

**ADMINISTRATION OF UT OF DNH & DAMAN & DIU  
OFFICE OF THE PRINCIPAL,  
GOVERNMENT ENGINEERING COLLEGE,  
VARKUND, NANI-DAMAN 396210.**

**Notice No. 27.2/EQU/GEC/MECH/2020-21/317**

**DATED : 21/11/2020.**

**E-TENDER**

The Principal, Government Engineering College, Daman on behalf of President of India, invites Tender for purchase of following item:

1. Supply of Equipment's for Mechanical Engineering Laboratory of Government Engineering College, Daman through On-line bidding from the website of Gepnic.

* On-line downloading of Tender documents	21.11.2020 to 21.12.2020 -04:30 P.M.
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* On-line submission of Tenders	Upto 21.12.2020 – 04:30 P.M. only
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* On-line Opening of Technical Bids	On 22.12.2020 at 10:00 A.M.
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\* Bidders have to submit their PRICE bid in Electronic format only on <https://ddtenders.gov.in/nicgep/app> till the last date & time for submission. PRICE bid in Physical format shall not be accepted in any case.

**Only Tender fees & EMD to be submitted in physical form**, all other documents related to Technical Bid shall be uploaded only through e-tender website of NIC i.e. <https://ddtenders.gov.in/nicgep/app>. [The Tender fees & EMD shall be done by RPAD / Speed post or by hand in Tender Box in Office of the Principal, Govt. Engineering College, Daman upto 21.12.2020 by 04:30 P.M.] However Tender inviting authority will not be responsible in case of Postal or other delay.

The inviting authority reserves the rights to accept or reject any tender without assigning any reason. Tender opening can be postponed depending on the decision of the Tender committee.

In-case bidder needs clarification / training for participating in online tender, they can contact:

National Informatics Centre, Daman  
GePNIC Portal, 24x7 Help Desk Nos. 0120-4200462, 4001002, 4001005 and 6277787  
Email: [support-eproc@nic.in](mailto:support-eproc@nic.in)

- Sd -

(Dr. Avinash R. Chaudhari)

I/c. Principal,

Ph No. 9426888068

Email ID: gecdaman@gmail.com

Copy to :

1. The NIC, Daman, with request to put-up on website of Administration of Daman & Diu.
2. The Field Publicity Officer, Daman with a request to publish in newspapers specified in the office letter.

**ADMINISTRATION OF UT OF DNH & DAMAN & DIU  
OFFICE OF THE PRINCIPAL,  
GOVERNMENT ENGINEERING COLLEGE,  
VARKUND, NANI-DAMAN - 396210.**

Terms & Conditions for Supply of Equipment's for Mechanical Engineering Laboratory of Government Engineering College, Daman.

**Notice No. 27.2/EQU/GEC/MECH/2020-21/317**

**DATED : 21/11/2020.**

General terms and Conditions:

1. Tender bids should be submitted duly signed and stamped on every page by the vendor's authorized signatory on or before 21/12/2020 by 4:30 pm. (TENDER Fee Rs. 1000/-) in the form of Demand Draft.
2. The EMD of Rs. 1,46,000/- in the form of F.D.R. in favour of "The Principal, Govt. Engineering College, Daman" should be submitted with the Technical Bid.
3. The EMD FDR must have a due date of at least 06 months.
4. The bidders who are registered under NSIC/MSME organisation of Govt. of India for exemption of submitting EMD/Bid security may enclose documents proof of authenticate their firm's registration for the specific item(s).
5. The rates quoted should be valid for 180 days from the date of submission of the Tenders.
6. The Vendor should be the authorized manufacturer / supplier / dealer of the required item.
7. The item should be complied with the specifications / configuration given in the Annexure – III.
8. Minor variation/Deviation/ Relaxation in the technical specification will be only subjected to acceptance by the concerned department and tendering inviting authority.
9. Model, Make and standards of the item should be specified clearly.
10. Technical literature / brochure of item indicating the quoted make and model shall be enclosed.
11. The Committee or a respective member will visit the successful bidder for Demonstration, Inspection & Physical verification of the said items to be purchased.
12. **Manufacture / Company of each product of Tender should be ISO Certified with valid License.**
13. **Calibration Certificate to be submitted for all items mentioned in ANNEXURE-III (Column No. 5 Calibration Submission).**
14. Clause number 12 & 13 applicable to major / important components (subject to acceptance by technical Expert of the tendering committee that has to be submitted on demand) along.
15. Items / Machineries / Equipment's to be supplied / quoted should be standard make / reputed brand. Sub-standard or made in China items will be rejected from the Bid (proof of make may be sought if needed later).
16. Supply, transportation, installation, testing, integration of the item shall be sole responsibility of the selected supplier.
17. The supply and installation of items should be done within 60 days from the date of receipt of supply order.
18. Minimum (01) one-week onsite training shall be given to users on operational modules of the item or as required.
19. Head of Office reserves the right to cancel the order in the event of delay in supply and installation beyond 60 days from the date of Purchase Order resulting in forfeit of the EMD amount.
20. **Delivery: (60 Days from the receipt of Supply Order)**
  - (a) **The Equipment's / Items should be ready for inspection within 40 days from the date of supply order.**
  - (b) **The Inspection committee shall inspect respective items of supply, by way of selecting any random piece from the quantity ordered within 35<sup>th</sup> to 40<sup>th</sup> day of supply order (any extension for supply and inspection shall not exceed more than 45 days from the date of supply order) failing to which the order shall be liable for cancellation.**
  - (c) **The expense / arrangement for inspection by the inspection committee of respective items**

**at the factory / franchise site award of supply order, will be borne by the bidder.**

21. Penalty: If the suppliers fails to deliver all or any of the Tendered items or perform the service within the specified date, penalty at the rate of 1% per week of the total order value subject to the maximum of 10% of total order value will be deducted, and also be liable to be blacklisted for future participation etc. and thereafter the L2 /bidder for the respective item will be awarded the supply order.
22. Complete warranty for minimum (01) one-year period for the Tendered items from the date of installation.
23. Any required Replacement in part or complete, required services / calibration, Transportation related to such occurrence etc. during the warranty period shall be fully borne by the vendor / supplier.
24. Price of the item should be quoted as per the sample price format given in the (Annexure – III) in Electronic format only through GePNIC.
25. Price of the item quoted in the tender shall be inclusive all charges like tax, freight, installation, activation, integration, documentation, training etc. (if any).
26. Item-wise lowest bids will be accepted for purchase of the respective Mechanical Machinery & equipment's and accordingly the tender awarded to the respective suppliers.
27. The lowest quoted item should be compatible with other purchased items. (Committee reserved the right to choose best compatible supporting equipments to the Primary item.
28. The prices as quoted would be considered as the final prices for evaluation. In any case, upward revision will not be allowed.
29. After the submission of bids, no change in the content of the bid would be allowed. However, the Institute at its discretion may request the vendor to provide additional inputs if required. In case of the vendor not being able to submit the additional input in writing on or before the date specified by the Institute, the bid received from the vendor would be rejected and no explanation would be offered to the vendor for the rejection.
30. The earnest money deposited (EMD) with the bid shall be returned along with the final payment in case of successful bidder. In case of other bidders it will be returned after finishing the codal formalities or after placing the supply order to the eligible bidder.
31. The bidder must be able to service / replace / repair the instruments within 03 to 04 days of the complaint during the warranty period.
32. Tenders will be opened in the presence of the committee member & the representatives of the firms who may like to be / will be present on the date and time of opening of the tenders.
33. The Selected vendor will be required to submit a Security Deposit in the form of FDR, in the favour of "The Principal, Govt. Engineering College, Daman" of 10% of total order value for a warranty period from the date of supply and installation within one week of receipt of the supply order. (the security deposit shall remain with the principal for the entire warranty period).
34. Payment will be made on submission of bill in duplicate after satisfactory completion of all the formalities of supply, installation, testing and integration of the products at Govt. Engineering College, Daman after obtaining NOC of the concern department or principal.
35. Decision of the Head of the institute will be final and binding in any matters relating to the tender, also the Tender inviting authority reserves the rights to relax T&C related to this tender.
36. In case the vendor requires any further information / clarification related to this tender or specifications, they may contact the undersigned in writing on or before the due date & time of submission of tender, any arguments after the due date will not be acceptable.

The following documents among others must be submitted online ONLY (through GepNIC in the form of PDF duel numbered as per below Sr. No., without which tender will be liable for rejection.

1. Copy of EMD of Rs. 1,46,000/- in the form of F.D.R. valid up to 06 months from a nationalised bank.
2. Copy of Authorised Supplier / Dealer / Distributor of the said items.
3. Copy of Registration Certificate of the firm of a competent authority.
4. List of current two major clients with satisfactory completion certificate.
5. Copy of Calibration Certificate for all items mentioned in ANNEXURE-III. (Column No. 5 Calibration Submission\_)
6. Copy of Manufacturers latest ISO / ISI certification. (as mentioned at clause no.11)
7. Copy of VAT / CST/GST and PAN Card.
8. Copy of Income Tax return for last three years A.Y. 2017-18, 2018-19, 2019-20.

9. Self-certified certificate of assurance to service / repair / replace the complaint in reference of the instruments within one week of intimation.
10. Self-certified certificate of not being a “Black listed company / supplier etc.

**NOTE : UPLOAD SINGLE COPY FOR ALL ABOVE DOCUMENTS, THE DEPT. SHALL REQUEST ADDITIONAL INPUTS IF & WHEN FOUND NECESSARY.**

(Dr. Avinash R. Chaudhari)  
I/c. Principal,  
Ph No. 9426888068  
Email ID: gecdaman@gmail.com

TENDER FORM (TECHNICAL BID)

TENDER DOCUMENT FOR  
SUPPLY OF EQUIPMENT’S FOR MECHANICAL ENGINEERING LABORATORY OF GOVERNMENT  
ENGINEERING COLLEGE, DAMAN

Notice No. 27.2/EQU/GEC/MECH/2020-21/317

DATED : 21/11/2020.

From:

Date:

To,  
The Principal,  
Government Engineering College,  
Varkund, Nani Daman.

1.	Full name of the Company / Firm / Supplier (in block letters)	:	
2.	Full address of the Company / Firm / Supplier with telephone number, E-mail number, fax number	:	
3.	Year of incorporation	:	
4.	Name(s) of the Proprietors / Partners / Directors with their full address, Telephone Number, e-mail, fax etc.	:	
5.	Tender Fee Demand Draft No. & Date		
6.	Details of EMD of Rs. 1,46,000/- in the form of F.D.R.		
7.	Name of two major clients with their Address etc.	:	
8.	Details of Registration, Trade License, Labour Licence, other license held / obtained from the various authorities	:	
9.	Copy of Last three years Income-tax return i.e. 2017-18, 2018-19 & 2019-20.	:	
10.	Company / Firm / Supplier Bank Details  A. Bank Account No.- B. Bank Name & Branch location -	:	
11.	Copy of "TEST Certificate" from National Laboratories for components mentioned TEST Certificate Necessary	:	
12.	Service tax / VAT / CST No.	:	
13.	PAN No.	:	

I / We certify that I / We read, understood and accept the contents of the broad terms and conditions incorporated in the Tender Form submit this Tender for consideration. I / We certify that the above statements are true.

(Signature of the Owner / Partner / Contractor with SEAL )

Full Name \_\_\_\_\_

Address \_\_\_\_\_

Schedule of Tender

Notice No. 27.2/EQU/GEC/MECH/2020-21/317

DATED : 21/11/2020.

Sr. No.	Particulars	Details
1.	Name of the Work	Supply of Equipment's for Mechanical Engineering Laboratory of Government Engineering College, Daman
2.	Estimated Cost	Rs. 48,51,000/- (approx.)
3.	Earnest Money Deposit	An EMD amounting to Rs. 1,46,000/- FD from any nationalized bank in favour of "The Principal, Govt. Engineering College, Daman.
4.	Address for issue of Tender Papers	Download from the website i.e. <a href="https://ddtenders.gov.in">https://ddtenders.gov.in</a>
5.	Last Date/ Time of Submission of Tender	Upto 21/12/2020 – 04:30 P.M. only
6.	Address at which tender to be submitted	Office of the Principal, Govt. Engineering College, Daman.
7.	Venue of Tender Opening	Office of the Principal, Govt. Engineering College, Daman.
8.	Date & Time of opening of Tender	On 22/12/2020 at 10:00 A.M.
NOTE	Tender to remain valid till 60 days from opening the tender. Supply & Installation shall be within 30 days of award of work.	

(Dr. Avinash R. Chaudhari)  
I/c. Principal,  
Ph No. 9426888068  
Email ID: gecdaman@gmail.com

## Schedule for Supply of Equipment's for Mechanical Engineering Laboratory of Government Engineering College, Daman

Notice No. 27.2/EQU/GEC/MECH/2020-21/317

DATED : 21/11/2020.

Table below must be filled as required and submit in Technical Bid Cover

Sr. No.	Item Particular	Configurations Required	Quantity	Test/ Calibration Certificate of Components	Configuration offered with Brand / Make	Whether offer model compiles to configuration on given parameter? (Yes/ No.) with deviation.
1	2	3	4	5	6	7
<b>1.THEORY OF MACHINE LAB</b>						
1.1	Universal Governor Apparatus	<p><b>Requirement:</b> Equipped with Digital RPM Indicator and Proximity Switch.</p> <p><b>Mounting Area:</b> 1.5 m * 2.0 m (max)</p> <p><b>Electric Input:</b> Single Phase, 220 V (AC) with power rating of 0.5 kW.</p> <p><b>Motor Specifications:</b> 1 HP Variable Speed Motor having Variable Speed Controller for varying the speed of the motor.</p> <p><b>Aim:</b> To study the working of different Governors normally used to control the speed.</p> <p><b>Construction:</b> The apparatus should consist of Main Spindle vertically mounted on the base plate. Variable Speed Motor mounted vertically must drive the Spindle. Speed Control Unit mounted must be able to control the speed of the motor. A Governor Assembly should be mounted on the Spindle.</p> <p><b>Measurement:</b> A Graduated Scale should be fitted to measure the Displacement of the Sleeve.</p> <p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Identifying the Characteristic Curve of Sleeve Displacement against the Rotational Speed of Governor.</li> <li>2. To study the consequence of varying mass of Sleeve in Porter and Proell Governor.</li> <li>3. To study the consequence of varying Spring Compression in Hartnell Governor.</li> <li>4. To plot the Characteristic Curve of Radius of Rotation against Controlling Force for all Governors.</li> </ol>	1			

		<p><b>Technical Specifications:</b></p> <p><b>A.</b> Governor Mechanism having following components:</p> <ol style="list-style-type: none"> <li>1. Watt Governor</li> <li>2. Porter Governor</li> <li>3. Hartnell Governor</li> <li>4. Proell Governor</li> <li>5. Springs</li> <li>6. Weights</li> <li>7. Digital Tachometer</li> </ol> <p><b>B. Spindle:</b> Spindle must be made of Stainless Steel.</p> <p><b>C. Apparatus Set-up:</b> The entire Set-up must be Powder Coated and Rigid Structure.</p> <p><b>Control Panel:</b></p> <p><b>A.</b> Standard make ON / OFF Switch</p> <p><b>B.</b> Mains Indicator</p> <p><b>C.</b> Speed Control Unit</p> <p><b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.</p>				
1.2	Motorized Gyroscope	<p><b>Measurement:</b> Digital RPM Indicator and Proximity Switch.</p> <p><b>Electric Input:</b> Single Phase, 220 V (AC) with power rating of 0.5 kW.</p> <p><b>Motor Specifications:</b> 1 HP Variable Speed Motor having Variable Speed Controller for varying the speed of the motor.</p> <p><b>Construction:</b> A Stainless-Steel Disc coupled horizontally with Variable Speed Motor. The Rotor Shaft should be Coupled with Motor mounted on Trunion Frame with Bearing in Yoke Frame and should be free to rotate in vertical axis. To balance the weight of the motor, Counter weights can be equipped on the opposite side. Rotor Disc can freely move in three axis. Gyroscopic Couple can be calculated by calculating the Torque based on Weights and Distance of Weights from the Center axis of the Rotor.</p> <p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To study the Gyroscopic Effect of the Rotating Disc.</li> <li>2. Experimental Justification of the Equation <math>T = I \cdot \omega \cdot p</math> for calculating the Gyroscopic Couple by means of Observation and Measurement of Results for independent Vibrations.</li> </ol> <p><b>Control Panel:</b></p> <p><b>A.</b> Standard make ON / OFF Switch</p> <p><b>B.</b> Mains Indicator</p> <p><b>C.</b> Speed Control Unit</p>	1			



		<b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.				
<b>2.FLUID POWER LAB</b>						
2.1	Pelton Wheel Turbine Test Rig	<p><b>Technical Specifications:</b></p> <ol style="list-style-type: none"> <li><b>Discharge:</b> 400 Liters per Minute (LPM)</li> <li><b>Water Circulation:</b> 3 Phase 5-HP Centrifugal Pump rotating at a speed of 2800 RPM.</li> <li><b>Storage Tank:</b> The Storage Tank should have capacity to hold 200 Liters and must be made of Stainless Steel.</li> <li><b>Supply Head:</b> 25 Meter</li> <li><b>Output Power:</b> 1 kW</li> <li><b>Nozzle Material:</b> Stainless Steel</li> <li><b>Dynamometer:</b> Rope Brake Dynamometer</li> <li><b>Discharge Measurement:</b> Pitot Tube with Manometer</li> </ol> <p><b>Mounting Area:</b> 1.5 m * 2.0 m</p> <p><b>Construction:</b> The set-up should consist of Buckets mounted on Runner. The water from storage tank should be pumped using Centrifugal Pump and fed to the Turbine through Stainless-Steel Nozzle and Stainless-Steel Spear Tangentially to the Runner. For controlling the flow of the water fed to turbine, the position Spear provided must be variable in nature using given Hand wheel. The Runner should be mounted in such a way that its one end is coupled with Central Stainless-Steel Shaft and Brake Arrangement on the other end.</p> <p>A Transparent Acrylic Sheet should be provided to Turbine Casing for observation of Fluid Flow onto the Buckets. The entire set-up must be supported by Rigid MS structure.</p> <p><b>Measurements:</b> For Calculating the Efficiency of the Turbine, Load on the Turbine can be applied using Rope Brake Dynamometer. The Inlet of the Turbine must be equipped with a Pressure Gauge to measure the turbine supply head.</p> <p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>To study the Operation of Pelton Wheel Turbine.</li> <li>To determine the Output Power and Efficiency of the Pelton Wheel Turbine.</li> </ol> <p><b>Control Panel:</b></p> <ol style="list-style-type: none"> <li>Energy Meter</li> <li>Mains Indicator</li> <li>Miniature Circuit Breaker (MCB) for Overload Protection</li> </ol> <p><b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.</p>	1	YES		
2.2	Kaplan Turbine Test Rig	<p><b>Technical Specifications:</b></p> <ol style="list-style-type: none"> <li><b>Discharge:</b> 2500 Liters per Minute (LPM)</li> </ol>	1	YES		

		<ol style="list-style-type: none"> <li>2. <b>Water Circulation:</b> 3 Phase 7.5-HP Centrifugal Pump.</li> <li>3. <b>Pump Size:</b> Suction and Discharge size of 100 mm.</li> <li>4. <b>Storage Tank:</b> The Storage Tank should be able to store sufficient quantity of water and made up of Mild Steel.</li> <li>5. <b>Supply Head:</b> 7 Meter</li> <li>6. <b>Output Power:</b> 1 kW</li> <li>7. <b>Nozzle Material:</b> Stainless Steel</li> <li>8. <b>Dynamometer:</b> Rope Brake Dynamometer</li> <li>9. <b>Spring Balance:</b> 6 kg</li> <li>10. <b>Pressure Gauge:</b> 0-7 kg / cm<sup>2</sup></li> </ol> <p><b>Note:</b> The entire apparatus must be fitted on Rigid MS Frame. The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.</p>				
2.3	Francis Turbine Test Rig	<p><b>Technical Specifications:</b></p> <ol style="list-style-type: none"> <li>1. <b>Water Circulation:</b> 3 Phase 15-HP Centrifugal Pump.</li> <li>2. <b>Discharge:</b> 2000 Liters per Minute (LPM)</li> <li>3. <b>Storage Tank:</b> The Storage Tank should be able to store approximately 400 Liters of Water.</li> <li>4. <b>Supply Head:</b> 20 Meter</li> <li>5. <b>Output Power:</b> 3 kW</li> <li>6. <b>Dynamometer:</b> Rope Brake Dynamometer having Diameter of 300 mm.</li> <li>7. <b>Runner:</b> Curved Vanes</li> <li>8. <b>RPM Measurement:</b> Digital RPM Indicator with Proximity Switch</li> <li>9. <b>Discharge Measurement:</b> Venturi with Manometer</li> </ol> <p><b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.</p>	1			
2.4	Centrifugal Pump Test Rig	<p><b>Technical Specifications:</b></p> <ol style="list-style-type: none"> <li>1. <b>Pump:</b> 1-HP Pump operating at approximately 2800 RPM</li> <li>2. <b>Supply Head:</b> 12 Meters</li> <li>3. <b>Drive:</b> 1-HP Thyristor Controlled DC Motor with Variable Speed</li> <li>4. <b>Storage Tank:</b> The Storage Tank must be able to store approximately 110 Liters of Water and made up of Stainless-Steel.</li> <li>5. <b>Stop Watch:</b> Electronic</li> <li>6. <b>Pressure Gauge:</b> Bourdon type Pressure Gauge</li> <li>7. <b>Flow Measurement:</b> Measuring Tank of 70 Liters Capacity fitted with Piezometer and made of Stainless-Steel</li> </ol> <p><b>Control Panel:</b></p> <ol style="list-style-type: none"> <li>1. Standard ON / OFF Switch</li> <li>2. Mains Indicator</li> </ol>	1	YES		

		3. Digital RPM Indicator with Proximity Sensor for measuring Speed 4. Electronic Energy Meter for measuring Energy Consumed <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.				
2.5	Reciprocating Pump Test Rig	<b>Technical Specifications:</b> 1. <b>Pump:</b> Double Acting Cylinder that can be operated at approximately 320 RPM 2. <b>Piston Stroke:</b> 40 mm 3. <b>Piston Diameter:</b> 45 mm 4. <b>Suction Pipe:</b> 1 Inch 5. <b>Delivery Pipe:</b> 3/4 Inch 6. <b>Pressure Gauge:</b> 0-2 kg / cm <sup>2</sup> 7. <b>Vacuum Gauge:</b> 0 – 760 mm Hg 8. <b>DC Motor:</b> 1-HP 9. <b>Stop Watch:</b> Electronic 10. <b>Electrical Input:</b> 220 V (AC) and 50 Hz 11. <b>Valves:</b> Total 3 Valves made of Gun Metal; one each for Inlet, Bypass and Drain. 12. <b>Piping and Fitting:</b> Galvanized Iron 13. <b>Storage Tank Dimensions:</b> 600 mm * 300 mm * 300 mm 14. <b>Measuring Tank Dimensions:</b> 300 mm * 300 mm * 300 mm 15. <b>MCB:</b> 16 Ampere 16. <b>Water Measurement:</b> Piezometer Tube fitted with Measuring Tank 17. <b>Energy Measurement:</b> Digital Voltmeter and Ammeter <b>Note:</b> The entire apparatus must be fitted on Rigid Iron Frame. The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		
2.6	Centrifugal Compressor Test Rig	<b>Technical Specifications:</b> 1. <b>Compressor:</b> Centrifugal Compressor having Forward Curved Impeller 2. <b>Motor:</b> 0.5-HP Variable Speed Motor rotating at 2800 RPM and equipped with Speed Controller 3. <b>Pitot Tube and Manometer:</b> Pitot Tube with U-Tube Manometer for measuring Air Flow 4. <b>Inclined Tube Manometer:</b> 0 – 100 mm of Water Column for Intake Pressure 5. <b>Piezometer:</b> 0 – 150 mm of Water Column for Delivery Pressure 6. <b>Temperature Sensor:</b> 2 Quantities of RTD PT-100 Sensor with Indicator (inlet & outlet) 7. <b>Voltmeter:</b> 500 Volt 8. <b>Ammeter:</b> 2 Ampere 9. Other necessary Electrical Switches and Indicators <b>Note:</b> The entire apparatus must be fitted on Rigid MS Frame with Powder Coating.	1	YES		

		The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.				
2.7	Reciprocating Compressor Test Rig	<b>Technical Specifications:</b> <ol style="list-style-type: none"> <li><b>Compressor:</b> Double Acting Cylinder</li> <li><b>Motor:</b> Three Phase 2-HP Motor mounted on Air Receiver with Delivery Valve and Pressure Gauge at Outlet</li> <li><b>Air Measurement:</b> Orifice with Water Manometer for Air Intake Measurement</li> <li>Digital Temperature Indicator</li> <li>Digital Watt Meter</li> <li><b>Pressure:</b> Bordon type Pressure Gauge measuring 2 MPa</li> </ol> <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		
2.8	Impact of Jet Apparatus	<b>Technical Specifications:</b> <ol style="list-style-type: none"> <li><b>Structure:</b> A Transparent Clear Box of Dimension 400 mm * 400 mm * 400 mm to Visualize Impact of Jet</li> <li><b>Storage Tank:</b> 700 mm * 700 mm * 500 mm</li> <li><b>Measuring Tank:</b> 400 mm * 260 mm * 380 mm</li> <li><b>Nozzle:</b> 8 mm Diameter</li> <li>Dead Weights to measure the force</li> <li>Plates- Flat plate, Curved Plate, Angle Plates (30°,60°), (M/s with Chrome plating)</li> <li>Necessary Pipping and Fittings</li> </ol> <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1			
2.9	Hydraulic Ram Test Rig	<b>Technical Specifications:</b> <ol style="list-style-type: none"> <li><b>Ram:</b> 50 mm * 15 mm</li> <li><b>Air Vessel:</b> Of Suitable Capacity made of Stainless-Steel</li> <li><b>Delivery Line:</b> The pipe should be of 50 mm Diameter and 6 Meter in Length</li> <li><b>Storage Tank:</b> 150 Liters</li> <li><b>Overhead Tank:</b> 100 Liters</li> <li><b>Measuring Tank:</b> 2 Measuring Tanks one for each Supply and Drain fitted with Piezometer Tube and made up of Stainless-Steel</li> <li><b>Piping:</b> Galvanized Iron or Poly-Vinyl Chloride (PVC)</li> <li><b>Stop Watch:</b> Electronic</li> <li><b>Pressure Gauge:</b> Bourdon Tube</li> </ol> <b>Control Panel:</b> <ol style="list-style-type: none"> <li>Standard ON / OFF Switch</li> <li>Mains Indicator</li> </ol> <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		

3. I. C. ENGINE LAB						
3.1	Multi-Cylinder Four Stroke Petrol Engine	<b>Engine:</b> Four Cylinder, Four Stroke, Vertically Mounted, Water Cooled, Self-Start, Petrol Engine <b>Loading:</b> 1. Rope Brake Dynamometer <b>Fuel Measuring System:</b> A Fuel Tank equipped with a Glass Burette and a Three-Way Cock <b>Air Intake Measuring System:</b> Air Tank fitted with Orifice and Manometer <b>Gas Calorimeter:</b> Exhaust Gas Calorimeter made of Stainless Steel to calculate the amount of Heat Carried away by the Exhaust Gases. The Calorimeter should be insulated with Ceramic Wool and Cladded by Aluminum Foil. <b>Temperature Measurement:</b> Digital Temperature Indicator with Multi-Channel Switch <b>Temperature Sensor:</b> Thermocouple K-Type <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		
3.2	Single-Cylinder Four Stroke Diesel Engine	<b>Engine:</b> Single Cylinder, Four Stroke, Vertically Mounted, Water Cooled, Self-Start, Diesel Engine with a power rating of 5-HP at 1500 RPM <b>Loading:</b> <b>Air cooled Eddy Current Dynamometer</b> <b>Fuel Measuring System:</b> A Fuel Tank equipped with a Glass Burette and a Three-Way Cock <b>Air Intake Measuring System:</b> Air Tank fitted with Orifice and Manometer <b>Gas Calorimeter:</b> Exhaust Gas Calorimeter made of Stainless Steel to calculate the amount of Heat Carried away by the Exhaust Gases. The Calorimeter should be insulated with Ceramic Wool and Cladded by Aluminum Foil. <b>Temperature Measurement:</b> Digital Temperature Indicator with Multi-Channel Switch <b>Temperature Sensor:</b> Thermocouple K-Type <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		
3.3	Single-Cylinder Two Stroke Petrol Engine	<b>Engine:</b> Single Cylinder, Two Stroke, Vertically Mounted, Air Cooled, Manual-Start, Petrol Engine <b>Loading:</b> <b>Eddy Current Dynamometer</b> (Torque Measurement by Spring Balance) <b>Fuel Measuring System:</b> A Fuel Tank equipped with a Glass Burette and a Three-Way Cock <b>Air Intake Measuring System:</b> Air Tank fitted with Orifice and Manometer <b>Gas Calorimeter:</b> Exhaust Gas Calorimeter made of Stainless Steel to calculate the amount of Heat Carried away by the Exhaust Gases. The Calorimeter should be insulated with Ceramic Wool and Cladded by Aluminum Foil. <b>Temperature Measurement:</b> Digital Temperature Indicator with Multi-Channel Switch	1	YES		

		<b>Sensor:</b> Thermocouple K-Type <b>RPM Indicator:</b> Digital Tachometer <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.				
3.4	Exhaust Gas Analyzer	<b>Temperature:</b> 5 <sup>0</sup> to 400 <sup>0</sup> C <b>Humidity:</b> 95 % <b>Air Pressure:</b> 70 kPa to 106 kPa <b>Power Supply:</b> 220 V (AC) and 50 Hz <b>Oil Temperature:</b> 1200 <sup>0</sup> C <b>Rotational Speed:</b> Up to 10000 RPM <b>Measurements:</b> <ol style="list-style-type: none"> <li><b>HC:</b> 0 – 10000, 10-6 (PPM) vol</li> <li><b>CO:</b> 0 – 10, 10-2 (%) vol</li> <li><b>CO<sub>2</sub>:</b> 0 – 20, 10-2 (%) vol</li> <li><b>O<sub>2</sub>:</b> 0 – 25, 10-2 (%) vol</li> <li><b>NO:</b> 0 – 5000, 10-6 (PPM) vol</li> </ol> <b>Note:</b> The Density of HC, CO and CO <sub>2</sub> should be measure directly whereas Density of NO and O <sub>2</sub> should be measured via Electrochemical Sensor. <b>Note:</b> The Apparatus Instruction Manual containing Experimental Procedure and Block Diagram of the Set-up should be provided.	1	YES		
3.5	Ignition System	The Model Consists of 4 different Ignition Systems: <b>Working Model of Ignition System for 4-Wheeler:</b> <b>Construction:</b> The Model should be made up of OEM used parts such as Switches, Ignition Coil, Distributor, Spark Plugs, High Tension Cables, Battery for Power Supply and necessary Wirings. <b>Working:</b> By Switching On the circuit and Rotating the Distributor, Sequential Sparks must be visible at Spark plugs. <b>Working Model of Electronic Ignition System for 4-Wheeler:</b> <b>Construction:</b> The Model should be made up of OEM used parts such as Switches, Electronic Ignition Coil, Distributor, Spark Plugs, High Tension Cables, Battery for Power Supply and necessary Wirings. <b>Working:</b> By Switching On the circuit and Rotating the Distributor, Sequential Sparks must be visible at Spark plugs. <b>Working Model of Magneto Ignition System for 2-Wheeler:</b> <b>Construction:</b> The Model should be made up of OEM used parts such as Switches, Ignition Coil, Magneto Assembly, Spark Plug, High Tension Cables and necessary Wirings. <b>Working:</b> By Switching On the circuit and Rotating the Magneto Assembly, Spark must be visible at Spark plug. <b>Working Model of Electronic Ignition System for 2-Wheeler:</b>	1 each			

		<p><b>Construction:</b> The Model should be made up of OEM used parts such as Switches, Electronic Ignition Coil, Spark Plug, Pick-up Coil, High Tension Cables, Battery for Power Supply and necessary Wirings.</p> <p><b>Working:</b> By Switching On the circuit and Rotating the Pick-up Coil, Spark must be visible at Spark plug</p>				
3.6	Cut Section Model of Various Carburetors	<p>Following Cut-Section Models of Carburetors made of Aluminum:</p> <ol style="list-style-type: none"> <li>1. Zenith Carburetor</li> <li>2. Solex Carburetor</li> <li>3. S. V. Carburetor</li> <li>4. Multi-Jet Carburetor</li> </ol>	1 each			
3.7	Model for Fuel Supply System of Petrol and Diesel	<p><b>Petrol Fuel Supply System:</b>  <b>Construction:</b> The Model should be made up of OEM used parts such as Fuel Tank, Fuel Filter, Fuel Injection Pump, Fuel Injector with Atomizer.  <b>Working:</b> By Switching On the circuit, the Fuel Pump will supply the Pressurized Fuel from Fuel Tank to the Fuel Injector where the fuel spray can be visualized.</p> <p><b>Diesel Fuel Supply System:</b>  <b>Construction:</b> The Model should be made up of OEM used parts such as Fuel Tank, Fuel Filter, Fuel Injection Pump, Fuel Injector with Atomizer.  <b>Working:</b> By Switching On the circuit, the Fuel Pump will supply the Pressurized Fuel from Fuel Tank to the Fuel Injector where the fuel spray can be visualized.</p>	1 each			
3.8	Model of Engine Cooling System	The Model should demonstrate the Cooling System of an Internal Combustions Engine and made up of OEM used parts such as Radiator, Radiator Fan, Water Pump and Hose Pipes. The Components should be mounted on Wooden Base.	1			
3.9	Model of Engine Lubricating System	The Model should demonstrate the Lubricating System of an Internal Combustions Engine and made up of OEM used parts such as Oil Pump, Oil Filter and Oil Strainer. The Components should be mounted on Wooden Base.	1			
3.10	Cut Section Models of Various types of Gearboxes	<p>Following Cut Section Models of various types of Gearboxes in <b>working Condition</b> are required to demonstrate the actual working:</p> <ol style="list-style-type: none"> <li>1. Sliding Mesh Gearbox</li> <li>2. Constant Mesh Gearbox</li> <li>3. Synchromesh Gearbox</li> <li>4. Continuous Variable Transmission (CVT) System</li> </ol>	1 each			

3.11	Power Transmission System (P-T System)	<p><b>Technical Specifications:</b> Entire Power Transmission System resting on structural frame made of Iron and containing original OEM used components of Front Engine Rear Wheel Drive vehicle including Engine, Gearbox, Universal joints, Propeller Shaft, Sliding Joints, Differential, Axles, Wheels and Tyres.</p> <p><b>Working:</b> The drive to engine must be supplied via an Electric Motor mounted on the Crank Pulley directly or using intermediate gears. The Power from the Engine must reach Rear Wheels and rotate them with the help of Gearbox, Propeller Shaft and Differential.</p>	1			
3.12	Working Models of Steering System	<p><b>Technical Specification:</b> The Model of Steering System must be made of original OEM used components such as Steering Wheel, Steering Column, Steering Gearbox, Steering Arms, Electric Motor, Battery for Power Supply and other necessary wirings and Switches. The model must rest on the steel structure with appropriate mountings and supports as in a vehicle.</p> <p><b>Working:</b> The Power to the Steering System should be supplied by electric motor of required capacity. On supplying electric power, electric motor must work and on rotating the steering wheel, the steering arms must travel in appropriate direction.</p>	1			
3.13	Smoke Meter	<p>Smoke Meter should be suitable for conducting Full Load and Free Acceleration test for all types of Diesel Vehicles. The Smoke Meter must have an extendable Control Unit to operate, measure and display the results.</p> <p><b>Technical Specifications:</b></p> <ol style="list-style-type: none"> <li><b>1. Display:</b> A Display Screen on both Smoke Meter as well as on Extendable Control Unit.</li> <li><b>2. Printer:</b> An Integrated Printer in the Smoke Meter must be there to allow printing the results for future reference.</li> <li><b>3.</b> The Smoke Meter must have port to connect it to external Monitor or Display using VGA Cable.</li> </ol> <p><b>Measurements:</b></p> <ol style="list-style-type: none"> <li><b>1. Oil Temperature Measurement:</b> The Temperature Sensor must be provided which can be fitted at the place of dipstick and used to measure the Oil Temperature. The Temperature measurement must range between 0<sup>0</sup> to 200<sup>0</sup> C.</li> <li><b>2. RPM Measurement:</b> The Speed Sensor should be provided to measure the speed on the Engine in the range of 200 RPM to 6000 RPM.</li> <li><b>3. Resolution:</b> The Smoke Meter must have a Resolution of at least 0.1 m<sup>-1</sup>.</li> <li><b>4. Smoke:</b> The Meter must have probe that can be inserted in the tail pipe of the vehicle to measure the Particulate Meter and Opacity of the Smoke.</li> </ol>	1			
3.14						



	Braking System Model	The Model should demonstrate various components of the Braking System including Brake Shoes, Brake Drum, Brake Disc, Brake Pads, Brake Booster, Brake Oil Reservoir and Brake Cylinder. All the components must be original OEM used components and fitted on Wooden Board.	1	YES		
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