GOVERNMENT COLLEGE OF ENGINEERING

JAMUNALIA, OLD TOWN, KEONJHAR-758 002

No: 1932 Dated: 01.12.2018

TENDER CALL NOTICE

Sealed tenders are invited from reputed original manufacturers/authorized dealers up to the date mentioned in the tenders for supply of equipment through speed post for Department of **Mechanical Engineering**. The date of opening the tender is mentioned in the respective tender document, which will be opened in the office of the Principal, Government College of Engineering, Keonjhar in the presence of bidders and/or their nominees. The tender bid documents with details of terms and conditions are to be downloaded from the College Website: **www.gcekjr.ac.in.**

The authority reserves the right to reject/cancel the tenders in whole or in part without assigning any reason thereof. The authority will not be responsible for any postal delay.

Sd/-
Principal

BIDDING DOCUMENTS AND INSTRUCTION TO SUPPLY EQUIPMENTS

FOR

DEPARTMENT OF MECHANICAL ENGINEERING

GOVERNMENT COLLEGE OF ENGINEERING, KEONJHAR

[A Constituent College of Biju Patnaik University of Technology]

Jamunalia,Old Town,Keonjhar– 758 002

INVITATION FOR BIDS

Principal, Government College of Engineering, Keonjhar invites sealed bids from eligible bidders for supply of machineries/equipments to Mechanical Department.

Interested eligible Bidders may obtain detail information and list of items with technical specifications from **the website of the College www.gcekjr.ac.in**

Particulars about submission of bidding document are as follows:

(a) Price of bidding document : **Rs. 1000/-**

(non-refundable)

(b)First date of availability of Bidding

Document in the website : 01.12.2018

(c) Last date and time for submission of bids : **28.12.2018**

(d) Time and date of opening of technical bids : 03.01.2019, 11.30 AM

(f) Time and date of opening of financial bids: Will be communicated to the successful technical bidders after scrutiny of the technical committee/ notice will be published in college website

(e) Place of opening of bids : **Principal Office**

Government College of Engineering Jamunalia, Old Town, Keonjhar-758002

(f) Address for communication : **Principal/Head of Department**

(Mechanical Engineering)

Government College of Engineering

Jamunalia, Old Town,

Keonjhar-758002

Sd/

Principal

1. Eligibility of Tenderer and General Instructions:

1.1 Eligibility:

Those who fulfill the following criteria are eligible to participate in the tender.

Those who fulfill the following criteria are eligible to participate in the tender.

a) The tenderer must be a reputed Original Manufacturer and/or the Authorised agent/ dealer of a reputed manufacturer. Manufacturers must provide all documents relating to their Manufacturing Capabilities.

b) If the tenderer is an Authorized Dealer/Agent of a reputed manufacturer, necessary certificate to this effect from his manufacturer must be enclosed

c) The tenderer must be registered with GST.

d) Annual turn-over of the tenderer must be more than Rs. One crore each in last three years. As a letter of support the bidder should submit audited balance sheet of last three financial years.

e) The bidder should be a registered firm with GST Authority. The bidder should furnish the GST registration certificate, details along with the tender paper and necessary clearance certificates up to March 2018. Enclose copies supporting documents. In absence of such certificates, the Bid is liable to be rejected, PAN Number must be enclosed along with the Tender documents.

f) The tenderer must have cleared Income Tax payment up to date. Attested copies of attested copy of Income Tax Clearance Certificate or non-assessment certificate, as the case may be, from the competent authority, up to date and PAN Number must be enclosed along with the Tender documents.

g) The tenderer must have the willingness for providing comprehensive maintenance support of the Machine supplied by him for at least two years after expiry of the warranty period.

h) The tenderer must provide evidence of purchase order and successful execution of supply of orders with installation and successful after sales support in reputed organizations like NITs/IITs/IIESTs/IISERs/NISER/IISc/Central Research Laboratories/ Government Engineering Colleges of Odisha.

i) All after sales support must be provided directly by the manufacturer only.

j) The manufacturer should be preferably ISO: 9001-2008.

k) The manufacturer should have preferably its own NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited laboratory or equipments supplied should have certification from any NABL accredited laboratory in respect of quality and performance.

l) The manufacturer should be preferably registered with ESI.

The manufacturer should have preferably its own R&D section registered with Government of India.

1.2 General Instructions:

The selection for procurement of equipments will be based on quality and performance along with cost. In this context decision of technical committee is final based on documentary evidence or actual physical verification.

a) Submission of more than one bid by a particular tenderer under different names is strictly prohibited. In case it is discovered later on that, this condition is violated, all the tenders submitted by such tenderer/s would be rejected or contract cancelled.
b) The tenderer should mentionin the tender paper, the location of its service centre nearest to Keonjhar.
c) All offers should be in English and the price quoted for each item should be firm.
d) Warranty period, Delivery period and After-Sale-Service conditions, etc. are also to be clearly indicated.
e) The rates and the conditions of the offer will remain valid for three months from the date of opening of the tender and no change or alteration of the rate will be acceptable on any account.
f) Submitted tender forms with overwriting or erased or illegible specifications and rates will be rejected.
g) Request from tenderer in respect of additions, alterations, modifications, corrections, etc. of either terms & conditions or rate after opening of the bid may not be considered. However, negotiation may be made before finalization.
h) Tenderers shall carefully examine the bid documents and fully inform themselves of all the conditions, which may in any way affect the work of the cost thereof.
i) Should a tenderer find discrepancies or omissions from the specification or other documents and any doubt as to their meaning, he should at once notify the purchaser and obtain clarification in writing.
j) This, however, does not entitle the tenderer to ask for time beyond the due date fixed for receipt of tenders.
k) The tenderer must also specify minimum time and maximum time to repair/replace in the event of a failure and penalty there of.
l) Verbal clarification and/or information given by the purchaser or its employees or representatives shall not be binding on the purchaser.
m) Submission of sealed bid will carry with the implication that the tenderer agrees to abide by the conditions laid down in the detailed particulars of the bid notice.
n) Conditional offers and offers qualified by vague and indefinite expression, as ‘subject to immediate acceptance’ ‘subject to prior sale’, etc. will not be considered.
o) While tenders are under consideration, tenderers and their representatives or other interested parties are advised to refrain from contacting by any means, to the purchaser's personnel or representatives on matter relating to the tenders under study.
p) The purchaser, if necessary, will obtain clarification on tenders by requesting such information from any or all the tenderers either in writing or through personal contact as may be necessary.
q) The tenderer will not be permitted to change the substance of his offer after the tenders have been opened.
r) In the event of non-compliance with this provision, the tenderer is liable to be disqualified.

1.3Procedure for Submission of Tenders:

a) The Tenderers must submit their bids as required in two parts in separate sealed covers prominently super scribed as Part-I “Technical Bid” and Part-II “Financial Bid” and also indicating on each of the covers the “Tender call Notice Number & Date” and due date and time of submission as mentioned in Tender Cal Notice.

Excepting the price schedule, all other documents as mentioned in para 1.1 i.e details of technical specifications, printed information Catalogue for each instrument, Copy of Firm Registration Certificate from the competent authorities, Sale Tax clearance, Income Tax Clearance, PAN Card copy, list of clients, evidence of successful execution, etc. along with tender document duly signed by the authorized person in each page shall be covered in Part-I (Technical Bid).

Part-II (Financial Bid)

All indications of price shall be given in Part-II (Financial Bid)

b) Both sealed covers Part-I " Technical Bid" and Part-II "Financial Bid" should be placed in a third cover along with requisite EMD & cost of Tender documents (separately in the form of DD drawn in favour of Principal, Government College of Engineering, Keonjhar at any Nationalized Bank payable at Keonjhar) , others requisite supporting documents etc. and sealed. The sealed cover containing tender documents as per procedure indicated above should be sent to the Office of the Principal, GCE,Keonjhar by Registered Post/Speed Post only addressing to the Principal, Government College of Engineering, Jamunalia, Old Town, Keonjhar-758002 within the due date and time as stipulated in Tender. The sealed envelope must show the name of the tenderer and his address and should be super scribed as "*Tender for supply of Equipment for Mechanical Engineering Department*" on the top of the envelope**.**

c) All the documents submitted must be in the papers showing signature of the tenderer and printed office name of the tenderer on official seal.

d) All the documents must be submitted in a sequential manner with separator/flags to help in quick scanning of the topics. Wherever possible, data in tabular form should be given.

2. Requirements by Tenderer before Supply:

2.1 Rating Plate, Name Plate and Labels:

Each of the equipment is to have permanently attached to it, a rating plate of non-corrosive material in a conspicuous position, upon which the total specifications along with the manufacturer's name, address, etc. are to be engraved.

2.2 Packaging:

All the equipment are to be suitably protected, covered in water -proof packing and crated to prevent damage or deterioration during transit and storage till the time of installation. The supplier shall be responsible for any loss or damage caused during transportation, handling or storage till their successful installation.

2.3.Inspection:

a) All materials / equipment shall be inspected and tested for completeness, proper assembly, operation, cleanliness and state of physical condition and performance as per quoted specification.

b) The test shall be conducted, reported and certifications to be provided by the tenderer.

c) The tenderer shall provide all test and measuring equipment/tools required for inspection / testing.

d) The cost of all such tests shall be borne by the Tenderer.

e) GCE reserves the right to reject any equipment if it does not comply with the specifications during site testing, installation and commissioning stage.

f) Inspection & testing would be conducted, jointly, at various stages as applicable during unpacking, installation and commissioning of respective equipment / components at the manufacturing site.

2.4. Environmental Condition:

All the equipment supplied shall be rugged and should operate without any deviation in quality, or degradation of equipment performance. All the specification/parameters shall be guaranteed over the following environmental conditions:

* Storage Temperature : 0 to 50^0 C
* Operating Temperature : 0 to 50^0 C
* Humidity : 95% RH (non-condensing)

All the equipment are intended to operate under 220 V/ 440V, 50 Hz power supply.

3. Requirements by Tender after Supply:

3.1 Supply:

a) The material would be delivered by the supplier at GCE, Jamunalia, Old Town, Keonjhar – 758002, Odisha.

b) The items should be supplied directly from the manufacturing terminal having passed all tests successfully with Certifications as required.

c) The equipment should conform to the latest relevant National/International standards and shall be completed in all respect.

d) Any component, fitting etc. which may not have been specifically mentioned in the specifications but which are usual and necessary for the equipment, shall be supplied by the tenderer at no extra cost.

e) In case, articles are found damaged in transit or found short at the time of delivery the full cost of the same will be deducted from the bill of the supplier in case the supplier does not replace the stock within a week from the date of the complain.

f) The articles ordered must be supplied in one lot within 4 (four) weeks of placing of the order.

g) In case of delay in delivery or successful installation, a penalty of 1% (one per cent) per week shall be levied.

h) GCE reserves the right to procure the materials from alternative sources at the risk and cost of the successful tenderer giving 15 days notice.

i) Any increase in tax and duties after expiry of delivery period will be bourne by the supplier.

j) In case the items supplied by the supplier are found not up to the specification shall be rejected.

k) The supplier will be intimated to take back the stocks at his own cost within three days from the date of rejection and to replace the same within 7 days, failing which the EMD will be invoked in addition to taking legal actions.

l) Imported consignment, if any, should be destined to GCE, Jamunalia, Old Town, Keonjhar – 758002, Odisha, India through Bhubaneswar Air Port.

m) The suppliers shall be responsible for releasing the consignments from the carriers/transporters.

n) The equipment shall be delivered and installed at site at the cost of the tenderer.

o) All taxes, levies, surcharges including the customs clearance and handling freight and insurance should be paid and handled by the tenderer.

3.2 Installation and Commissioning:

Installation and Commissioning shall include the following:

a) Installation and Testing of the Equipment, Machineries etc. must be conducted by the tenderer at GCE.

b) It will be the responsibility of the tenderer to provide all necessary spares and consumables, which may be required during installation and commissioning, at no extra cost to purchaser.

c) The tenderer is to bring their own testing and measuring instruments required for installation, testing, commissioning, which can be taken back after completion.

d) Installation must complete within 15 days after delivery on site.

e) During installation and commissioning the complete intended experiments is to be conducted with results must be within accepted level of accuracy.

f) The raw materials and samples required for conducting experiments during installation is to be supplied by the tenderer free of cost.

3.3 Documentation:

a) Detailed technical manuals, handbooks, drawings, Warranty card and Factory Quality Assurance checklist, test results and any other certifications mentioned in the Technical specifications shall be supplied along with the consignment.

b) Supplied manuals/handbooks must cover detailed technical specifications and installation, operation, maintenance and System Safety procedures.

c) For Experimental setups details of theory, procedure and methods of taking measurements etc. should be provided in the form of hand books for each experiment.

d) The receipts for taxes paid, if any, for the supplied materials should also be submitted.

3.4 Trial Operation and Performance Guarantee Test:

a) After successful completion of Installation and Commissioning of the equipment, a 7-day continuous trial operation putting those on optimum use shall be conducted by the tenderer at site, during which the performance of the equipment shall be demonstrated for trouble-free continuous operation, meeting the specified standards and proper training shall be imparted to two persons of the purchaser.

b) During trial operation, tenderer shall do all necessary adjustments required to ensure the performance as per the acceptable level.

c) In case, guaranteed performance is not established, the tenderer shall be given opportunity to rectify/replace the equipment/components, and restart the 7 days continuous trial operation, at the risk and cost of the tenderer.

3.5 On-Site Warranty:

a) The entire materials may be used continuously. The reliability and safety of the total installed system and trouble-free operation are, therefore, of prime importance. The supplied devices/equipment and components shall be covered under **Two-years or more** comprehensive on-site warranty from the date of issue of successful completion of Performance Guarantee Report.

b) During the period of warranty, it shall be the responsibility of the tenderer to provide all essential spares and consumables, which may be required for maintenance and trouble-free operation of the devices / components at the tenderer's cost.

c) Software, if any, has to be tested with at least one-year warranty for trouble free operation.

3.6 Comprehensive Maintenance Contract:

a) The tenderer shall be under the obligation of entering into a Comprehensive Maintenance Contract (CMC) with GCE for a minimum period of two years, renewable if felt necessary, on mutually acceptable rates, terms and conditions. CMC shall start after the completion of Warranty.

b) The scope of CMC shall cover maintenance and supply/replacement of materials and components, for smooth and reliable operation of the systems without trouble.

c) Accordingly, the tenderer has to offer rates for the CMC structure per equipment along with the price for the Systems and other associated Equipment supplied.

3.7 After Sales Service

a) During the warranty period and subsequently, after signing of Agreement for CMC the tenderer shall attend to the problems reported by the users of GCE on a priority basis.

b) For any problem reported the tenderer shall attend and rectify the problem within 7 (seven) days or provide a standby system of the similar configuration.

c) The report on any problem will be informed through phone or fax number of which shall be given by the tenderer.

d) The branch office of the concerned manufacturing firm will be fully responsible to provide maintenance service, in case of any negligence, in providing the service by the tenderer.

e) On failure to comply with those instructions, the Bank Guarantee provided for the warranty period shall be invoked.

4. Financial Terms:

4.1 EMD

a) The tenderer has to submit a Demand Draft / Banker's Cheque / Pay order of Rs.25000/ - **in favour of Principal, Government College of Engineering, Keonjhar** payable at Keonjhar in any Nationalized Bank towards EMD.

b) There will be no interest paid to the tenderer towards EMD money.

c) In no case, the EMD Money in cash or other forms will be accepted at the time of opening of the bid.

d) No request for adjustment of claims, if any, will be accepted.

e) The EMD of unsuccessful tenderers will be refunded as soon as possible after the tenders are finalized.

4.2 Performance Security Deposit:

In case of successful Bidder EMD will be kept as Performance Security Deposit and will be refunded after expiry of stipulated warranty periods (Two years) from the completion date of installation and commissioning on satisfactory performance of the equipment.

4.3 PRICES:

Price quoted should be **FOR Government College of Engineering, Keonjhar only. Tax components as applicable should be mentioned clearly in the financial bid.**

a) Price should be quoted for unit item.
b) Purchase order will be placed as a single lot for each type of item or for all the items together, as the case may be.
c) In case of items of import, the tenderer should take full responsibility for customs clearance, handling, tax payment, etc. and specify the charge for the same in the price bid.

4.4 Sales Tax Concession:

Central Sales Tax Concession is to be availed on production of the required certificates applicable to Educational Institution.

4.5 Discount:

a) Our Institute is a pioneer Institution in the field of Teaching and Research in Engineering and allied disciplines and do not run with profit motive.
b) As such we are availing price discount for purchase of equipment/instruments.
c) The rate of discount or any other Institutional benefit arising out of Govt. Policy etc., on each item may also be indicated in the bid specifically.

4.6 Payments:

a) In case of imported items, payment will be made by opening LC in the name of the manufacturer subject to the condition that a Bank Guaranty for an equal amount will be submitted by the selected tenderer to GCE for the period of completion of installation and commissioning.

4.7 In case of purchase in Indian Rupees, payment of 90 percent of the ordered value will be made after successful installation and commissioning of the equipment subject to submission of satisfactory performance report by the concerned Head of Department. The rest 10 percent of the payment will be made after one year of successful installation of the equipment.

4.8 Penalty:

If the delivery, installation and commissioning is not carried out in time as specified in other part of the tender document, the tenderer/manufacturer will be charged @ 1 % (one per cent) per week of the total value of the concerned machine / equipment.

4.9 Rate Contract with DGS&D or any other Government Organisation:

In case the tenderer has entered into a Rate Contract with DGS & D or any other Government Organization such as EPM, rate contract preference, number & copy of rate contract have to be submitted along with tender.

5. Instruction to the Tenderer:

a) Some of the minimum specifications specified may be redundant, obsolete or incompatible and in these cases, quote the particulars of correct specification of latest trend and technology.

b) Higher specifications instead of minimum specifications are allowed if a minimum specification is not available, obsolete or incompatible.

c) Otherwise, model with higher specification should be in addition to the model with minimum specifications.

d) Specify brand name and full model name and number for each offer.

e) Include the printed catalogue and pricelist if any for each of the equipment quoted.

f) Specify the list of Accessories required along with each of the equipment.

g) Quote the additional price of the accessories; only those, which are fully compatible with the quoted model, should be furnished.

h) Specify the list of Accessories to be given free of cost, along with the equipment as "**Free Accessories"**; these should be fully compatible with the quoted models.

5.1 Solving Disputes:

a) GCE, the tenderer and the manufacturer shall make all efforts to resolve amicably by direct informal negotiation on any disagreement or dispute arising between them under or in connection with this contract.

b) All disputes arising out of the contract shall be referred to courts under the jurisdiction of the Keonjhar court only.

c) **The above terms and conditions except those otherwise agreed upon, shall form a part of the Purchase Order**.

d) Sign on each page of this tender document and Return it along with the offer enclosing this part together with the Technical Offer.

e) The GCE authority has all rights to accept / reject any tender without assigning any reasons there of.

6. Technical Specifications:

Following are the minimum specifications of the equipment.

a) The minimum specifications are indicative and not exhaustive.

b) The models with higher specifications may be quoted.

c) The quoted materials should be of latest trend and technology.

d) Each equipment should be complete in itself without needing any extra requirements except the requirement of general test and measuring instruments.

GOVERNMENT COLLEGE OF ENGINEERING, KEONJHAR

Machine/Equipment Specifications for Different Basic Labs in Mechanical Engineering Department (Academic purpose)

Sl. No	Name of Machine/Equipment	Specifications	Quantity
		THERMAL LAB	
1	Model of COCHRAN BOLIER Boilers with accessories and mountings	Standard Model (preferably Cut-section to see the different components inside the boiler)	**1**
2	Model of BABCOCK & WILCOX BOILER Boilers with accessories and mountings	Standard Model (preferably Cut-section to see the different components inside the boiler)	**1**
3	Measurement of steam quality using calorimeter (Throttling and bomb calorimeter)	• The flow meter for accurate steam flow measurement with wet steam detection, available as compact or remote version. Integrated temp. Measuring for mass/ energy flow of saturated steam. Suitable for a wide range of applications; optimized for steam applications. • Measured variable: Volume flow, mass flow, corrected volume flow, energy flow, heat flow difference, temperature • Measuring Range: Steam, gas: 2 to 32 166 m^3/h (1.18 to 18 932 ft^3/min) depending on medium: steam with 180 °C, 10 bar a (356 °F, 145 psi a); air with 25 °C, 4.4 bar a (77 °F, 63.8 psi a)	**1**
4	Exhaust Gas analyser for automobile.	• High quality microprocessor based instrument with combine optical precision. • Option of adding Non Thermal Paper Printer for printing a record of the test results. CO- 0 to 21% VOL HC- 0PPM to 20000PPM RPM- 200 to 9999 NOX- 30PPM to 5000PPM OIL TEMP- 30^0 to 150^0C Display- LED MONITOR	**1**
5	Model of Steam Power plant	Standard Model	**1**
6	Emissivity measurement Apparatus	• heat transfer between heated metal cylinder and vessel wall by convection and radiation • operation with various gases possible • experiments in vacuum or at a slight positive gauge pressure • electrically heated metal cylinder in the pressure vessel as experimental vessel	**1**

		• temperature-controlled heating element • vacuum generation with rotary vane pump • instrumentation: 1 temperature sensor on the metal cylinder, 1 power sensor at the heating element, 1 Pirani pressure sensor, 1 piezo-resistive pressure sensor • digital displays for temperature, pressure and heating power • Software for data acquisition via USB under Windows 7, 8.1, 10 **Technical data:** Heating element - output: 20W - radiation surface area: approx. 61cm2 Pressure vessel - pressure: -1...1,5bar - volume: 11L Pump for vacuum generation - power consumption: 250W - nominal suction capacity: 5m3/h - final pressure with gas ballast: 3-10-3mbar - final pressure without gas ballast: 3-10-3mbar Measuring ranges - negative pressure: 0,5-10-3...1000mbar - pressure: -1...1,5bar rel. - temperature: 0...250°C - power: 0...23W 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 1340x790x1500mm	
7	Heat pump apparatus for find out the COP	• investigation of a heat pump with a water circuit as load • refrigeration circuit with compressor, evaporator with fan, thermostatic expansion valve and coaxial coil heat exchanger as condenser • hot water circuit with pump, tank and condenser as heater • additional cooling via pipe coil in the hot water tank and external cooling water • record and display of all relevant measured values and • Software for data acquisition via USB under Windows 7, 8.1, 10 **Technical data** Compressor - capacity: 372W at 7,2/32°C Coaxial coil heat exchanger (condenser) - refrigerant content: 0,55L - water content: 0,3L	**1**

		Finned tube evaporator - transfer area: approx. 0,175m2 Pump - max. flow rate: 1,9m3/h - max. head: 1,4m Hot water tank volume: approx. 4,5L Measuring ranges - pressure: 2x -1...15bar - temperature: 4x 0...100°C, 2x -100...100°C - power: 1x 0...6000W - flow rate: 1x 0...108L/h (water) - flow rate: 1x 10...160L/h (cooling water) 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 1620x790x1910mm	
8	Model of Centrifugal Compressor	• Axial • Radial • Mixed	**One from each**
9	Model of Cooling tower with draught system (forced, induced)	Standard size	**One from each**
10	Model of different type of steam turbine (impulse and reaction)	Standard model	**One from each**
11	Model of Refrigerator	Standard Model (Cut section to see the different components)	**1**
12	Model of Air-conditioner	Standard Model (Cut section to see the different components)	**1**
HYDRAULIC LAB.			
1	Bernoulli's apparatus with Venturimeter for flow measurement.	• Familiarisation with Bernoulli's principle • Venturi Nozzle with transparent front panel and measuring points for measuring the static pressure • Axially movable pitot tube for determining total pressure at various point. • 6 tube manometer for displaying the static pressure. • Single tube manometer for displaying the total pressure. • Flow rate determined by base module. • Water supply using base module or via lab supply. • Venturi Nozzle- A: 84 ...338mm^2 -Angle at Inlet- 10. 5^0 - Angle at Outlet- 4^0 • Pitot Tube- Movable Range: 0.....200mm	**1**

		• Diameter- 4mm Pipe and Pipe Connectors: PVC • L X W X H: 1100 X 680 X 900mm	
2	Model of different types of Hydraulic pumps	• Centrifugal Pump • Reciprocating pump • Dredge pump • Jet pump • Submersible Pump • Standard Model (preferably Cut-section to see the different components inside the pump like impeller, casing)	**1**
3	Calibration of Bourdon Tube Pressure gauge and measurement of pressure using Manometer	• Basic experiments for measuring pressure with three different measuring instruments. • U-tube and inclined tube manometer • One bouden tube pressure gauge each for positive and negative pressure • Plastic syringe generates test pressures in the milli bar range • Calibration Device with Bourden tube pressure gauge for calibrating mechanical manometers. • Specification- Inclined tube manometer –Angle- 30^0 • Measuring ranges 1. 0..... ±60 mbar 2. 0.....500WC (U-tube manometer) 3. 0.....500WC (Inclined tube Manometer) • L X W X H: 750 X 610 X 810mm • Calibration Device- 410 x 410 x 410 mm	**1**
4	Reynold's Apparatus for visualisation of Laminar and turbulent flow	• Visualisation of laminar and turbulent flow in the Reynolds experiments. • Water as flowing medium and ink as contrast medium. • Vertical Glass pipe section. • Water tank with glass beads to stabilize the flow. • Flow rate in pipe section can be adjusted via a valve. • Flow rate determined by base module. • Tech. Specification: 1. Water tank capacity- 2200Ml 2. Pipe section- Length :675mm (inside diameter: 10mm) 3. Tank for ink: capacity: 250mL 4. L X W X H: 400 X 400 X 1140MM	**1**
5	Losses in Pipe system (influence of flow velocity on pressure loss)	• Investigation of pressure losses in piping elements and shut-off device. • Different measuring objects for determining flow	**1**

		rate according to the differential pressure method. • Six pipe section capable of being individually shut-off, with different pipe elements, sudden contraction, sudden enlargement, Y-pieces, T-pieces, Corner and bends. • One pipe section to hold interchangeable shut-off/ measuring objects. • Measuring objects made of transparent material: venture nozzle, orifice plate and measuring nozzle. • Shut off devices: angle seat valve, gate valve • Annular chambers allow measurement of pressure without interaction. • Two twin tube manometers for measuring the pressure difference. • Flow rate determined by base module. • Tech. Specification: 1. Pipe section to hold fittings or measuring objects – 20 x 1.5mm (pvc) 2. Pipe section inside diameter: d -straight: 20x1.5mm, length:800mm (pvc) - sudden contraction: 32x1.8mm & 20x1.5mm (pvc) - sudden enlargement: 20x1.5mm & 32x1.8mm (pvc) - with 2x Y-piece 45^0 and 2x T-piece - with 2x 90^0 elbow/bend: d= 20x1.5mm, pvc - 2x twin tube manometers: 0....1000mm WC (measuring ranges : 0....0.1bar 3. L X W X H: 1550 X 640 X 1300mm	
6	Model of hydraulic turbines (tangential, radial flow, axial flow)	Impulse turbine Francis turbine Kaplan Turbine Proton turbine	**One from each**
MACHINE DYNAMICS LAB			
1	Rope break dynamometer	• Rope Brake Dynamometer Consists Of A Drum Mounted On a Fabricated Frame. • Driven With the Help of Electric Motor. Rope is wound Around the Dynamo-meter & With the Help of Spring Balance, The System Can Be Operated with Motor. Maximum Load Applied Will Be 20 Kg. • Motor/pump rating: 2HP,440 V,2800RPM,3 A,3 Phase • Accessories: Energy meter, DOL starter, Dial gauge (0-25 kg), Tachometer.	**1**

		• Dimension: 800mm x 585mm x1000 mm	
2	Static and Dynamic balancing apparatus	• demonstration of static and dynamic imbalance • determine imbalance • processes involved in balancing • transparent protective cover for safe operation • foundation with elastic bearing • integrated angular and longitudinal scale • digital speed display Technical data: Number of imbalance masses: 4 Max. total imbalance: 880cmg Measuring ranges - speed: 0...1400min-1 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 420x400x380mm	**1**
3	Coriolis Component of Acceleration	• visualisation of the Coriolis force effect • rotating reference frame consisting of transparent water tank with submersible pump on a rotating arm • deflection of a water jet in radial direction dependent on the speed and direction of rotation • scale to read the deflection of the water jet • closed water circuit • speed sensor with digital display Technical data: Rotating arm - continuously adjustable speed: 0...60min-1 - adjustable direction of rotation -Submersible pump - flow rate: 10L/min 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 420x400x320mm	
4	Cam Profile Analysis Apparatus with model of different types of cams and followers.	• investigation of cam mechanisms • cam-shaped cam members: tangent cam, hollow cam, 2 circular arm cams with different head radius • different engaging members: flat receiver with plunger or rolling receiver with plunger • interchangeable return springs and spring preload • drive motor with variable speed • oscillating mass can be increased with 5 additional weights • mechanical drum recorder with nib and coated paper	**1**

		• optical speed sensor • transparent protective cover for safe operation Technical data: Drive motor - DC asynchronous motor with frequency converter - power: 250W - speed: 60…670min-1 Cam-shaped cam member - stroke, each: 15mm - opening angle, each: 140° Spring stiffness - hard: 5,026N/m - medium: 2,601N/m - soft: 613N/m Masses - additional weight: 200g - plunger: 530g - flat receiver: 93g - rolling receiver: 20g Recorder: toothed belt drive 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 800x440x440mm (experimental unit) Weight: approx. 40kg LxWxH: 360x320x160mm (display and control unit)	
5	Journal Bearing Apparatus with model of different types of bearing.	• kit of an upright hydrodynamic journal bearing • part of the Practice Line for assembly, maintenance and repair • journal bearing to DIN 31690 • stainless-steel drive shaft • lubrication via oil lubricating ring • floating edge seal to the face of the shaft seal • contact surfaces of the housing halves sealed with non-hardening sealant • complete set of tools for assembly journal bearing parts and tools housed in a sheet-steel tool box Technical data: Bearing bore - Ø 80mm Drive shaft - nominal diameter: Ø 80mm Materials - bearing housing: grey cast iron - bearing shells: steel supports, coated with white metal - seal: ultra-heat-resistant, fibre-reinforced plastic - shaft: stainless steel LxWxH: 690x360x312mm (tool box)	**1**

6	Model of different types of nut, bolt, washers and different types of threads(wooden or Plastic)	Standard model & size	**One from each**
7	Model of different types of coupling	• Flange, • rigid, • muff, • Oldham, • universal	**One from each**
8	Model of steering mechanism	Standard size	**1**
9	Model of differential mechanism	Standard size(cut section)	**1**

10	Strain Rosette	• Determination of Principal stresses 1 and 2 in magnitude and direction.
		• Study of effect of pressure on principal stresses.
		  • Three-element 45°rectangular planar rosette 350 Ω
		  • Three-element 60° delta planar rosette120 Ω
			1
			
			1

11	Stress Analysis through Photo-elasticity	• Photo-elastic experiments with an overhead polariscope • polariser and analyser each comprise a polarising filter and a quarter-wave filter • filter enclosed, with stress-free glazing • all filters arbitrarily rotatable in the horizontal plane • linear or circular polarised light possible • green filter for monochromatic light • load application device with force gauge for pressure and tensile load • eight different polycarbonate models are delivered • storage system for parts **Technical data** Filter bracket with polariser and analyser - diameter of filters: Ø 165mm 1 green filter, diameter: Ø 150mm Load application device with force gauge - load force: 0...250N 8 models, PC - un-notched bar - bar with hole - bar notched on one side - bar notched on both sides - rectangle without recesses - rectangle with recesses - fork - crane hook	**1**

		LxWxH: 500x190x30mm (frame) LxWxH: 280x280x90mm (filter bracket) Weight: approx. 8kg LxWxH: 1170x480x178mm (storage system) Low-voltage halogen lamp: 400W / 36V Brightness: 4.300 ANSI-Lumen Projection ratio: 1.3 Picture width: 1,20…3,40m Projection distance: 1,60…4,50m Power consumption: 500W 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase 120V, 60Hz, 1 phase UL/CSA optional LxWxH: 357x357x732mm	
12	Models of Levers	• Class-1 • Class- 2 • Class- 3	**1** **1** **1**
13	Experimental set up to determine spring constant under tension and compression	➢ Coil Springs and Helical Springs **<u>Spring testing machine</u>** ➢ Machine Capacities in N-200-1000N ➢ Max. length and deflection of spring in mm= 200, 300, 400 500 or 1000 depending on the spring to be tested ➢ Crosshead travel (displacement range) in mm= Either 200, 300, 400 500 or 1000 depending on the spring to be tested ➢ Parallelism between stationary platform and load cell plate. ➢ Operating Voltage 220 ± 10% VAC ➢ Operating Temperature +10 °C to +55°C ➢ Displacement resolution in mm 0.001 (1 micron), 0.005 (5 micron), 0.01 (10 micron) ➢ Vernier calliper Micrometer	**1**
PRODUCTION LAB			
1	Model of Pyramid, Cube, Prism, Pentagon ,Hexagon, different types of cones(Wooden or Plastic)	Standard size	**One from each model**
2	Tools and equipments for Green sand mould box preparation with different types of gate.	For preparation of green sand moulding	**30 sets**

MACHINING SCIENCE AND TECHNOLOGY LAB			
1	CNC Wire Cut Electro Discharge Machine(Travelling Wire Type)	**Machine Tool:** ➢ Main Table Traverse(X, Y) = 300 X 400mm ➢ Aux. Table Traverse(u, v) = 80 X 80 mm ➢ Table Size = 440X 650mm ➢ Max. Taper Angle =± 30^0/50mm ➢ Max. Work Piece Height = 200mm ➢ Max. Work Piece Height = 300kg ➢ Resolution = 0.0005mm ➢ Max JOG Speed = 900 mm/min ➢ Max. Cutting Speed = 170 mm^2/min. ➢ Max. Wire Spool Capacity = 6kg(Up to DIN 160/P5) ➢ Wire Electrode Diameter = 0.25mm (std), 0.15, 0.2 mm (opt) **Pulse Generator** ➢ Pulse Peak Voltage = 1 Step ➢ CNC Controller = Turbo ➢ Controlled Axes = X, Y,u, v(Simultaneous) ➢ Interpolation = Linear and Circular ➢ Least Input Increment = 0.001mm ➢ Least Command Input(X, Y, u, v) = 0.0005mm ➢ Max. Programmable Dim. (X, Y, u, v) = 99999.999mm ➢ Input Power Supply = " 3 Phase, AC, 415 V, 50 Hz" ➢ Average Power Consumption = 6 to 7 kVA Connected Load = 10 kVA	**1**
2	Hydraulic Universal Cylindrical Grinding Machine	➢ Centre Height = 150mm ➢ Distance between Centres = 600 mm ➢ Dwell at reversals = 0 – 60 sec. ➢ Grinding Wheel (d Xw) = 400 X 40 X 127 mm ➢ Internal Grinding(Spindle Optional) = 60 X 250 mm ➢ Auto in feed at reversal (OPTIONAL) = 0.01mm ➢ Max. Swivel of Table = 7 degree ➢ No. of work head speed = 8 ➢ Table speed infinitely variable = 0.1-4 m/min ➢ Tail Stock Centre = 4MT ➢ Wheel head rapid approach = 50mm ➢ Wheel head swivel = 60 degree ➢ Work head Centre = 4MT Work head Swivel = 90 degree	**1**

3	Slotting Machine	➢ Stroke = 10 – 250 mm ➢ Longitudinal movement = 230mm ➢ Cross movement = 230mm ➢ Speed adjustment = 3 speed ➢ Ram adjustment = 250mm ➢ Power = 1.5 HP ➢ A = 330 mm B = 410mm	**1**