CERTIFICATE FOR SPECIFICATIONS**  
**(One for each item must to be enclosed in the Technical bid)**

Item Sl. No.			
Specifications as per Annexure-IV		Quoted Item Specs.*	Complied (Yes/No)
Parameter	Specification		

Signature with Seal:.....

Vendor: M/s.....

**\* Vendor must quote the parameter specification of the quoted product in this column and not just copy the specification from the tender call document. Failure to do so will lead to rejection of the tender.**

**PERFORMANCE BANK GUARANTEE**

To:

**The Director  
National Institute of Technology Mizoram**

**WHEREAS**..... (Name of Supplier)

Hereinafter called "the Supplier" has undertaken, in pursuance of Contract No..... dated ..... 20... to supply.....  
..... (Description of Goods and Services) hereinafter called "the order".

**AND WHEREAS** it has been stipulated by you in the said order that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with the Supplier's performance obligations in accordance with the order.

**AND WHEREAS** we have agreed to give the Supplier a Guarantee:

**THEREFORE WE** hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of.....  
..... (Amount of the Guarantee in Words and Figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the order and without cavil or argument, any sum or sums within the limit of ..... (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the .....day of.....20.....

Signature and Seal of Guarantors

.....

Date.....20....

Address:.....

.....

All correspondence with reference to this guarantee shall be made at the following address: **National Institute of Technology Mizoram, Chaltlang, Aizawl, Mizoram, India: 796012**

**MANUFACTURERS' AUTHORIZATION FORM**

No.

Dated \_\_\_\_\_

**The Director  
National Institute of Technology  
Aizawl-796012, Mizoram**

Dear Sir:

We..... who are established and reputable manufacturers of .....having factories at-----  
(address of factory) do hereby certify that .....(Name of the Authorized Dealer)is our authorized dealer to quote against your tender enquiry no ..... **,Last Date of Submission is:**

No other Company other than .....  
(Name of the Authorized Dealer) is authorized to quote of our products against this Tender Enquiry No.....

Yours faithfully,

(Name)

(Name of manufacturers)

**TECHNICAL SPECIFICATION FOR FLUID MECHANICS LABORATORY**

<b>SL NO.</b>	<b>TECHNICAL SPECIFICATION</b>	<b>QTY</b>
1.	<p><b>BERNOULLI'S THEOREM APPARATUS</b></p> <ol style="list-style-type: none"> <li>1. Test Section : Material Acrylic (One Piece).</li> <li>2. Piezometer Tubes : Material P.U. Tubes (7 Nos.)</li> <li>3. Water Circulation : FHP Pump, Crompton/godrej/G.E. make.</li> <li>4. Flow Measurement : Using Measuring Tank with Piezometer, Capacity 25 Ltrs.</li> <li>5. Sump Tank : Capacity 70 Ltrs.</li> <li>6. Inlet Tank : Capacity 20 Ltrs.</li> <li>7. Stop Watch : Electronic.</li> <li>8. Control Panel Comprises of: Standard make On/Off Switch, Mains Indicator, etc.</li> <li>9. Tanks should be made of Stainless Steel.</li> <li>10. The whole set-up should be well designed and arranged in a good quality painted structure</li> <li>11. The equipment should be designed and fabricated to demonstrate the Bernoulli's theorem.</li> <li>12. It should consists of a test section made of acrylic.</li> <li>13. It should have convergent and divergent sections.</li> <li>14. Pressure tapings should be provided at different locations in convergent and divergent section.</li> <li>15. The Equipment should be self-contained water re-circulating unit, and should be provided with a sump tank, centrifugal pump etc.</li> <li>16. An arrangement should be done to conduct the experiment on different flow rates.</li> <li>17. Flow rate of water should be measured with the help of measuring tank and stopwatch.</li> <li>18. It should have the scope to verify Bernoulli's Theorem experimentally.</li> <li>19. It should have the scope to plot the Total energy Vs distance.</li> </ol>	01(One)  No
2.	<p><b>LOSSES DUE TO FRICTION IN PIPE LINES APPARATUS</b></p> <ol style="list-style-type: none"> <li>1. Pipe Test Section : <ol style="list-style-type: none"> <li>(i) Dia ½", Length : 1m, Material G.I.</li> <li>(ii) Dia ¾", Length : 1.25m, Material G.I.</li> </ol> </li> <li>2. Water Circulation : FHP Pump, Crompton/godrej/G.E make.</li> <li>3. Flow Measurement : Using Measuring Tank with Piezometer, Capacity 25 Ltrs.</li> <li>4. Sump Tank : Capacity 50 Ltrs.</li> <li>5. Stop Watch : Electronic.</li> <li>6. Control Panel Comprises of : Standard make On/Off Switch, Mains Indicator, etc.</li> </ol>	01(One)  No

	<ol style="list-style-type: none"> <li>7. Tanks will be made of Stainless Steel.</li> <li>8. The whole set-up should be well designed and arranged in a good quality painted structure.</li> <li>9. The equipment should consist of 2 pipes of different diameters, which should be connected in parallel.</li> <li>10. Pressure tapings should be provided on each pipe to measure the pressure losses with the help of a Differential Manometer.</li> <li>11. Control valves should be fitted on each pipe, which enables to use one pipe at a time for experiment.</li> <li>12. The equipment should be self-contained water re-circulating unit, provided with a sump tank and a centrifugal pump etc.</li> <li>13. Flow control valve and by-pass valve should be fitted in water line to conduct the experiment on different flow rates.</li> <li>14. Flow rate of water should be measured with the help of measuring tank and stop watch .</li> <li>15. It should have the scope to determine the losses due to friction in pipes.</li> <li>16. It should have the scope to determine the friction factor for Darcy Weisback equation.</li> </ol>	
3.	<p><b>CENTRE OF PRESSURE APPARATUS:</b></p> <ol style="list-style-type: none"> <li>1. Tank capacity : 5 litres (approx).</li> <li>2. Distance between suspended mass and fulcrum : 275mm (approx)</li> <li>3. Cross-sectional area of quadrant : 100 x 100 mm<sup>2</sup></li> <li>4. Total depth of completely immersed quadrant : 160mm (approx)</li> <li>5. Height of fulcrum above quadrant : 100mm (approx)</li> <li>6. The Hydrostatic Pressure apparatus should determine the static thrust exerted by a fluid on a submerged surface and allow comparison of the measured magnitude and position of this force with simple theory.</li> <li>7. A fabricated quadrant should be mounted on a balance arm, which pivots on knife-edges.</li> <li>8. The knife-edges should coincide with the centre of arc of the quadrant. Thus, of the hydrostatic forces acting on the quadrant when immersed, only the force on the rectangular end face gives rise to a moment about the knife-edges.</li> <li>9. The balance arm should incorporate a balance pan for the weights supplied and an adjustable counterbalance.</li> <li>10. This assembly should be mounted on top of an acrylic tank.</li> <li>11. Correct alignment should be indicated on a circular spirit level.</li> <li>12. Water should be admitted to the top of the tank and may be drained through a cock in the side of the tank.</li> <li>13. The water level should be indicated on a scale on the side of the quadrant.</li> <li>14. It should have the scope to determine the centre of pressure on both a submerged or partially submerged plane surface and comparison with the theoretical position.</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>
4.	<p><b>REYNOLD'S APPARATUS</b></p> <ol style="list-style-type: none"> <li>1. Tube : Material Borosilicate Glass</li> <li>2. Dye vessel : Material Stainless Steel, Suitable Capacity</li> <li>3. Capillary Tube : Material Copper/Stainless Steel.</li> <li>4. Constant Head Water Tank: Capacity 40 Ltrs.</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<ol style="list-style-type: none"> <li>5. Water Circulation : FHP Pump, Champion/ godrej make.</li> <li>6. Flow Measurement : Using Measuring Cylinder.</li> <li>7. Sump Tank : Capacity 60 Ltrs.</li> <li>8. Stop Watch : Electronic.</li> <li>9. Control Panel Comprises of :Standard make On/Off Switch, Mains Indicator, etc.</li> <li>10. Tanks will be made of Stainless Steel.</li> <li>11. The whole set-up should be well designed and arranged in a good quality painted structure.</li> <li>12. The equipment should consist of a glass tube with one end having bell mouth entrance; connected to a constant head water tank, at the other end a valve should be provided to vary the flow rate.</li> <li>13. The tank should be of sufficient capacity to store water.</li> <li>14. A capillary tube should be introduced centrally in the bell mouth for feeding dye from a small container placed at the top of tank, through polythene tubing.</li> <li>15. By varying the rate of flow, the Reynold's number should be changed. This also changes the type of flow.</li> <li>16. Visual observation of dye (Thread) should indicate the type of flow, which can be confirmed from the Reynold's number computed.</li> <li>17. The equipment should be self-contained water re-circulating unit, provided with a sump tank and a centrifugal pump etc.</li> <li>18. The flow control valve and by-pass valve should be fitted in water line.</li> <li>19. The flow rate of water should be measured with the help of measuring cylinder and stop watch:</li> <li>20. It should have the scope to determine the Reynold's number and hence the type of flow either laminar or turbulent.</li> <li>21. It should have the scope to study transition zone.</li> </ol>	
5.	<p><b>SUPERSONIC WIND TUNNEL</b></p> <ol style="list-style-type: none"> <li>1. Positive displacement fan, variable speed <ol style="list-style-type: none"> <li>a. sound-dampened, max. 84dB(A)</li> <li>b. power consumption:55kW</li> </ol> </li> <li>2. Cross section of the measurement section: <ol style="list-style-type: none"> <li>a. 100x25mm</li> </ol> </li> <li>3. Interchangeable walls for measuring section <ol style="list-style-type: none"> <li>a. 1x straight contour:Ma&lt;1</li> <li>b. 2x Laval contour: Ma 1.4 and Ma 1.8</li> </ol> </li> <li>4. Schlieren optics <ol style="list-style-type: none"> <li>a. halogen lamp with 50 and 100W.</li> <li>b. 2 adjustable parabolic mirrors.</li> <li>c. adjustable slit diaphragm</li> <li>d. screen for Schlieren optics</li> </ol> </li> <li>5. It should have drag bodies. <ol style="list-style-type: none"> <li>a. wedge, double wedge, projectile, rocket</li> <li>b. Along with Desktop PC equipped with Processor Intel i7.</li> </ol> </li> <li>6. The supersonic wind tunnel should be an "Eiffel" type open wind tunnel used to study the aerodynamic properties of various drag bodies at subsonic and supersonic flow.</li> <li>7. A fan sucks air from the environment through the supersonic wind tunnel.</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<p>There should be a subsonic nozzle located at the air inlet, in which the intake air accelerates.</p> <ol style="list-style-type: none"> <li>8. The contour of the subsonic nozzle with integrated flow straightener ensures a uniform velocity distribution with little turbulence in the subsequent measurement section.</li> <li>9. In the closed measurement section, the air is accelerated further down the supersonic wind tunnel, the air flow is slowed down in supersonic and subsonic diffusers and comes through a suction filter into the fan.</li> <li>10. The air is compressed and then emitted back into the environment.</li> <li>11. A sound damper at the air outlet limits the sound level.</li> <li>12. Interchangeable wall with different contours are used in the measurement section to generate flow velocities up to Mach 1.8.</li> <li>13. The Schlieren optics should be supplied with wind tunnel to allow direct observation of the supersonic flow and the resulting shock fronts.</li> <li>14. Pressures should be detected with the sensors, transmitted directly to a PC via USB and analysed there using the software supplied.</li> <li>15. Additionally, the pressure is displayed on a manometer at the measuring point.</li> <li>16. The continuous method of operation should mean there is enough time available for observation and taking measurements.</li> <li>17. Investigation of pressure curves in supersonic flow.</li> <li>18. Visualisation of Mach lines and shock waves using Schlieren optics.</li> <li>19. Continuously operating, open supersonic wind tunnel, low pressure principle.</li> <li>20. Interchangeable walls in the measurement section for velocities up to Mach 1.8</li> <li>21. Positive displacement fan with variable speed</li> <li>22. Interchangeable walls in the measurement section produce velocities up to Mach 1.8.</li> <li>23. Drag bodies: rocket, projectile, double wedge and wedge</li> <li>24. .Manometer for displaying the pressure in the measurement point</li> <li>25. Software(Licensed Free)for data acquisition(Pressure measurement) via USB under Windows Vista or Windows 7</li> <li>26. It should have the scope to determine the pressure curves in supersonic nozzles(Laval nozzle)</li> <li>27. It should have the scope to determine the pressure curves and losses in tunnel flows with Mach&gt;1</li> <li>28. It should have the scope to observe shock waves in drag bodies using Schlieren optics</li> <li>29. It should have the scope to determine the Mach number from the angle of the shock waves</li> <li>30. It should have the scope to for comparison of theory and experiment. PC with i7 processor, at least 2GB RAM with latest windows operating system and 17" LCD Monitor, along with Laser Printer &amp; UPS.</li> </ol>	
6.	<p><b>Subsonic Wind Tunnel</b></p> <p><b>Technical Specifications:</b></p> <p>1.Measuring section:</p> <p style="padding-left: 40px;">A. flow cross section WxH: 292x292mm</p>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<p>B. length: 420mm C. wind velocity: 3,1...28m/s</p> <p>2.Axial fan - power consumption: 2,55Kw</p> <p>3.Measuring ranges</p> <p style="padding-left: 40px;">A. force: 2x -5...5N</p> <p style="padding-left: 40px;">B. pressure: 0...5mbar</p> <p>4.Experiments from the field of aerodynamics and fluid mechanics with an "Eiffel" type wind tunnel</p> <p>5.Wide range of accessories should be available</p> <p>6.Transparent, closed measuring section</p> <p>7.Inlet contour, nozzle and diffuser made of GRP</p> <p>8.Variable-speed fan motor for energy-efficient operation</p> <p>9.Flow straightener reduces turbulence</p> <p>10.Electronic two-component force sensor for measuring the flow forces</p> <p>11.Inclined tube manometer for displaying the air velocity</p> <p>12.Digital display of drag and lift Display of measured values for pressure, displacement/angle, velocity and</p> <p>13.This apparatus should be used to demonstrate and measure the aerodynamic properties of various models. For this purpose, air should be drawn in from the environment and accelerated.</p> <p>14.The air flows around a model, such as an aerofoil, in a measuring section. The air should then decelerated in a diffuser and pumped back into the open by a fan.</p> <p>15.The carefully designed nozzle contour and a flow straightener should ensure a uniform velocity distribution with little turbulence in the closed measuring section.</p> <p>16.The flow cross section of the measuring section should be square. The built-in axial fan with guide vane and a variable-speed drive should have characterized by an energy-efficient operation at high efficiency. Air velocities of up to 28m/s could be reached in this wind tunnel.</p> <p>17.The trainer should equip with an electronic two-component force sensor. Lift and drag should detect and displayed digitally. The air velocity in the measuring section should display on the inclined tube manometer.</p> <p>18.The tube manometers should be recommended for measuring the pressure curves</p>	
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	<p>in drag bodies.</p> <ol style="list-style-type: none"> <li>1. Accessories to Work along with the Subsonic Wind Tunnel(1 Set):</li> <li>2. Drag Model "Sphere"</li> <li>3. Drag Model "Hemisphere"</li> <li>4. Drag Model "Circular Disc"</li> <li>5. Drag Model "Circular Ring"</li> <li>6. Drag Model "Square Plate"</li> <li>7. Drag Model "Paraboloid"</li> <li>8. Drag Model "Cylinder"</li> <li>9. Drag Model "Streamlined Shape"</li> <li>10. Drag Model "Aero Foil with slat and slot"</li> <li>11. Drag Model "Concave Shape"</li> <li>12. Pressure distribution on aerofoil</li> <li>13. PC Data Acquisition System</li> <li>14. Multi Tube Manometer Panel/600 mm</li> <li>15. Electronic Pressure Measurement</li> <li>16. Pressure distribution on Cylinder</li> <li>17. Boundary Layer Plate with Probe</li> <li>18. Bernouill's Equation</li> <li>19. Pitotstatic Tube</li> <li>20. Electronic Displacement Management</li> <li>21. Fog Generator</li> <li>22. Three-Component Force Sensor</li> <li>23. Desktop Computer: Intel Corei3 Processor, 2 GB RAM with Windows WP Operating system, 17" LCD Monitor , Make: HP/LENOVO along with Laser Printer &amp; UPS</li> </ol>	
7.	<p><b>WIND TUNNEL FOR FLOW VISUALISATION OF STREAMLINES</b></p> <ol style="list-style-type: none"> <li>1. Experimental section <ol style="list-style-type: none"> <li>a. transparent area:252x252mm</li> <li>b. cross section: 252x42mm</li> <li>c. Aerofoil pivotable by 360<sup>0</sup></li> </ol> </li> <li>2. Models <ol style="list-style-type: none"> <li>a. cylinder: diameter: 60mm,height:24.5mm</li> <li>b. aerofoil: 15x24,5x100mm</li> <li>c. orifice plate: 2x25x24.5,5x10mm</li> </ol> </li> <li>3. Orifice opening: 10mm</li> <li>4. It should have Radial fan <ol style="list-style-type: none"> <li>a. Max. Air flow : 480m<sup>3</sup>/h</li> <li>b. Max. Pressure level: 300Pa</li> </ol> </li> <li>5. Fog generator <ol style="list-style-type: none"> <li>a. power consumption:700W</li> </ol> </li> <li>6. Along with a Digital Video Camera with a Stand.</li> <li>7. Visualisation of streamlines flowing around and through different models</li> <li>8. Open wind tunnel with radial fan and a fog generator.</li> <li>9. Operation with non-toxic and water -soluble fog fluid.</li> <li>10. Illuminated experimental section with sight window and background.</li> <li>11. Low-turbulence flow through stabilisation chamber with flow straightener</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<p>12. Distributor with nozzles for injecting the fog</p> <p>13. Four different models, angle of attack at aerofoil and guide vane adjustable</p> <p>14. Scale for displaying the angle of attack.</p> <p>15. Streamlines should be visualised in steady flow in the wind tunnel by using fog, smoke or tufts. In this way, a clear impression of an instantaneous flow field should be taught and problematic flow areas, such as stall, can be shown.</p> <p>16. The experimental unit wind tunnel for flow visualisation of streamlines should be an open wind tunnel, flow separation and turbulence should be made visible by using fog.</p> <p>17. The evaporated fog fluid should be non-toxic, water soluble and the precipitate should not affect common materials. Precipitates should be easily wiped off with the cloth.</p> <p>18. There should be a fan for air flow. To achieve a low-turbulence flow, the air should flow through a stabilization chamber with a flow straightener.</p> <p>19. Fog should be added to the flowing air through several nozzles.</p> <p>20. The air should flow around or through model in a experimental section and the flow field should become visible.</p> <p>21. The experimental section should have a black background and a sight window and additional lighting to make the streamlines clearly visible.</p> <p>22. Four interchangeable models(cylinder, orifice plate, aerofoil and guide vane) must be included. The aerofoil's angle of attack should be adjustable.:</p> <p>23. For visualisation of streamlines</p> <p>24. For visualisation of flow around or through differently shaped models</p> <p>25. For visualisation of flow separation and turbulence.</p> <p>26. It should have the scope to stall as a function of the angle of attack.</p>	
8.	<p><b>FLOW THROUGH ORIFICE &amp; MOUTHPIECE APPARATUS</b></p> <p>1. Set of Orifices : Material Acrylic (2 Nos.) a. Dia. 10mm and 15 mm</p> <p>2. Set of Mouthpieces : Material Acrylic (3 Nos.) a. Dia 10 mm (L/D = 1) b. Dia 10 mm (L/D = 2.5) c. Dia 10 mm (L/D = 4)</p> <p>3. Constant Head tank : 35 Ltrs.</p> <p>4. Hook/Pointer Gauge : To measure X-Y co-ordinates of Jet.</p> <p>5. Water Circulation : FHP Pump, Crompton/godrej/G.E. make.</p> <p>6. Flow Measurement : Using Measuring Tank with Piezometer, Capacity 25 Ltrs.</p> <p>7. Sump Tank : Capacity 70 Ltrs.</p> <p>8. Stop Watch : Electronic.</p> <p>9. Control Panel Comprises of :Standard make On/Off Switch, Mains Indicator, etc.</p> <p>10. Tanks should be made of Stainless Steel.</p> <p>11. The whole set-up should be well designed and arranged in a good quality painted structure.</p> <p>12. The equipment should consist of a tank provided with inlet supply diffuser, overflow, outlet, Provision for fitting Orifice or Mouthpiece at the outlet of tank should be provided.</p> <p>13. An arrangement should be done to vary head and keep it constant at desired</p>	01(One)  No

	<p>level.</p> <p><b>14.</b> A Hook/pointer gauge arrangement for measuring X-Y co-ordinates of Jet should also fitted.</p> <p><b>15.</b> The equipment should be self-contained water re-circulating unit, provided with a sump tank and a centrifugal pump etc.</p> <p><b>16.</b> Flow rate of water should be measured with the help of measuring tank and stop watch.:</p> <p><b>17.</b> It should have the scope to determine the co-efficient of discharge of different Orifice and mouthpieces.</p> <p><b>18.</b> It should have the scope to determine the co-efficient of velocity</p>	
<b>9.</b>	<p><b>METACENTRIC HEIGHT APPARATUS</b></p> <p><b>1.</b> Pontoon : Size 300 x 300 mm (approx.) with a Horizontal Guide Bar for aliening weight and Removable Strips, Graduated Arc with Pointer with moveable hanger and set of weights.</p> <p><b>2.</b> Water Tank : Size 600 x 450x 400 mm (approx.)</p> <p><b>3.</b> Front Window of Tank : Made of Glass/Perspex.</p> <p><b>4.</b> A set of weights should be supplied with the apparatus.</p> <p><b>5.</b> Tanks should be made of Stainless Steel.</p> <p><b>6.</b> Pendulum and graduated are for accurate measurement of Tilt angle.</p> <p><b>7.</b> The pontoon should be allowed to float in a small tank having a transparent side</p> <p><b>8.</b> Removable steel strips placed in the model for the purpose of changing the weight of the model.</p> <p><b>9.</b> Displacement of weight should be measured with the help of a scale. By means of a pendulum (consisting of a weight suspended to a long pointer) the angle of tilt could be measured on a graduated arc.</p> <p><b>10.</b> For tilting the ship model, a cross bar with two movable hangers should be fixed on the model.</p> <p><b>11.</b> Pendulum and graduated arc should suitably fixed at the center of the cross bar.</p> <p><b>12.</b> Set of weights should be supplied with the apparatus</p> <p><b>13.</b> It should have the scope for determination of the metacentric height and position of the metacentric height with angle of heel of ship model.</p>	<p><b>01(One)</b></p> <p><b>No</b></p>
<b>10.</b>	<p><b>VENTURIMETER &amp; ORIFICEMETER APPARATUS</b></p> <p><b>1.</b> Venturimeter : Material Clear Acrylic compatible to 1" Dia. Pipe.</p> <p><b>2.</b> Orificemeter : Orifice plate made of Stainless Steel and housing made of Clear</p> <p><b>3.</b> Water Circulation : FHP Pump, Crompton make</p> <p><b>4.</b> Pressure Measurement : By Using Differential Pressure Transmitter</p> <p><b>5.</b> Flow Measurement : By Using Flow Sensor</p> <p><b>6.</b> Sump Tank : Material Stainless Steel, suitable capacity</p> <p><b>7.</b> Tanks will be made of Stainless Steel .</p> <p><b>8.</b> The whole set-up should be well designed and arranged in a good quality PU painted structure.</p> <p><b>9.</b> The apparatus should consist of two pipelines emerging out from a common manifold. One pipe line should contain a Venturimeter and other contains an Orifice.</p> <p><b>10.</b> The Venturimeter and Orificemeter should be connected in parallel and any</p>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<p>one of them could be put in operation by operating valves provided at the downstream.</p> <ol style="list-style-type: none"> <li>11. The flow should also be regulated by these valves.</li> <li>12. The equipment should be self-contained water re-circulating unit, and should be provided with a sump tank and a centrifugal pump etc.</li> <li>13. Flow control valve and by-pass valve should be fitted in water line to conduct the experiment on different flow rates.</li> <li>14. Flow rate of water should be measured with the help of flow sensor and pressure should be measured with the help of pressure sensor</li> <li>15. It should have the scope demonstrate the use of Venturimeter &amp; Orificemeter as flow meters</li> <li>16. It should have the scope determine co-efficient of discharge of Venturimeter and Orificemeter</li> </ol>	
11.	<p><b>FORCED VORTEX APPARATUS:</b></p> <ol style="list-style-type: none"> <li>1. Cylinder : Material Acrylic. Dia. 200 mm (approx.)</li> <li>2. Height : 200mm approx.</li> <li>3. Motor : Variable Speed, DC Motor, Compatible capacity.</li> <li>4. Control Panel Comprises of : Speed Control Unit, Standard make On/Off Switch, Mains Indicator, etc.</li> <li>5. The whole set-up should be well designed and arranged in a good quality painted structure.</li> <li>6. The experimental set up should consist of a circular transparent cylindrical tank in which plate is rotated with the help of a variable speed motor so that the cylinder rotates about its vertical axis with the help of a V belt and forced vortex is formed.</li> <li>7. An upper probe should be transverse horizontally &amp; vertically across full diameter of the vessel so that water surface profile can be measure.</li> <li>8. Both axes should contain graduations so that exact position of the probe is known.</li> <li>9. The experimental procedure should involve measurement of the resulting free surface that represents the variation of the sum of the pressure head and datum head.</li> <li>10. An arrangement should be provided to drain the vessel.</li> <li>11. It should have the scope to plot the surface profile of a forced vortex by measurement of the surface profile coordinates and to show that total energy is constant throughout vortex.</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>
12.	<p><b>FREE VORTEX APPARATUS</b></p> <ol style="list-style-type: none"> <li>1. Cylinder : Material Acrylic. Dia. 200 mm (approx.)</li> <li>2. Height : 200mm approx</li> <li>3. Water Circulation : FHP Pump, Crompton/ godrej/G.E. make.</li> <li>4. Flow Measurement : Using Rotameter.</li> <li>5. Sump Tank : Made of Stainless Steel, Compatible capacity.</li> <li>6. Control Panel Comprises of: Standard make On/Off Switch, Mains Indicator, etc.</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<ol style="list-style-type: none"> <li>7. The whole set-up should be well designed and arranged in a good quality painted structure.</li> <li>8. The experimental set up should consist of a circular transparent cylindrical tank in which four circumferential jets should be placed along the circumference of the cylinder near its bottom which helps in the formation of free vortex.</li> <li>9. An upper prove should be transverse horizontally &amp; vertically across full diameter of the vessel so that water surface profile can be measure.</li> <li>10. Both axes should contain graduations so that exact position of the prove is known. The experimental procedure should involve measurement of the resulting free surface that represents the variation of the sum of the pressure head and datum head.</li> <li>11. An arrangement should be provided to drain the vessel.</li> <li>12. It should have the scope to plot the surface profile of a free vortex by measurement of the surface profile coordinates and to show that total energy is constant throughout vortex.</li> </ol>	
13.	<p><b>FULLY AUTOMATIC DIGITAL TOUCH SCREEN VISCOMETER</b></p> <ol style="list-style-type: none"> <li>1. It should have 5-inch Full Color</li> <li>2. It should have Touch Screen Display <ol style="list-style-type: none"> <li>a. New User Interface</li> <li>b. Enhanced Controls</li> <li>c. Real Time Trend Indicator</li> <li>d. Supports Multiple Languages</li> </ol> </li> <li>3. It should have Displayed Info: <ol style="list-style-type: none"> <li>a. Viscosity (cPa•s)</li> <li>b. Temperature (°C or °F)</li> <li>c. Shear Rate/Stress</li> <li>d. % Torque</li> <li>e. Speed/Spindle</li> <li>f. Step Program Status</li> </ol> </li> <li>4. It should have Enhanced Security <ol style="list-style-type: none"> <li>a. Customizable User Access</li> <li>b. Date and Time Stamp File</li> <li>c. Password Access</li> <li>d. Portable Log-in Settings</li> </ol> </li> <li>5. It should have built-in Options <ol style="list-style-type: none"> <li>a. Timed Tests</li> <li>b. Data Averaging</li> <li>c. Programmable QC Limits/Alarms</li> <li>d. Customizable Speed/Spindle Lists</li> <li>e. Test Based User Instructions</li> <li>f. On Screen Data Comparison</li> </ol> </li> <li>6. It Should have auto Range Showing <ol style="list-style-type: none"> <li>a. Maximum viscosity measured with</li> <li>b. Spindle/Speed combination</li> </ol> </li> <li>7. USB PC Interface <ol style="list-style-type: none"> <li>a. provides optional</li> <li>b. computer control and automatic</li> <li>c. data gathering capability</li> </ol> </li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

	<p>8. Convenient Bubble Level</p> <p>9. Download custom test programs with PG Flash Software (included with instrument)</p> <p>10. Accuracy: <math>\pm 1.0\%</math> of range, Displayed with test data</p> <p>11. Repeatability: <math>\pm 0.2\%</math></p> <p>12. Built-in RTD Temperature Probe</p> <p>13. Its accessories :</p> <ol style="list-style-type: none"> <li>It Should have 6 spindles (RV/HA/HB)</li> <li>The equipment should have PG Flash Software.</li> <li>It Should have RTD Temperature Probe</li> <li>It should have Spindle Guard Leg*</li> <li>The equipment should have Lab Stand .</li> <li>It should have convenience Pack (USB Flash Drive, Stylus, Cleaning Cloth)</li> <li>It should have carrying Case.</li> </ol> <p>14. Software Details: ( LICENSED FREE)</p> <ol style="list-style-type: none"> <li>PG Flash Software should be included</li> <li>PROGRAM GENERATOR SOFTWARE FOR CUSTOMIZING</li> <li>TEST CRITERIA FOR ROUTINE PRODUCT QC</li> <li>This exclusive Brookfield software allows you to create repeatable custom tests on your PC! Once the program (up to 25 steps) is created, it can be downloaded to supple USB flash drive and then uploaded to any DV2T Viscometer.</li> <li>PG Flash allows users to create repeatable custom tests with all of the built-in options on the DV2T plus the addition of multiple program lines (up to 25 steps).</li> <li>Create the program on the PC and download to a USB Flash Drive. Upload the program from the USB Flash Drive to the DV2T. Along with Desktop PC equipped with Intel i3 processor along with laser printer and UPS.</li> </ol>	
14.	<p><b>FLOWBENCH ALONG WITH ACCESSORIES</b></p> <ol style="list-style-type: none"> <li>The equipment should be designed for High pressure Flow Testing</li> <li>It should intake and exhaust flow capability.</li> <li>It should have Maximum Flow – 1200 CFM</li> <li>It should have 540 CFM @50"</li> <li>The equipment should maximum Test Pressure of 65" of water.</li> <li>It should have the following accessories: <ol style="list-style-type: none"> <li>Automatic Valve actuator and standard actuator adaptor -2Nos.</li> <li>Swirl Meter- 2 Nos</li> <li>V8 cylinder Head adapters.</li> <li>Metric cylinder Head adapters.</li> <li>Aluminium flow test stand.</li> <li>Flowbench gasket.</li> <li>Aluminium bore cylinder</li> <li>Adjustable Aluminum Bore Cylinders</li> <li>Adjustable Slider Plate SBC</li> <li>Adjustable Slider Plate SBF</li> <li>Adjustable Slider Plate BBC</li> <li>Adjustable Slider Plate BBC Gen V &amp; VI</li> </ol> </li> </ol>	<p>01(One)</p> <p>No</p>

	<ul style="list-style-type: none"> <li>m. Adjustable Slider Plate BBC</li> <li>n. Adjustable Slider Plate Custom</li> <li>o. Single Adjustable Slider Plate Insert 4 Nos</li> <li>p. Flow Stand Slider, SBC &amp; LS1 Combo Slider, LS1, Nextel Cup Slider</li> <li>q. Flow Stand Sliders, Small Block Ford</li> <li>r. Flow Stand Sliders, Big Block Chevy</li> <li>s. Slider Head Gaskets</li> <li>t. Radius Inlet Flow Guides</li> <li>u. Radius Inlet Flow Guides</li> <li>v. Universal Valve Opening Bar</li> <li>w. Flow Testing Springs</li> <li>x. Dial Indicator</li> <li>y. Carburetor Test Kit SF-1020 &amp; SF-1200</li> <li>z. Standard Pitot Tubes</li> <li>aa. WinDyn For Flowbenches</li> <li>ab. Along with Desktop PC equipped with Processor Intel i3 along with Laser Printer &amp; UPS</li> </ul>	
15.	<p><b>THERMAL ANEMOMETER WITH FIXED VELOCITY PROBE</b></p> <ol style="list-style-type: none"> <li>1. The equipment could measure the flow of velocity, volume flow and temperature.</li> <li>2. It could point and timed mean value calculation, Max./min. values</li> <li>3. It could hold button for freezing measurement value</li> <li>4. Display illumination</li> <li>5. Auto-off function</li> <li>6. It should have Velocity: <ul style="list-style-type: none"> <li>a. Measuring Range: 0 to +20 m/s</li> <li>b. Accuracy (<math>\pm 1</math> digit): <math>\pm(0.03 \text{ m/s} + 5\% \text{ of mv})</math></li> <li>c. Resolution : 0.01 m/s</li> </ul> </li> <li>7. The equipment should have temperature: <ul style="list-style-type: none"> <li>a. Measuring Range: -20 to +70 °C</li> <li>b. Accuracy (<math>\pm 1</math> digit): <math>\pm 0.5 \text{ °C}</math> (0 to +60 °C), <math>\pm 0.7 \text{ °C}</math> (remaining range)</li> </ul> </li> <li>8. The equipment should have resolution : 0.1 °C</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>
16.	<p><b>Hot Wire CFM Thermo-Anemometer</b></p> <ol style="list-style-type: none"> <li>1. Air Velocity/Air Flow meter with telescoping probe designed to fit into HVAC ducts and other small openings</li> <li>2. Telescoping probe extends up to 7.05ft (215cm) maximum length with cable</li> <li>3. Adjustable data sampling rate</li> <li>4. Stores 99 readings manually and 20M readings via 2G SD card</li> <li>5. Type K/J Thermocouple input for high temperature measurements</li> <li>6. Large (9999 count) LCD displays Air Velocity or Air Flow and Temperature simultaneously</li> <li>7. Record/Recall MIN, MAX, Data Hold and Auto power off</li> <li>8. Built-in PC interface</li> <li>9. Complete with 6 x AA batteries, SD card, telescoping probe with cable, and hard carrying case</li> </ol>	<p><b>01(One)</b></p> <p><b>No</b></p>

