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PANDIT DEENDAYAL ENERGY UNIVERSITY
Formerly Pandit Deendayal Petroleum University [PDPU]

Innovate
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Succeed

2025

LAB SHOWCASE

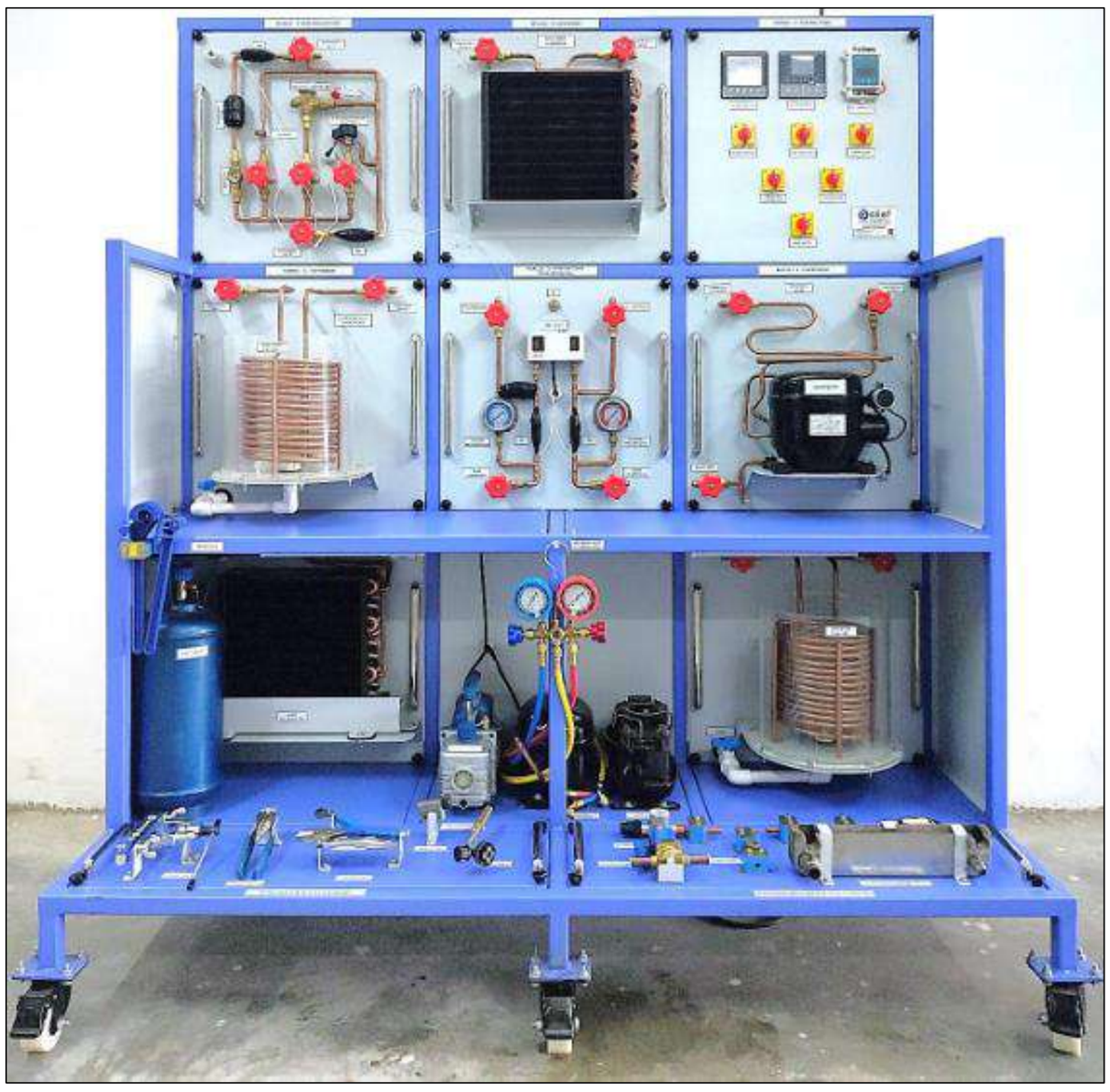
DEPARTMENT OF MECHANICAL ENGINEERING

Home to state-of-the-art labs driving innovation in thermal systems, robotics, sustainable energy, additive manufacturing, and smart systems. Our cutting-edge facilities empower businesses to co-create solutions for real-world challenges. Partner with our expert faculty to accelerate R&D, optimize processes, and pioneer breakthroughs in energy efficiency, automation, and next-gen product development.

Department of Mechanical Engineering

Refrigeration and Air Conditioning Trainer

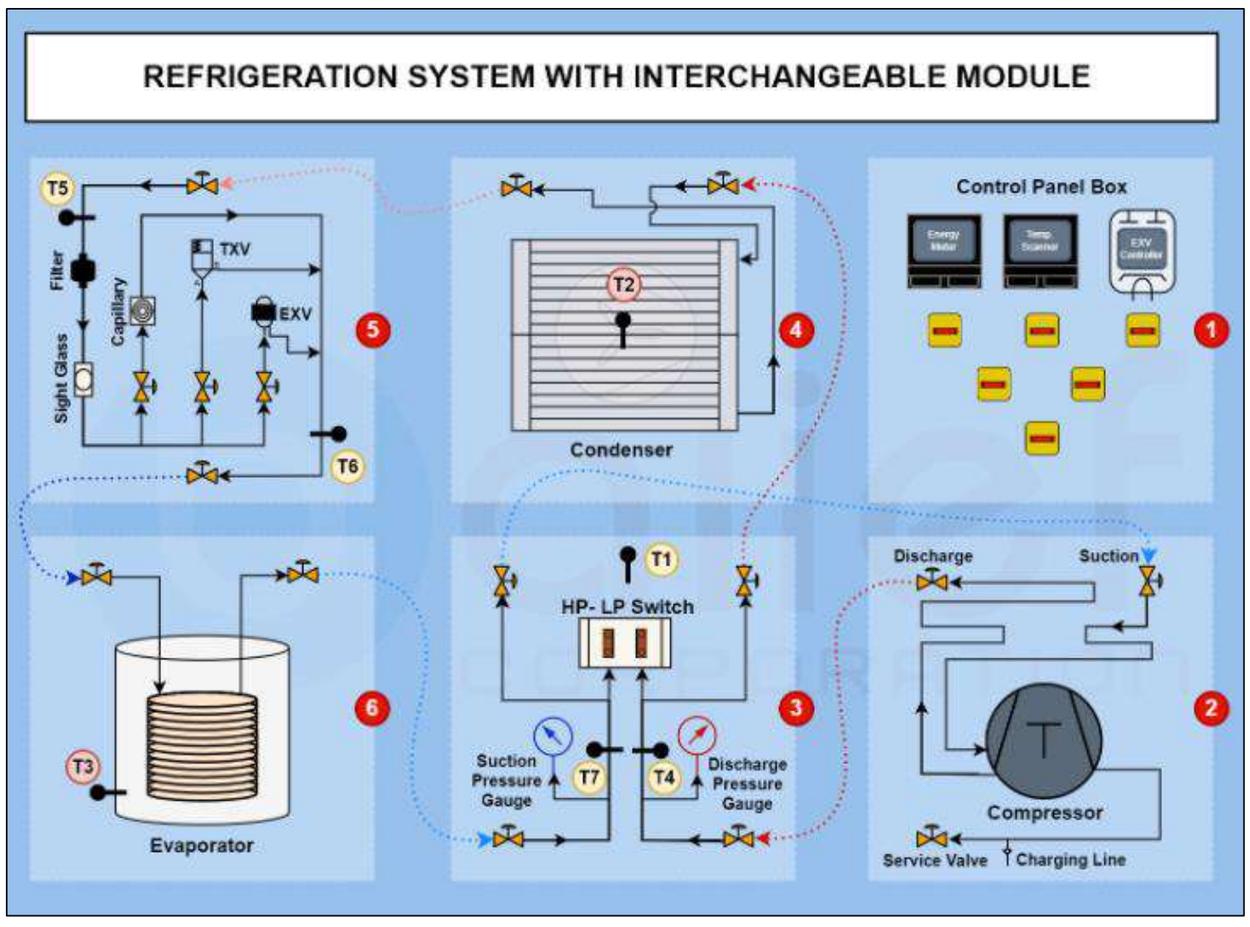
Bench-top trainer, allows trainees to investigate the fundamental principles of refrigeration and air conditioning.



Refrigeration System With Interchangeable Modules

Specifications

- **Interchangeable Modules:** Flexible component combinations.
- **Energy and Temp Display:** Monitors system performance.
- **Control Panel:** Comprehensive control and monitoring.
- **Multiple Condenser Types:** Air-cooled and water-cooled options.
- **Various Evaporators:** Fin & tube and submerged coil types.
- **Pressure Gauges:** High and low-pressure monitoring.
- **Temperature Sensors**: Multiple sensor locations for accurate data



Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like evacuating, filling the refrigeration system, and fault finding.
- **State Change Visualization:** Allows comparative studies between different types of condensers and evaporators and their combinations.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.
- **Fault Simulation:** Capability to simulate common faults for troubleshooting practice.
- **Flexible and Modular Design:** Interchangeable modules for diverse experimental setups and easy handling.

Beneficiaries of the R & AC Trainer

- **Engineering Students:** Mechanical, electrical, HVAC engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in HVAC systems.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** HVAC systems maintenance personnel training.

Applications of R &AC system

Contact us for more details

Dr. Vivek K. Patel
Professor, Department of Mechanical Engineering
vivekp@sot.pdpu.ac.in
9427259895

Dr. Jatin Patel
Associate Professor, Department of Mechanical Engineering
Jatin.patel@spt.pdpu.ac.in
9428415422

Department of Mechanical Engineering

Miller make continuum 350 with wire feeder

The miller make machine set up is an Advanced Gas metal Arc Welding (GMAW) machine capable of advanced short circuiting transfer process (RMD) as well as Wire Arc Additive Manufacturing (WAAM) process

Continuum 350 machine with wire feeder

Specifications

- **Wire feeder :** 4 roll advanced wire feeder having capability of accommodating wire diameter from 1.9 mm to 2.0mm
- **Torch:** Straight torch with 400 Amps air cooled set-up.
- **Power source:** 350 Amps at 100% duty cycle suitable for pulsed as well as advanced short circuit mode.
- **Power input**: 230-575 Volt supply

Salient features

- **Capabilities:** Capability to carry out GMAW process with different wire diameter sizes and variants.
- **Automation:** Machine equipped with straight torch mounted on in-house fabricated special purpose machine.
- **Control:** Automation allows user to monitor the process and get real time data/
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises of ascertaining correct defects in the components.

Beneficiaries of the machine

- **Engineering Students:** Mechanical, electrical, metallurgy engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in manufacturing domain.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Manufacturing components maintenance personnel training.

Applications

Contact us for more details

Dr. Jaykumar Vora
Assistant Professor, Department of Mechanical Engineering
Jay.vora@sot.pdpu.ac.in
9099962298

Dr. Rakesh Chaudhari
Assistant Professor, Department of Mechanical Engineering
Rakesh.chaudhari@spt.pdpu.ac.in
9712571197

Department of Mechanical Engineering

AVL437 Smoke meter

Smoke meter measures smoke opacity of exhaust gas emitted from diesel engines.

AVL437 Smoke Meter

Salient Features

- Approved by Automotive Research Association of India (ARAI) - Pune.
- Measures density of soot particles emitted from diesel engines in terms of smoke opacity
- Measures engine rpm
- Automatic self testing
- Built in printer and RTC
- Automatic zero calibration after switch on
- Warm up time less than 2 mins.
- Flexible hosepipe of stainless steel
- LCD display

Measuring Range/Accuracy/Resolution

	OPACITY	ABSORPTION	RPM
Measuring Range	0-100%	0-99.99 m^{-1}	400-6000 min^{-1}
Accuracy & Repeatability	± 1%	± 0.1 m^{-1}	±10
Resolution	0.1%	0.01 m^{-1}	±1

Beneficiaries of the AVL437 Smoke Meter

- **Engineering Students:** Mechanical and Automobile Engineering
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals working in engine domain
- **Academics and Educators:** University and technical institute educators.

Application of AVL437 Smoke Meter

- Measurement of smoke opacity from exhaust of diesel engines

Contact for more details

Dr. Hiren R. Dave
Assistant Professor,
Department of Mechanical Engineering
Hiren.dave@sot.pdpu.ac.in
7096528545

Department of Mechanical Engineering

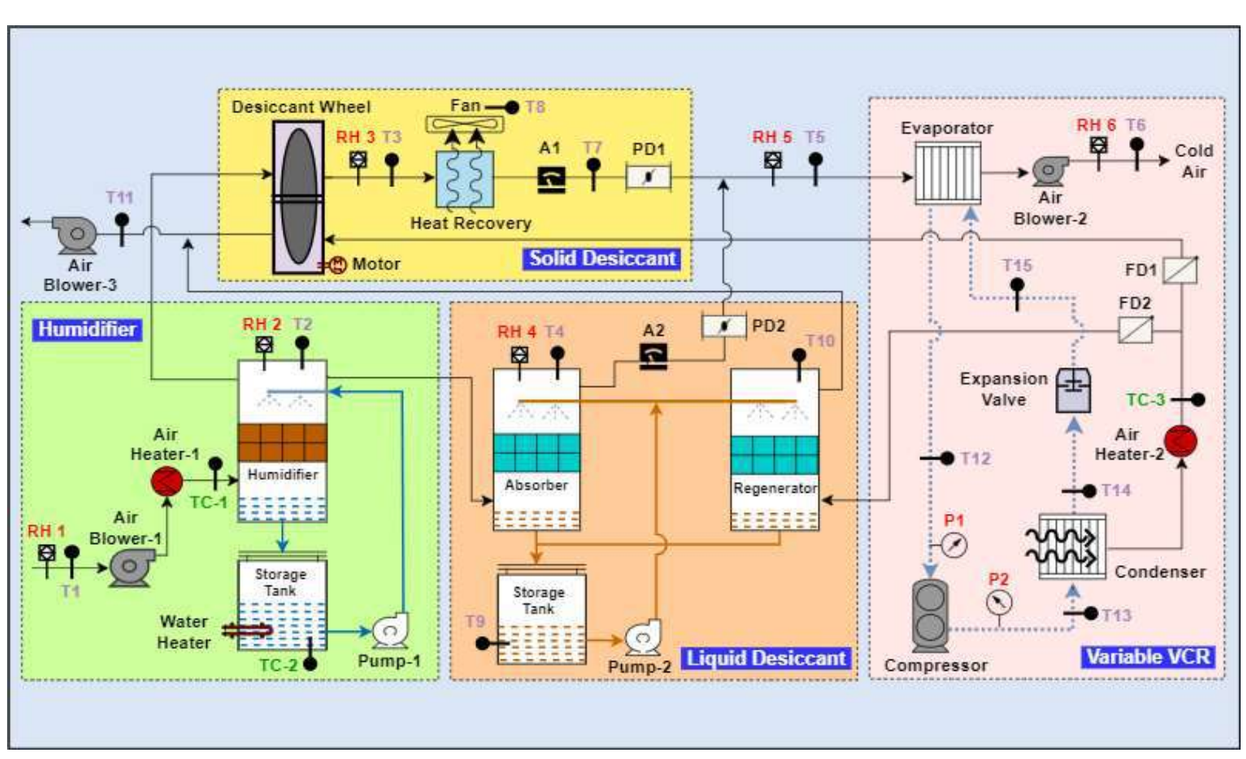
Desiccant assisted Vapour Compression Refrigeration System

Combine solid and liquid desiccant assisted vapour compression refrigeration (VAR) system, allows trainees to investigate the energy saving in conventional VCR system by introducing solid/liquid desiccant to handle latent heat load.

Desiccant based hybrid system

Specifications

- **Desiccant Assembly:** Separate solid and liquid desiccant subassembly with damper arrangement to control the flow of air passing to the desiccant sub system
- **Regeneration Sub System:** Subsystem to utilised condenser waste heat to regenerate desiccant system.
- **Environment Chamber:** Environment chamber to generate air with various temperature and humidity.
- **Variable Frequency Compressor:** Compressor frequency can vary from 35 Hz to 65 Hz according to load.
- **Control Panel:** HMI based control panel to control, monitor and store all operating and performance data.



Salient features

- **Comparative Study :** Enables trainees to evaluate the performance comparison of solid and liquid desiccant with VCR system to identify the energy saving.
- **Study of Desiccant Materials:** Allows comparative studies of different solid and liquid desiccant material to identify the energy saving.
- **Study of Air Temperature and Humidity:** Allows to evaluate the performance of the hybrid system for atmospheric air with different temperature and humidity condition.
- **Study of Regeneration:** Enables trainees to evaluate the performance of the hybrid system with different regeneration condition.
- **Study of Different Combination of Desiccant:** Allows comparative studies between various combination of solid and liquid desiccant subsystem.

Outcome of hybrid system

- **Product and Design Patent :** The product and design patent of the hybrid system is already granted.
- **Seminar & Projects:** Seminar and project work of graduate and post graduate students.
- **Publications :** Conference and journal paper based on the seminar and project work of the students.
- **Ph.D. work:** Students work on the hybrid system for their Ph.D. research (At present 2 student working).
- **Training Program :** To update technicians skills and knowledge of students

Applications of hybrid system

Contact us for more details

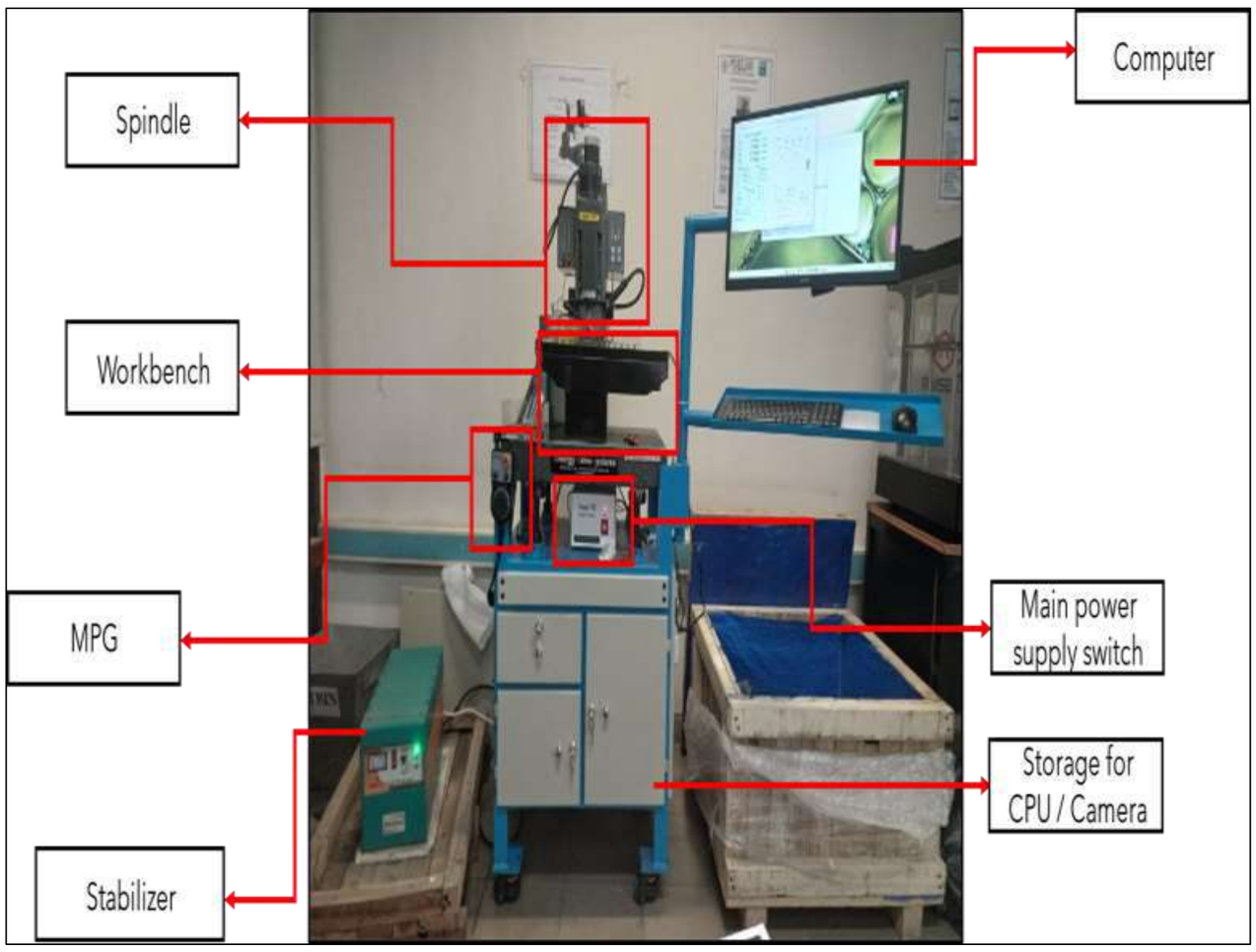
Dr. Vivek K. Patel
Professor, Department of Mechanical Engineering
vivekp@sot.pdpu.ac.in
9427259895

Dr. Rajesh Patel
Associate Professor, Department of Mechanical Engineering
Rajesh.patel@spt.pdpu.ac.in
9687848535

Department of Mechanical Engineering

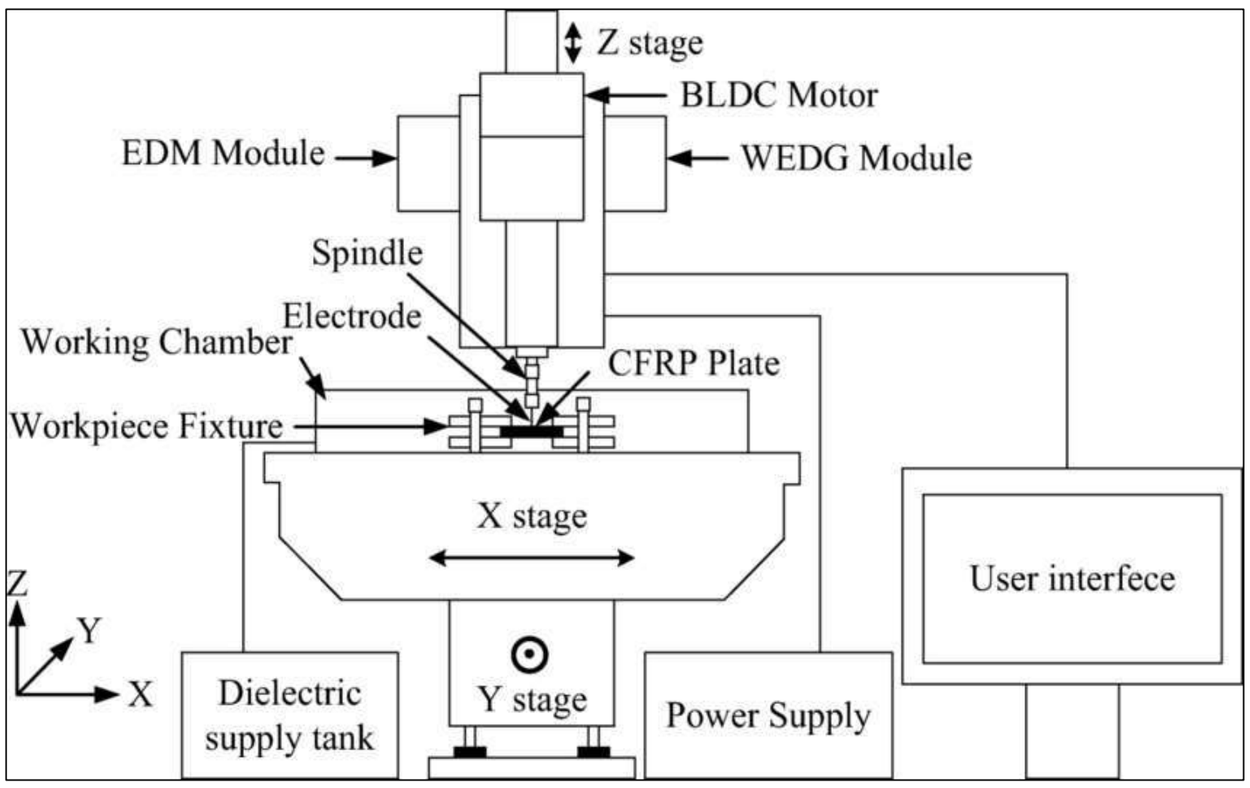
Micro-machine Trainer

Allows Trainees hands-on precision manufacturing experience and enhances their microfabrication research skills



Specifications

- **Work Table Dimensions**: 260mm x 110mm x 100mm
- **Travel Range**: 120mm x 65mm x 65mm
- Spindle Speed: BLDC motor with a speed range of 300 to 3000 RPM
- **Repeatability**: Better than ±5 microns
- **Slide Straightness**: Better than ±3 microns
- **Power Supply**: Switched R-C mode EDM power supply with output voltage range of 25 to 250V
- **Dielectric Storage Tank**: Capacity of 6 liters with a replaceable filter cartridge for reusing dielectric fluid



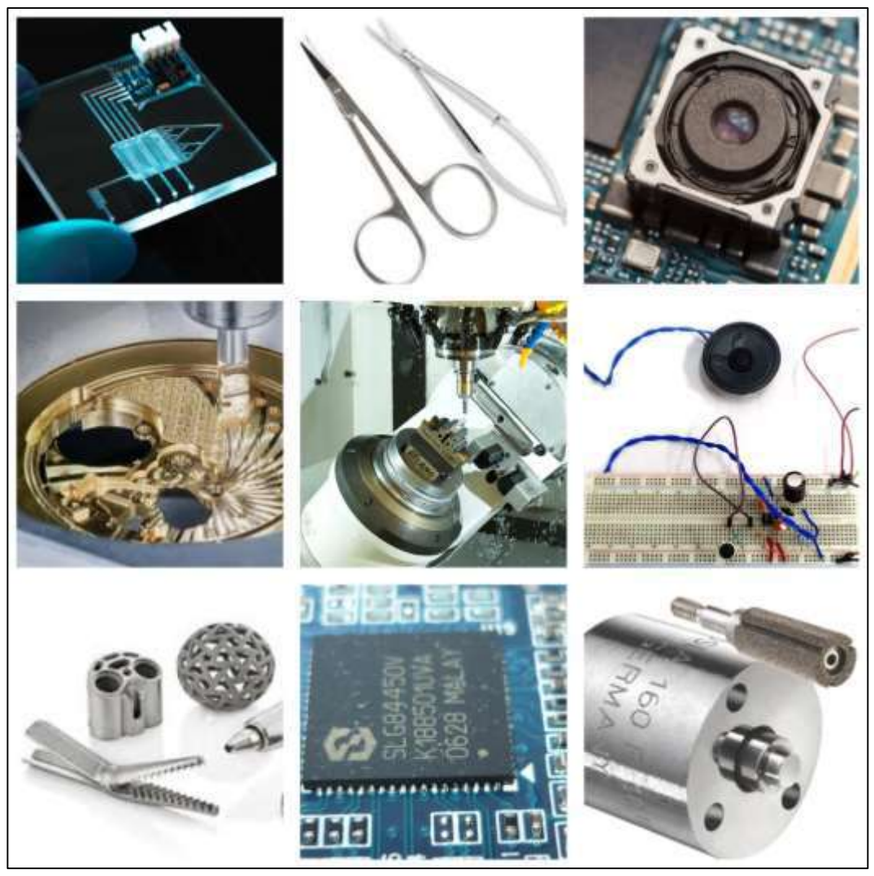
Salient features

- **High Precision**: 0.1-micron resolution step motor and 100 nm programming resolution.
- **Versatile Processing**: Micro turning, milling, drilling, EDM drilling, EDM milling, wire EDM, and wire grinding.
- **Advanced Measurement**: USB 2.0 microscope with 10x to 140x magnification and dedicated software.
- **Comprehensive Control**: Hybrid motion controller, automatic gap control, and NC code compatibility.
- **Robust Construction**: Mounted on a granite bed with passive dampers, and an acrylic tank with 20mm base and 10mm side thickness.

Beneficiaries of the Micro Machine Trainer

- **Engineering Students:** Mechanical, electrical, Micro/Nano engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in Micro/Nano systems.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Micro/Nano systems maintenance personnel training.

Applications of Micro-Machine



Contact us for more details

Dr. Abhishek Kumar
Assistant Professor, Department of Mechanical Engineering
Abhishek.K@sot.pdpu.ac.in
7600652935

Prof. Vishvesh J Badheka
Professor, Department of Mechanical Engineering
Vishvesh.badheka@spt.pdpu.ac.in
9824025256

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Department of Mechanical Engineering

Universal Testing Machine

The fundamental principle of a Universal Testing Machine (UTM) revolves around applying a controlled force to a specimen and measuring the response of the specimen to that force.

Salient features

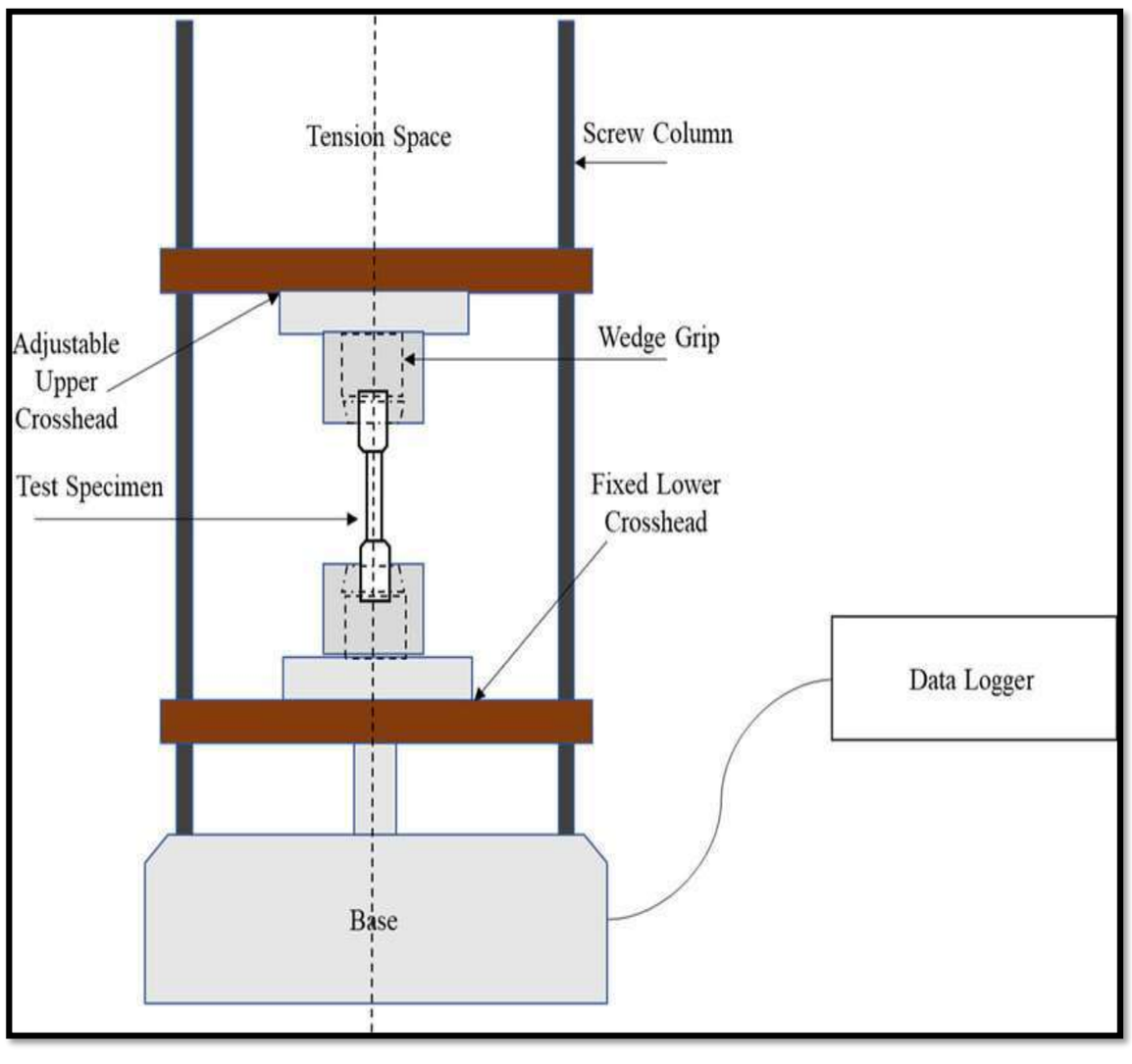
- **Accuracy and Precision:** UTMs are designed to apply forces and measure displacements with high accuracy and precision. This is essential for obtaining reliable and repeatable test results.
- **Controlled Testing Conditions:** Modern UTMs often feature controls for setting test parameters such as loading rate, displacement rate, and holding periods. This ensures that tests are conducted under standardized conditions
- **Data Acquisition and Analysis**: UTMs are equipped with sensors and data acquisition systems to measure load, displacement, and other relevant parameters during testing. This data is analyzed to determine mechanical properties such as tensile strength, yield strength, modulus of elasticity, and ductility.

Specifications

• **Electrical data**	230 V, 3 PHASE
• **Dimensions approx.**	780x360x1600 mm
• **Testing Capacity**	50 KN
• **Weight approx.**	1.5 TON

Beneficiaries

- **Engineering Students:** UG & PG ,PHD
- **Technicians and Practitioners**: Technicians updating skills and knowledge.
- **Industry Professionals:** All mechanical industries
- **Academics and Educators:** University and technical institute educators.



Applications of UTM machine

Contact us for more details

Dr. Vishvesh j Badheka
Professor, Department of Mechanical Engineering
Vishvesh.badheka@spt.pdpu.ac.in
9824025256

Department of Mechanical Engineering

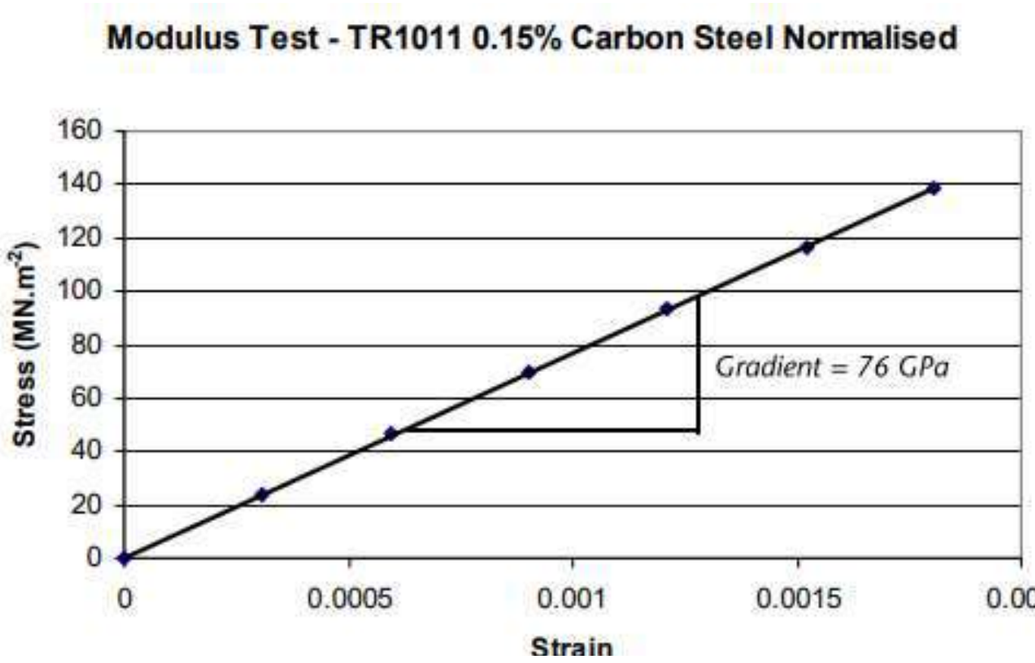
Torsion Testing Machine

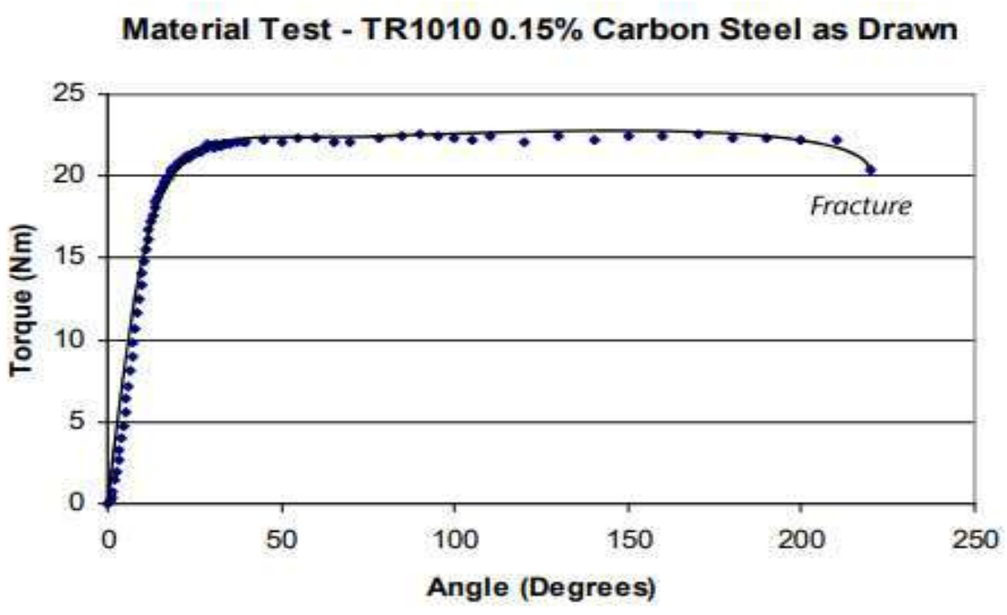
Computer based bench-top trainer allows trainees to determine material properties such as the modulus of elasticity in shear, the torsion yield strength and the modulus of rupture

Torsion Testing Machine

Specifications

- **Maximum Capacity:** 100 Nm
- **Least Count:** 0.1 Nm
- **Torsion Angle Resolution:** 0.01 degree
- **Maximum Effective Test Length:** 300mm
- Suitable for operation on 240V, 50 Hz, Single Phase, AC supply





Salient features

- **Hands-On Practical Training:** Enables trainees to determine material properties such as the modulus of elasticity in shear, the torsion yield strength and the modulus of rupture.
- Easy to operate
- Windows based software for unloading data
- Data downloaded in text, excel and csv format
- Online degree vs torque graph
- Accuracy of Torque measurements ± 1%

Beneficiaries of the Torsion Testing Machine

- **Engineering Students:** Mechanical, Civil, Petroleum, Material Science
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in manufacturing industry.
- **Academics and Educators:** University and technical institute educators.
- **Quality Control Department**
- **Design and Development Teams**.

Applications of Torsion Testing

Torsion testing finds widespread applications in multiple industries, including:

Automotive: Evaluating the torsional behavior of parts like drive shafts and steering columns for safety and performance.

Aerospace: Verifying the reliability of materials and components under torsional loads.

Construction: Assessing the torsional strength of materials like steel and concrete for structural integrity.

Biomechanics: Analyzing the torsional properties of biological materials, such as bone, for medical research and prosthetics.

Quality Control: Ensuring materials and components meet industry standards.

Material Characterization: Determining the strength and ductility of materials like metals and plastics.

Contact us for more details

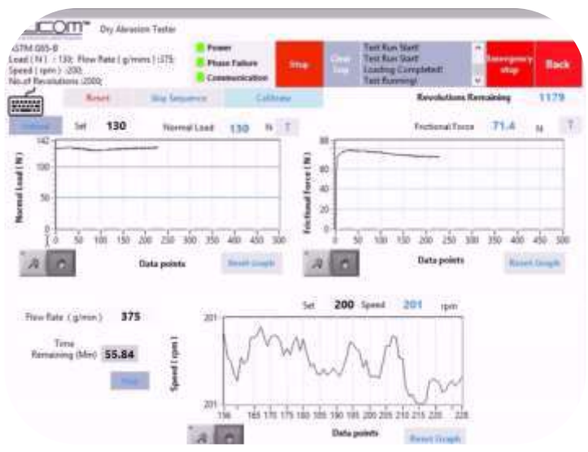
Dr. Nagababu Garlapati
Assistant Professor, Department of Mechanical Engineering
Nagababu.garlapati@sot.pdpu.ac.in
9724013948

Mr. Arvind Makwana
Labstaff, Department of Mechanical Engineering
Arvind.makwana@sot.pdpu.ac.in
9723263190

Department of Mechanical Engineering

Abrasion Tester (Dry and Slurry)

Bench-top trainer, allows trainees to investigate the fundamental principles of Abrasive Wear.



Abrasion Tester (Dry and Slurry)

Technical Specifications

- **Model**: ABT3
- **Load:** 100 N to 300 N (automatic)
- **Speed:** Up to 250 rpm
- **Friction Force:** up to 300 N
- **Duration:** 999,999 rev (Max)
- **Dimension**: L*W 694*650 mm

Test Standards

- **ASTM G65:** Standard Test Method for Measuring Abrasion Using the Dry Sand/Rubber Wheel Apparatus.
- **ASTM G105:** Standard Test Method for Conducting Wet Sand/Rubber Wheel Abrasion Tests.
- **ASTM B611:** Standard Test Method for Determining the High Stress Abrasion Resistance of Hard Materials.

Salient features

- **High Precision:** The tester is a sophisticated instrument to measure wear and friction force between abrading surfaces. The tester utilizes pneumatics for load application.
- **HMI:** The system is fully automated with touch-based HMI for ease of operation.
- **Three-Body Abrasion:** The tester provides easy access to test bodies under three body abrasion.
- **Low-Stress and High Stress Abrasion Tester:** The tester is capable to measure wear under low and high stress conditions.
- **Slurry Abrasion Tester:** The tester is capable to measure abrasive wear in the presence of slurry, which is an extreme form of wear due to the possibility of tribo-corrosion.

Beneficiaries of the Abrasion Tester

- **Engineering Students:** Mechanical (Under graduate, post graduate and doctoral) students.
- **Researchers:** Researchers engaged in the study of abrasive wear and surface engineering.
- **Industry Professionals:** Industry professionals engaged in surface engineering.
- **Academics and Educators:** University and technical institute educators.

Applications of Abrasion Tester

- Ranking of materials with respect to its abrasive resistance (dry and slurry).
- Quality analysis and product development of molding tools used in sand-lime bricks.
- Research in the area of refractory ceramics.
- Abrasive wear resistance of hard face coatings

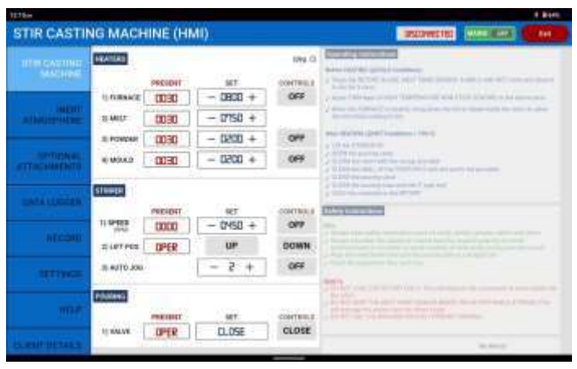
Contact us for more details

Dr. Vishvesh J. Badheka
Professor, Department of Mechanical Engineering
Vishvesh.Badheka@spt.pdpu.ac.in
9824025256

Department of Mechanical Engineering

Stir Casting Machine

Bottom pouring type, allows trainees to investigate the casting process of Aluminum and Magnesium (Al & Mg).



Stir Casting (For Al and Mg)

Technical Specifications

Operating Voltage	400/ 440 VAC
Frequency	50/60 Hz
Power	9.5KW with Earth and Neutral Connection
Capacity	700 gms to 2 Kg of Aluminum or Magnesium
Retort or Crucible	• Type: Fixed with bottom pouring • Material: SS 310 grade • Protective Sleeve: Mild Sleeve
Max. Temperatures for Heaters	• Bottom Pouring Furnace: 1000 ^{0}C • Preheating Furnace (Reinforcement): 800 ^{0}C • Die Preheater: 450 ^{0}C
Stirrer	• Speed: 300 to 1200 RPM variable • Blade & rod material: S.S 310 grade
Control Panel	Human machine interface (HMI) is customized software installed in the laptop / tablet provided along with the machine HMI and the machine is connected by wireless interface

Salient features

- **HMI:** The system is fully automated with touch-based HMI for ease of operation.
- **Four Modules:** Gravity Casting, Vacuum Casting, Rotary (Centrifugal) Casting and Squeeze Casting.
- **Ultrasonic Vibrator:** To enhance the dispersion and distribution of the reinforcing phase within the matrix.
- **Heat Insulation:** Ceramic Fiber for both furnace and preheater.
- All the temperatures of the heaters are controlled by PID logical heating to get the highest accuracy of heating.
- Lift with Auto cut off at max. top & bottom.
- Provision to interchange the stirrer blades.

Beneficiaries of the Stir Casting

- **Engineering Students:** Mechanical (Under graduate, post graduate and doctoral) students.
- **Researchers:** Researchers engaged in the study of liquid sate fabrication and casting.
- **Industry Professionals:** Industry professionals engaged in manufacturing.
- **Academics and Educators:** University and technical institute educators.

Applications of Stir Casting

- It is efficiency, cost-effectiveness, and versatility in various high-performance applications.
- High-Performance Engine Components and Advanced Braking Systems.
- Development of heat exchangers and thermal management devices.
- Marine and defense Technology.
- Sporting Goods and Medical Device Manufacturing

Contact us for more details

Dr. Vishvesh J. Badheka
Professor, Department of Mechanical Engineering
Vishvesh.Badheka@spt.pdpu.ac.in
9824025256

Department of Mechanical Engineering

Computerized Diesel Engine Test Rig

Diesel engine test rig allows trainees to investigate various combustion and performance parameters under various engine operating conditions.

Computerized Diesel Engine Test Rig

Specifications

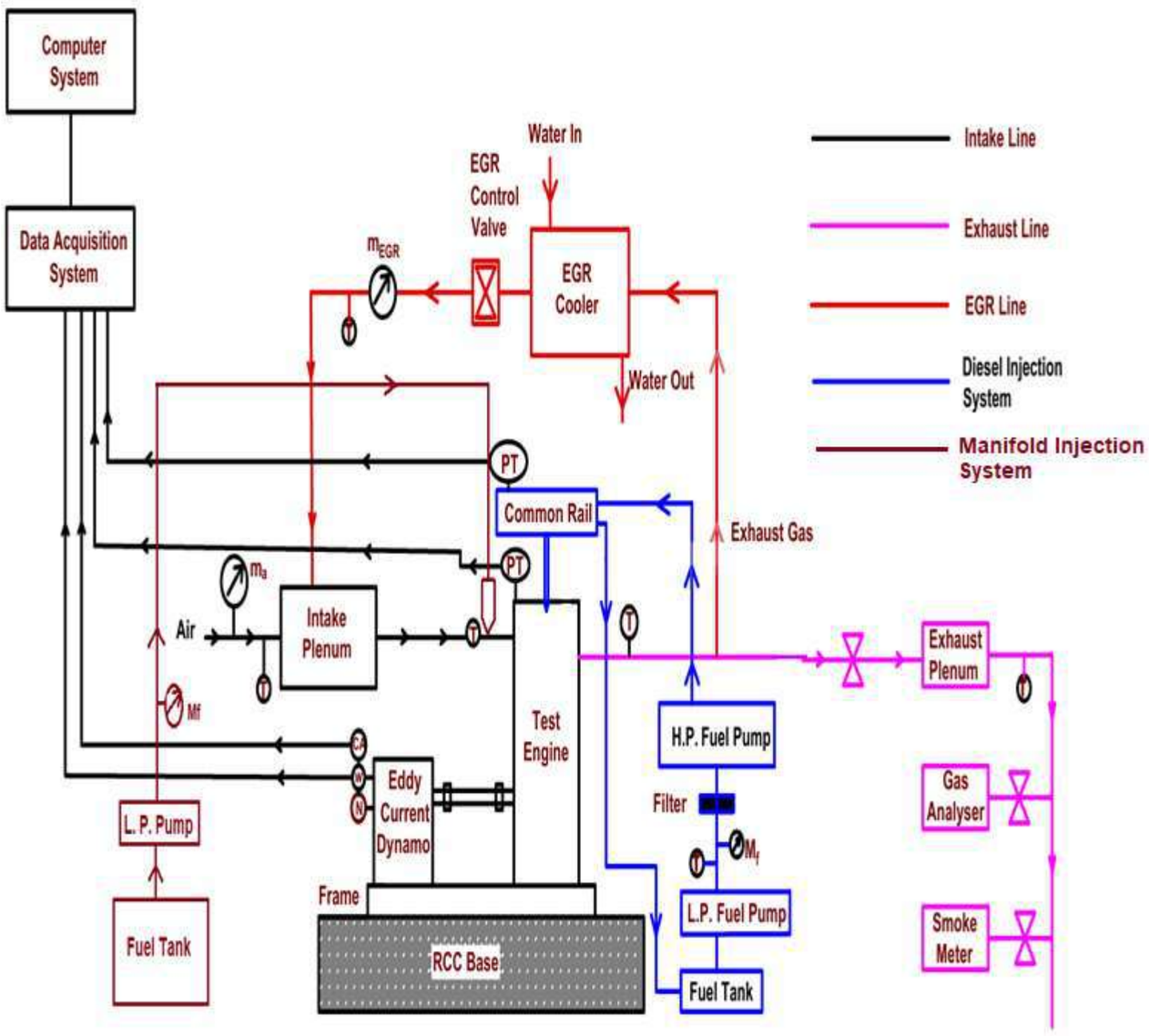
- **Automotive Diesel Engine:** Mahindra Jeeto
- **Pressure Sensor:** Measures combustion pressure.
- **Encoder:** Monitors crank shaft position.
- **Control Panel:** Comprehensive control and monitoring.
- **Multiple Injection:** Maximum 3 injections per cycle.
- **Flow meters:** Flow meters for measuring mass flow rate of air and fuel.
- **Temperature Sensors**: Placed at multiple locations.

Salient Features

- **Engine Coupled with Dynamo:** Eddy current dynamometer allows loading of engine.
- **CRDI System**: The test engine is equipped with common rail direct injection system which offers flexibility in terms of controlling various diesel fuel injection parameters.
- **MPFI System:** The multipoint fuel injection system of the test engine injects fuel inside the intake manifold.
- **Data Acquisition System:** Various combustion and performance parameters of the test engine are acquired using a data acquisition.
- **Flexible Operation:** The test engine can be operated under dual fuel as well as single fuel mode.
- **EGR System:** Exhaust gas recirculation system recirculates part of the exhaust gas back to the intake manifold.

Beneficiaries of the Engine Test Rig

- **Engineering Students:** Mechanical and Automobile engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals working on engines
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Engine maintenance personnel training.



Applications of Diesel Engines

- Automotive
- Agriculture
- Power generation
- Marine propulsion
- Construction equipments

Contact for more details

Dr. Hiren R. Dave
Assistant Professor,
Department of Mechanical Engineering
Hiren.dave@sot.pdpu.ac.in
7096528545

AVL444N Gas Analyzer

Gas analyzer measures various emissions exhausted from the engine tailpipe.

AVL444N Gas Analyzer

Salient Features

- Approved by Automotive Research Association of India (ARAI) - Pune.
- Measures hydrocarbon (HC), carbon monoxide (CO), nitrogen oxides (NO_x), carbon dioxide (CO_2) and oxygen (O_2) from exhaust of engines
- Measures engine rpm
- Automatic zero calibration
- Warm up time less than 2 mins.
- Flexible hosepipe of stainless steel
- LCD display with background illumination

Beneficiaries of the AVL444N Gas Analyzer

- **Engineering Students:** Mechanical and Automobile Engineering
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals working in engine domain
- **Academics and Educators:** University and technical institute educators.

Measuring Parameters/ Range/Accuracy/Resolution

Parameter	Measuring range	Resolution	Accuracy
CO	0-15 % vol	0.01 % vol	±0.02% Abs , ± 3% Rel
CO_2	0-20 % vol	0.1 % vol	±0.3% Abs, ±3% Rel
HC	0-30000 ppm vol	≤ 2000: 1 ppm vol, > 2000: 10 ppm vol	< 2000 ppm ± 4 ppm abs,3%Rel ≥ 2000 ppm ± 5 % Rel
O_2	0-25 % vol	0.01 % vol	±0.02% abs, 1% Rel
NO	0-5000 ppm vol	1 ppm vol	±5ppm abs, 1% rel
Engine speed	400-6000 min^{-1}	1 min^{-1}	± 1 % of ind. val.
Lambda	0-9.999	0.001	± 1 % of ind. val.

Applications of AVL444N Gas Analyzer

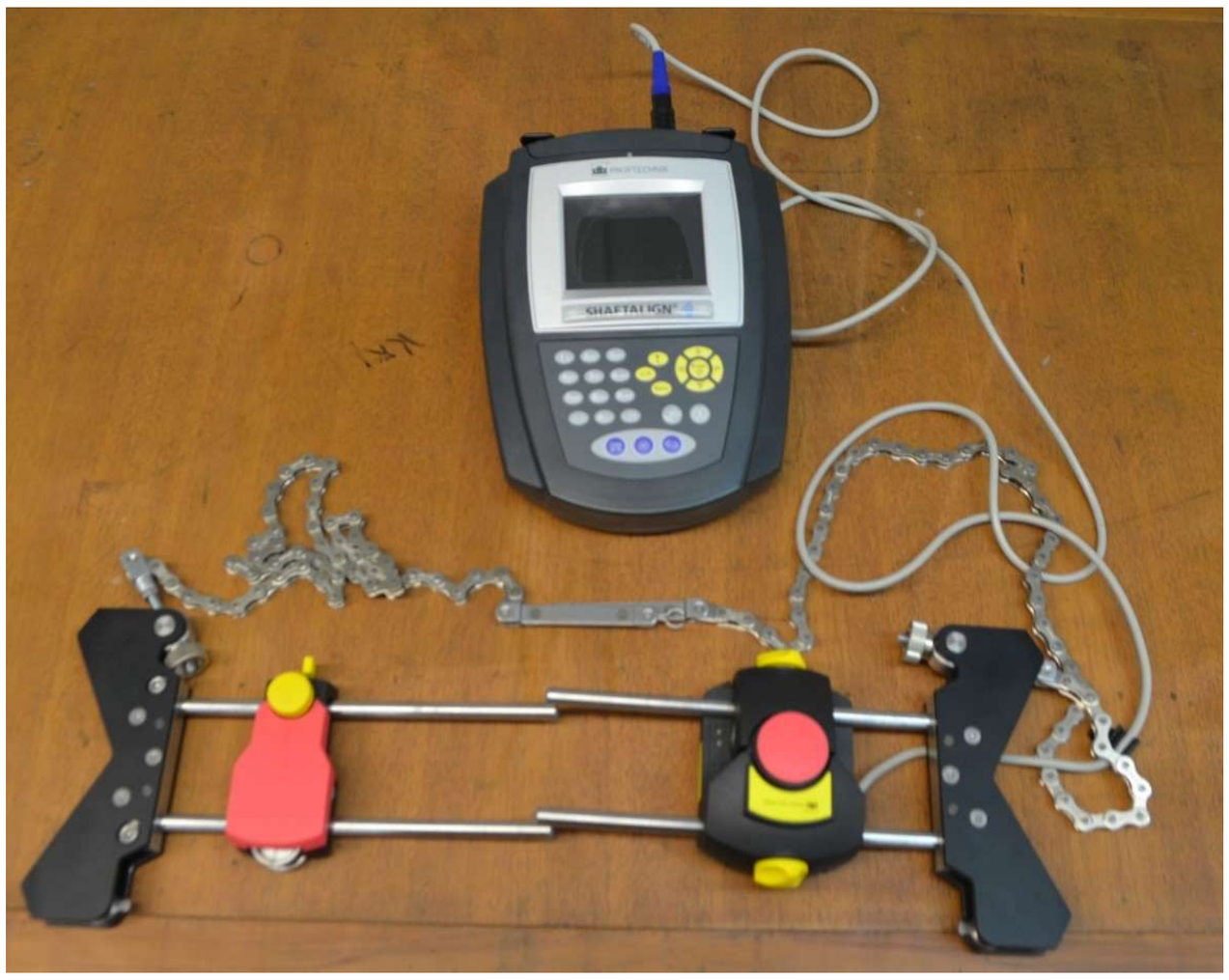
- Measurement of HC, CO, NO_x and CO_2 emissions from exhaust of engines
- Oxygen content of exhaust of engines

Contact for more details

Dr. Hiren R. Dave
Assistant Professor,
Department of Mechanical Engineering
Hiren.dave@sot.pdpu.ac.in
7096528545

Laser-based shaft alignment instrument

Allows trainees to investigate the bearing fault diagnosis and prognosis in Machinery Fault Simulator.



Laser-based shaft alignment instrument

Specifications

- **CPU:** Intel XScale PXA270 running at 520 MHz
- 64 MB RAM, 64 MB Flash.
- **Display**: Type- TFT, Resolulation-320 x 240 Pixel, Dimensions-89 mm [3,5"] diagonal
- **Power Supply:** 5 x 1.5 V IEC LR6 ("AA") with typical operating time of 9 hours.
- External interface: USB host & USB slave, RS232 (serial) for transducer, AC adapter/charger socket
- **Temperature Range**: Operation -10°C to 50°C
- **Dimensions**: Approx. 220 x 165 x 45 mm
- **Weight**: 742 g

Laser-Based Shaft Alignment for Motor Coupler shaft

Salient features of SHAFTALIGN® OS3

- **Active clock measurement mode**: Intelligent and precise alignment occurs because of the activated MEMS inclinometer used in this measurement mode. Measurements can be taken at any 3 (or 4) positions and the sensor angular position is automatically considered.
- **SWEEP measurement mode**: SHAFTALIGN® OS3 takes continuous readings to accurately determine the alignment condition of a shaft rotating at an angle as little as 60°. Automatic evaluation of alignment Dynamic tolerances through TolChek® evaluate the alignment condition based upon the machine RPM.
- **Live Move**: Both horizontal and vertical coupling and foot results are automatically calculated. The machine graphics show the direction and the correction value of feet to be moved. During Live Move, it continuously measures the corrections.

Beneficiaries of the Laser-based shaft alignment instrument

- **Engineering Students:** Mechanical, Automobile engineering students.
- **Industry Professionals:** Industry professionals dealing with Rotational Dynamical Systems.
- **Academics and Educators:** University and technical institute educators.

Applications of Shaft Alignment Instrument

Contact us for more details

Dr. Vinay Vakharia
Associate Professor, Department of Mechanical Engineering
Vinay.Vakharia@sot.pdpu.ac.in
8359881214

Dr. Manjeet Keshav (Lab-in-Charge)
Assistant Professor, Department of Mechanical Engineering
Manjeet.Keshav@sot.pdpu.ac.in
9501334684

Department of Mechanical Engineering

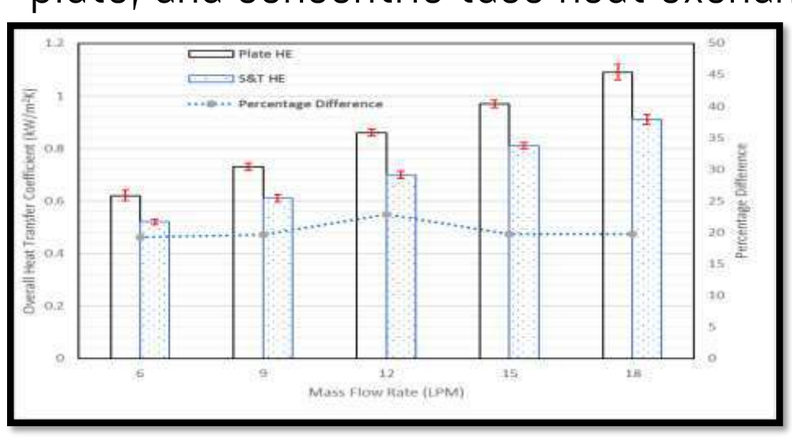
Multi-Heat Exchanger Test Rig

Bench-top trainer, allows trainees to investigate the performance of Heat Exchangers.

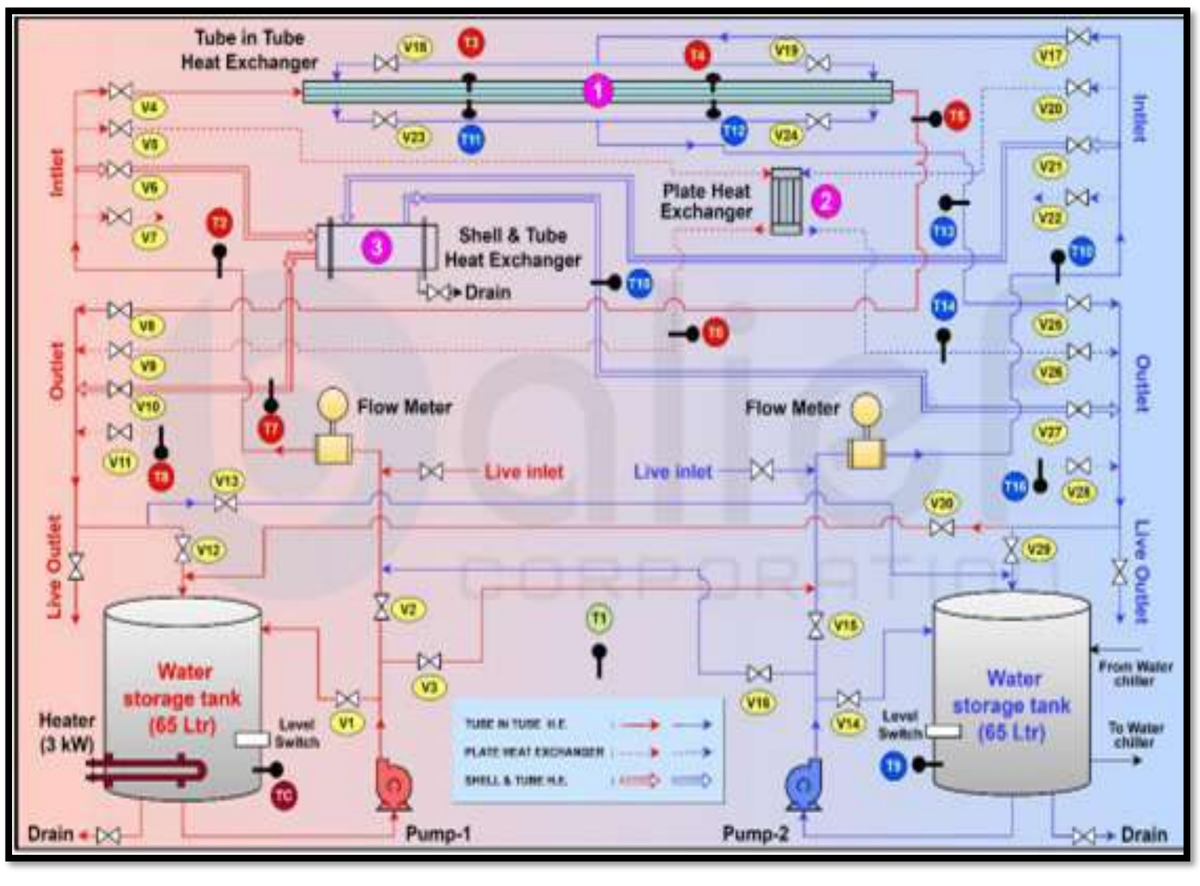
Multi-Heat Exchanger Test Rig

Specifications

- **Interchangeable Modules**: Allows for flexible combinations of heat exchangers.
- **High-Performance Pumps**: Features Lubi SMSJ 051 model pumps with 0.5 HP/0.37 kW and 18 m head.
- **Flow Measurement**: Utilizes an Accumax electromagnetic flow meter with a range of 0-150 LPM.
- **Multiple Heat Exchanger Types**: Includes shell and tube, plate, and concentric tube heat exchangers.



Schematic diagram of Multi-Heat Exchanger Test Rig



Salient features

- **Industrial-Grade Components**: Features a pre-installed shell and tube heat exchanger with a 0.3 m² heat transfer area, an Alfa Laval CBH16-25H plate heat exchanger with a 0.5 m² heat transfer area, and a concentric tube heat exchanger with a 0.15 m² heat transfer area.
- **Educational Utility**: Utilizes pre-installed heat exchangers for undergraduate courses focused on heat transfer.
- **Flow Pattern Flexibility**: Offers provisions for changing the flow pattern to either parallel or counter, along with the option to switch hot and cold water between inside or outside tubes.
- **Advanced Monitoring**: Equipped with RTD PT-100 type thermocouples and a Multispan UTC121P data logger for precise temperature measurement and monitoring.
- **Research and Testing Opportunities**: Provides connections to test any heat exchanger, supporting postgraduate research and consultancy projects.

Beneficiaries of the Test Rig

- **Engineering Students**: Beneficial for students in mechanical, chemical, and energy engineering programs.
- **Technicians and Practitioners**: Ideal for technicians looking to enhance their knowledge and skills in heat exchanger systems.
- **Industry Professionals**: Suitable for professionals in the heat transfer and process industries.
- **Academics and Educators**: Valuable for university and technical institute educators involved in teaching heat transfer concepts.
- **Research and Development Personnel**: Useful for R&D personnel conducting advanced studies and experiments on heat exchangers.
- **Consultancy and Project Engineers**: Supports engineers involved in consultancy and project-based applications.

Heat Exchanger Performance testing

Contact us for more details

Dr. Rahul Deharkar
Asst. Professor, Department of Mechanical Engineering
Rahul.deharkar@sot.pdpu.ac.in
8141145618

Dr. Vivek K. Patel
Professor, Department of Mechanical Engineering
vivekp@sot.pdpu.ac.in
9427259895

Organic Rankine Cycle Test Rig

Sophisticated test rig to understand the working principle and fundamentals of heat transfer and Rankine cycle

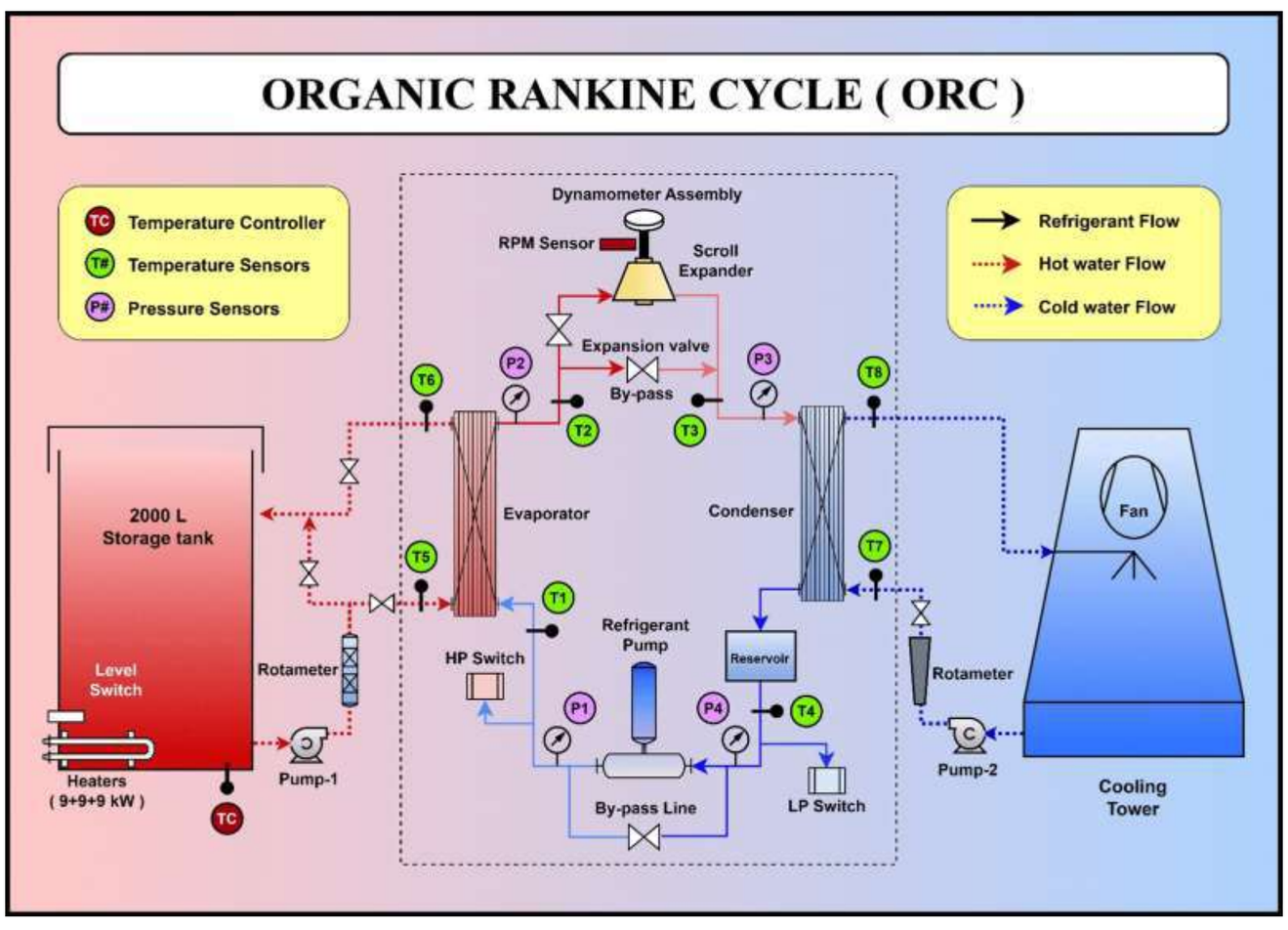
Organic Rankine cycle experimental setup

Salient features

- **Hands-On Practical Training:** Allows users to understand the real time working of organic Rankine cycle
- **Compatibility:** Suitable for low temperature waste heat applications and can be used with different type of energy sources.
- **Flexible and Modular Design:** Interchangeable HEXs, refrigerants and input heat source.
- **Compact and Automated :** Compact plug and play type system with automatic data logging.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.

Specifications

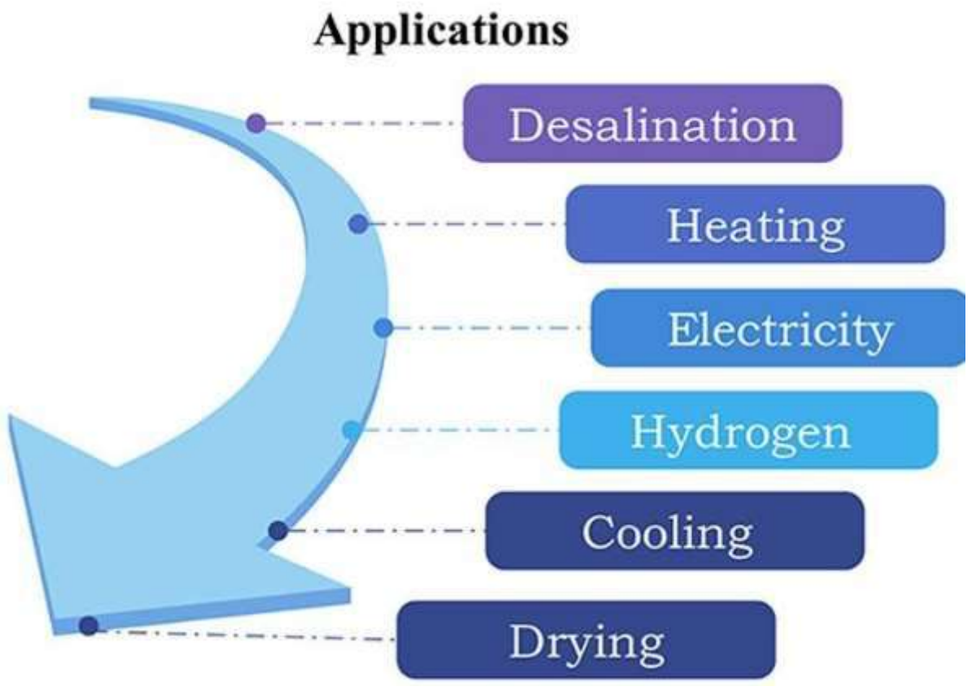
- **Expander:** Semi hermatic scroll expander, 5kW
- **Heat exchangers:** Evaporator and condenser, Brazed plate heat exchangers
- **Refrigerant pump:** Mulit-stage centrifugal, 2 m^3/hr.
- **Energy and Temp Display:** Monitors system performance.
- **Insulated storage tank:** Storage of hot water/oil to be used as heat source.
- **Control Panel:** Comprehensive control and monitoring.
- **Pressure Gauges:** High and low-pressure monitoring.
- **Temperature Sensors**: Multiple sensor locations for accurate data



Beneficiaries of the ORC System

- **Engineering Students:** Mechanical, chemical, thermal engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in power engineering systems.
- **Academics and Educators:** University and technical institute educators.

Applications of ORC system



Contact us for more details

Dr. Parth Prajapati
Assistant Professor, Department of Mechanical Engineering
Parth.prajapati@sot.pdpu.ac.in
9978978788

Dr. S S Kachhwaha
Professor, Department of Mechanical Engineering
Surendra.singh@sot.pdpu.ac.in
7567622800

Department of Mechanical Engineering

X-Ray Film viewer

The film reviewer illuminates the film to enable the Radiography inspector get details about the defect in the component

X-Ray Film viewer

Specifications

- **Viewing area :** 16" x 4", to view film with density up to 5.0.
- **Voltage:** 230V
- **Foot switch:** Shock proof plug in foot switch.
- **Brightness**: Automatic electronic brightness control.

Salient features

- **Luminance:** Capability to provide high luminance for excellent reproduction of features of the X-Ray film.
- **Energy saving:** Works on principle of energy saving to enable long hours of usage.
- **Ease of use:** Allows students to easily use the same as it is with a foot paddle.
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises of ascertaining correct defects in the components.

Beneficiaries of the machine

- **Engineering Students:** Mechanical, electrical, metallurgy engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in manufacturing and NDT domain.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Manufacturing components maintenance personnel training.

Application of X-Ray film viewer

Contact us for more details

Dr. Jaykumar Vora
Assistant Professor, Department of Mechanical Engineering
Jay.vora@sot.pdpu.ac.in
9099962298

Dr. Rakesh Chaudhari
Assistant Professor, Department of Mechanical Engineering
Rakesh.chaudhari@spt.pdpu.ac.in
9712571197

Department of Mechanical Engineering

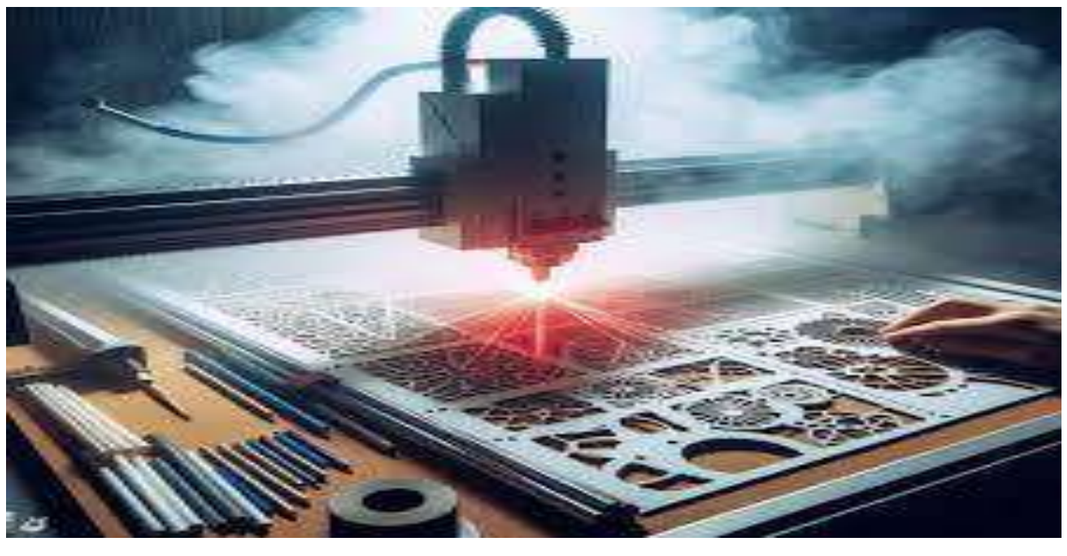
LASER MACHINE GALAXY 1000

The 3-in-1 LASER machine allows the user to navigate between 3 process i.e. LASER cutting, LASER welding and LASER cleaning .

3-in-1 Laser machine

Specifications

- **Power :** CW fibre laser with 1000 W capacity and touch screen controller
- **Capability:** Welding, cutting and cleaning
- **Beam diameter:** 0.2-8 mm diameter with argon gas supply.
- **Wavelength:** 1064nm with wire feeder capable of handing wire of sizes 00.8 – 2.0 mm
- **Chilling facility:** Equipped with Industrial water chiller
- **Machine power:** 6kW.
- **Temperature** : Working temperature of 0°C to 40°C



Salient features

- **One stop solution:** Capability to undergo three different process at a single station.
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like laser welding, laser cutting and laser cleaning.
- **Ease of use:** Allows students to easily maneuver the torch to get exact cut/weld/clean area.
- **Accurate parameter setting:** Machine equipped with machine peripherals and the arrangements to give same output at the desired inputs.
- **Modular torch Design:** Interchangeable torch and its fittings to give different process from a single source.

Beneficiaries of the machine

- **Engineering Students:** Mechanical, electrical, metallurgy engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in manufacturing domain.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Manufacturing components maintenance personnel training.

Application of 3-in-1 Laser machine

Contact us for more details

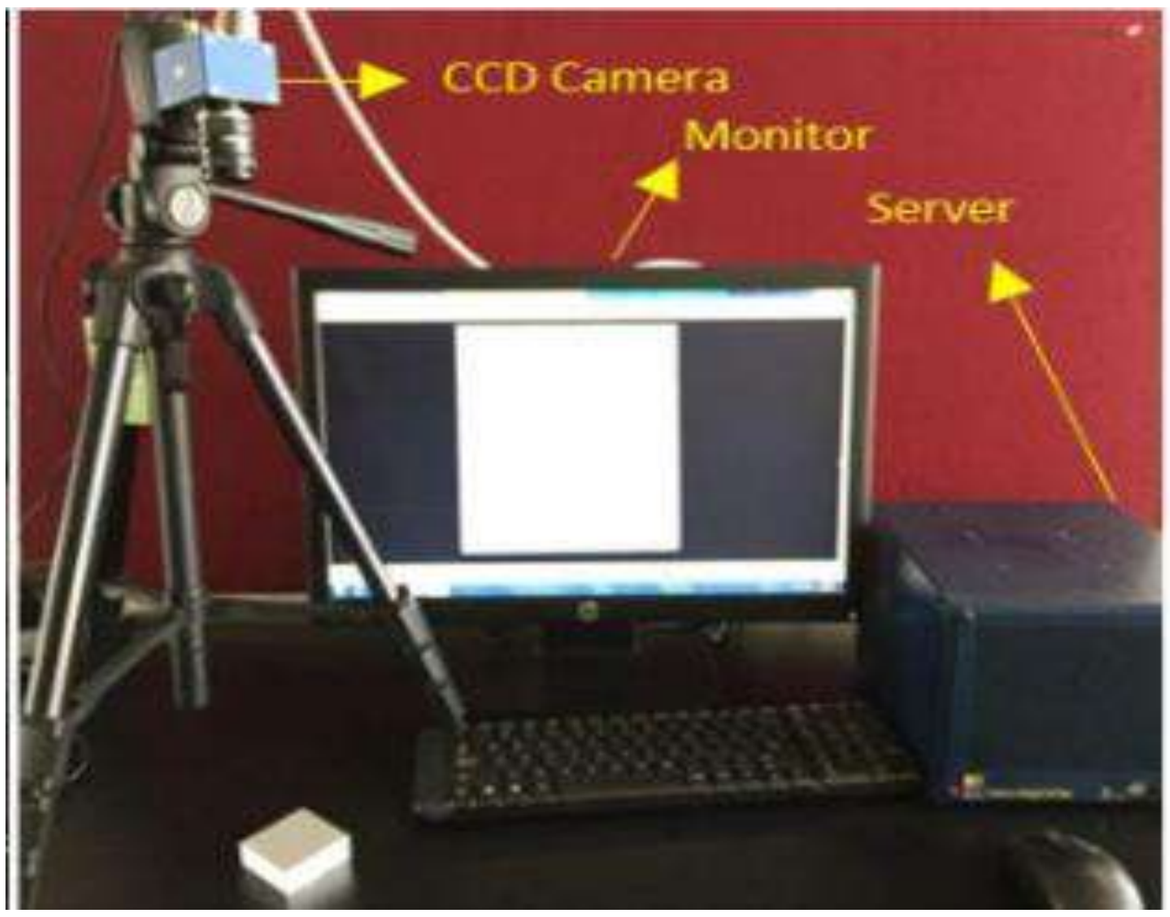
Dr. Jaykumar Vora
Assistant Professor, Department of Mechanical Engineering
Jay.vora@sot.pdpu.ac.in
9099962298

Dr. Rakesh Chaudhari
Assistant Professor, Department of Mechanical Engineering
Rakesh.chaudhari@spt.pdpu.ac.in
9712571197

Department of Mechanical Engineering

Machine Vision-Based Inspection System

The machine vision system allows trainees/end users to inspect machined components for (1) Dimensions (2) Surface texture (3) Defect identification, (4) Tolerances (5) Geometrical features



Machine Vision-Based Inspection System

Specifications

PURCHASE ORDER NO: PDPU/14-15/IT/SOT /Vision System - 001 Kind Attn: Mr. Amitkumar Sharma			DATE: 12/03/2015
Vendor:	M/s Benchmark Electronic Systems Pvt. Ltd 5C, East Ellaiamman Koil Street, Kottur, Chennai – 600085. India Ph: +91 44 2447 0014	Bill & ship to:	Pandit Deendayal Petroleum University At Post Raison Village, Gandhinagar - 382007

Sr. No	Product/Software	Part code	Qty	Benchmark	
				Unit Price in Rs.	Amount in Rs.
1	Matrox Solios Single Medium / Dual-Base, up to 85 MHz, Camera Link® x4 PCIe frame grabber with 256 MB DDR SDRAM and MDR26 (original CL) connectors. Includes cable adaptor (aux. I/O).	SOL 2M EV CLBL*	1	1,36,290	1,36,290
2	SVS-VISTEK Camera with 1600 x 1200 Pixel, 14Bit (ADC), 1Tap, 25Hz, 1/1.8" CCD Colour Camera, with Standard Lens, Power Supply, Camera Link Cable for 5m Length, Tripod Stand	svs274CUCP	1	3,95,350	3,95,350
3	Matrox MIL 10 development tookit for 32-bit Windows® XP/7/8 and 64-bit Windows® 7/8. Includes DVD with MIL, Matrox Intellicam, Matrox Inspector (32- bit), Matrox display drivers and on-line documentation. Also includes one (1) license USB hardware key and MIL Maintenance registration number.	MIL X WIN P U	1	2,75,200	2,75,200
4	Matrox 4Sight GP integrated unit with Intel Core i7-3770, 8GB DDR3 RAM, 500GB hard drive, Microsoft Windows Embedded Standard 7 (32-bit and 64-bit) and 300W power Supply with appropriate power cords. Pre-licensed for MIL Interface and DMIL packages. E for European power cord. 19 LCD monitor or equivalent. Keyboard and Mouse.	4GPI7M8*	1	4,52,380	4,52,380
			Total Amount		12,59,220

Funded Projects

AICTE Project No.: 20/AICTE/RIFD/RPS(POLICY-III)29/2012-13

Consultancy Projects

- Grindwell Norton India Pvt.Ltd, Bangalore
- Siddhi Industries, Ahmedabad

Salient features

- **Hands-On Practical Training:** Enables trainees to measure(1) machined components for dimensions, (2) Geometrical features (e.g. Angularity, Straightness, etc.) (3) Surface roughness parameters (4) Defect identification
- Easy to operate
- Windows-based software MATROX IMAGER
- Data downloaded in text, excel and csv format
- Accuracy of Dimensional measurements ± 0.85%

Beneficiaries of the Machine Vision System

- **Engineering Students:** Mechanical, Civil, Petroleum, Material Science
- **Technicians and Practitioners:** Technicians wanting to update skills and knowledge.
- **Industry Professionals:** Industry professionals in the Manufacturing/Automobile/Machine Tool industry.
- **Academics and Educators:** University and Technical institute educators.

Applications of Vision System

Vision System finds widespread applications in multiple industries, including:

Automotive: Evaluating the functional assessments of parts like drive shafts and steering columns by measuring the dimensions, tolerances, and surface finish.

Aerospace: Texture analysis of Aerospace components such as turbine blades etc. can be undertaken.

Machine Tool Manufacturing: Assessing the surface roghness, dimensional and tolerance of components made of steel and other materials (e.g. Milling Cutter, etc.)

Biomedical: Analyzing the textural properties of biological materials, such as bone, and tissues for medical research and prosthetics.

Quality Control: Ensuring materials and components meet design specifications.

Contact us for more detail

Dr. M.B.Kiran
Associate Professor, Department of Mechanical Engineering, SoT, PDEU
MB.Kiran@sot.pdpu.ac.in
9845688950

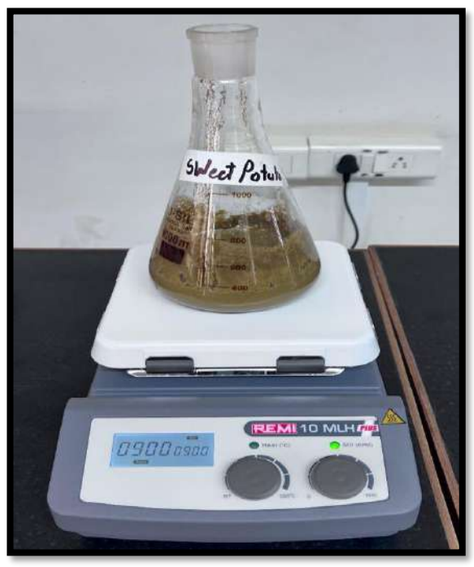
Mr. Arvind Makwana
Labstaff, Department of Mechanical Engineering,SoT,PDEU
Arvind.makwana@sot.pdpu.ac.in
9723263190

Nano powder Chemical Synthesis System

Preparation and composition of nanostructures (powders) for engineering applications

Heating oven

Ultrasonicator



Hot plate with magnetic stirring

Hydrothermal reactor

Specifications

- **Heating oven:** 1500 W heating capacity, upto 250 ^{o}C
- **Ultrasonicator:** Stirring speed 100 rpm to 1500 rpm, power rating 1000W, temperature range 50 to 500 ^{o}C.
- **Ultrasonicator:** Bath type, 2 Litres, Frequency 40 kHz,
- **Hydrothermal reactor:** Operating temperature < 200 ^{o}C, operating pressure < 30 bar, heating and cooling rate – 5 ^{o}C

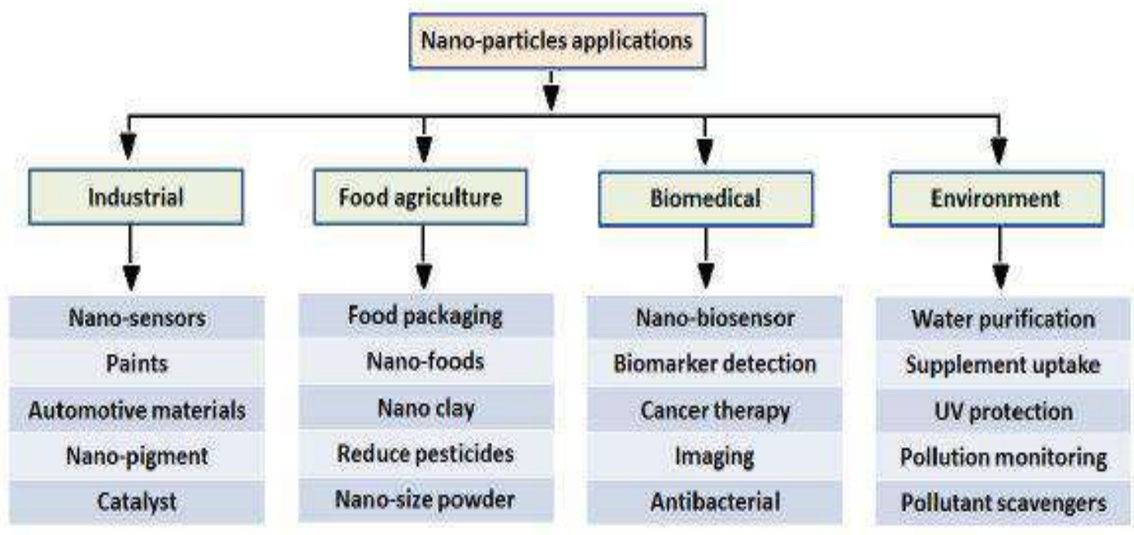
Salient feature

- **Controlled functionality –** Easy control of operating parameters
- **Hands-On Practical Training:** Allows users to understand the synthesis process of different nanopowders
- **Compatibility:** Variable speed control and continuous temperature detection within accurate range
- **Flexible and Modular Design**
- **Compact and Automated system**

Beneficiaries of the synthesis system

- **Engineering Students:** Mechanical, chemical, thermal engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in mechanical and chemical engineering systems.
- **Academics and Educators:** University and technical institute educators.

Applications of Nanoparticles



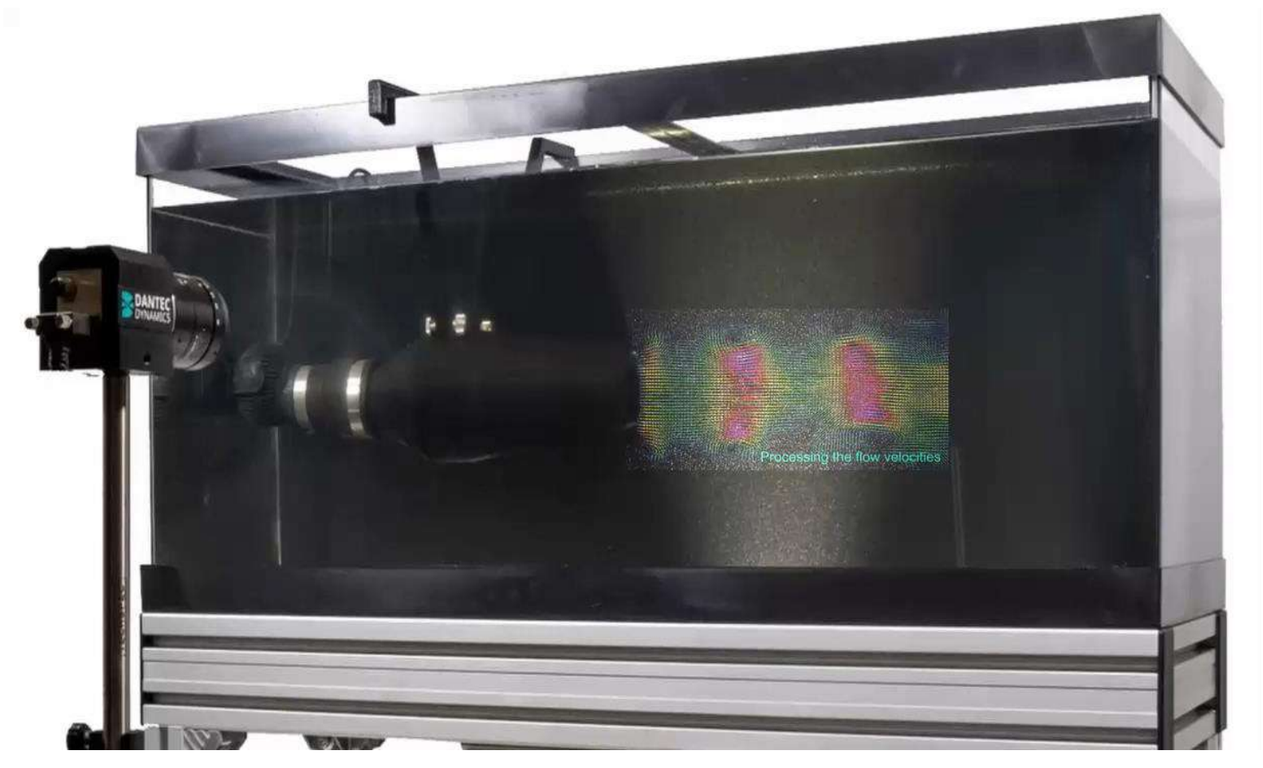
Contact for more details

Dr. Parth Prajapati
Assistant Professor, Department of Mechanical Engineering
Parth.prajapati@sot.pdpu.ac.in
9978978788

Department of Mechanical Engineering

PIV system for Liquid with computer and simulation system

Bench-top trainer for analyzing fluid flow with PIV technology, integrated with computer and simulation for enhanced learning.



PIV system

Specifications

Beneficiaries of the Test Rig

Industry Professionals:

•Suitable for professionals working in fields related to fluid dynamics, process engineering, and industrial applications of PIV technology.

Academics and Educators:

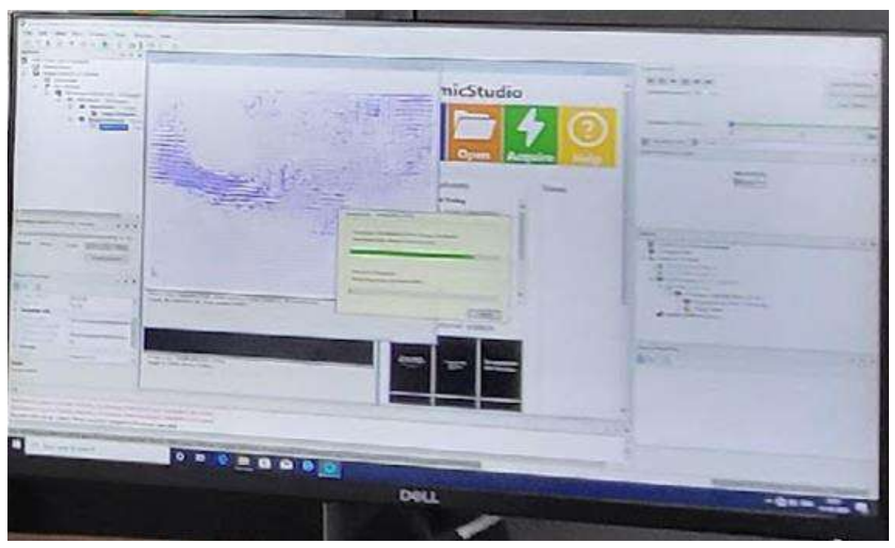
•Valuable for university and technical institute educators involved in teaching fluid mechanics and flow visualization concepts.

Research and Development Personnel:

•Beneficial for R&D personnel conducting advanced studies and experiments on fluid flow using PIV technology.

Consultancy and Project Engineers:

•Supports engineers involved in consultancy and project-based applications requiring detailed fluid flow analysis and visualization.

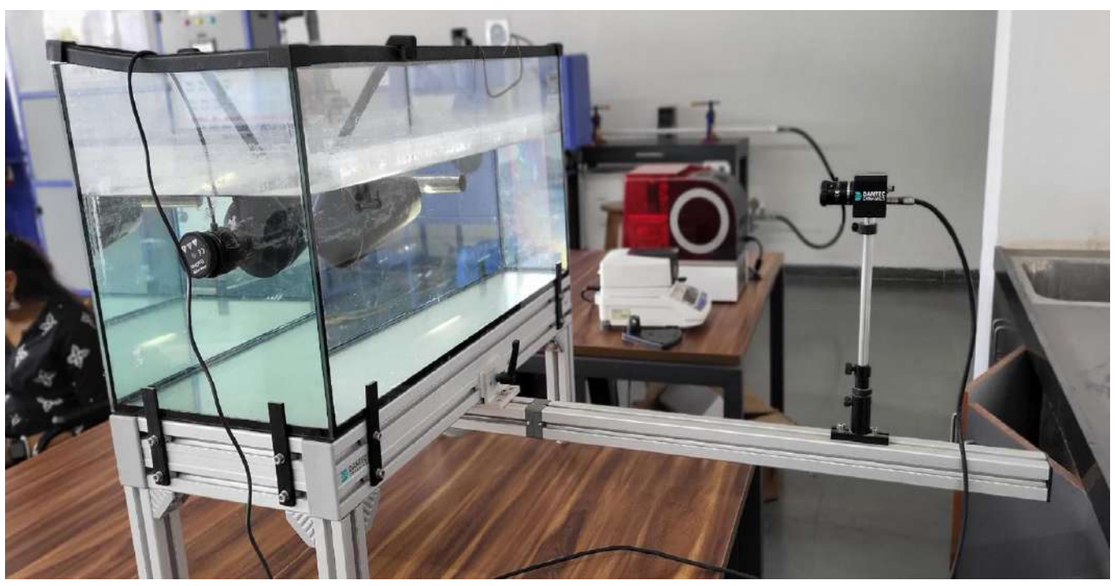


Data Visualization using PIV system

Scan QR for additional Information

Salient features

- **Complete, Pre-Configured PIV Systems:**
  - Ready-to-use PIV systems for educational and research applications.
  - Delivered with a flow loop for generating steady, periodic, or pulsed jet flow.
- **High-Resolution Imaging:**
  - USB-based 2MP cameras offering 165 frames per second (fps) without the need for a synchronizer.
  - Eye-safe LED illumination and light sheet optics for clear and safe visualization.
- **Educational Software:**
  - DynamicStudio EduPIV software included for comprehensive data analysis and learning.
  - Flow loop includes seeding particles to enhance flow visualization.
- **EduStereoPIV Upgrade:**
  - An additional camera for stereo PIV, providing 3D flow visualization.
  - Scheimpflug mounts for maintaining the field of view during camera tilting.
  - Bright 35mm f2.0 full format lenses for high-quality imaging.
  - Simple double-layer, double-sided target for automated calibrations.
  - Stereo PIV software add-on for advanced analysis.



Pictorial View of PIV system at PDEU

Contact us for more details

Dr. Rajesh Patel
Professor, Department of Mechanical Engineering
Rajesh.Patel@sot.pdpu.ac.in
9687848535

Dr. Vivek K. Patel
Professor, Department of Mechanical Engineering
vivekp@sot.pdpu.ac.in
9427259895

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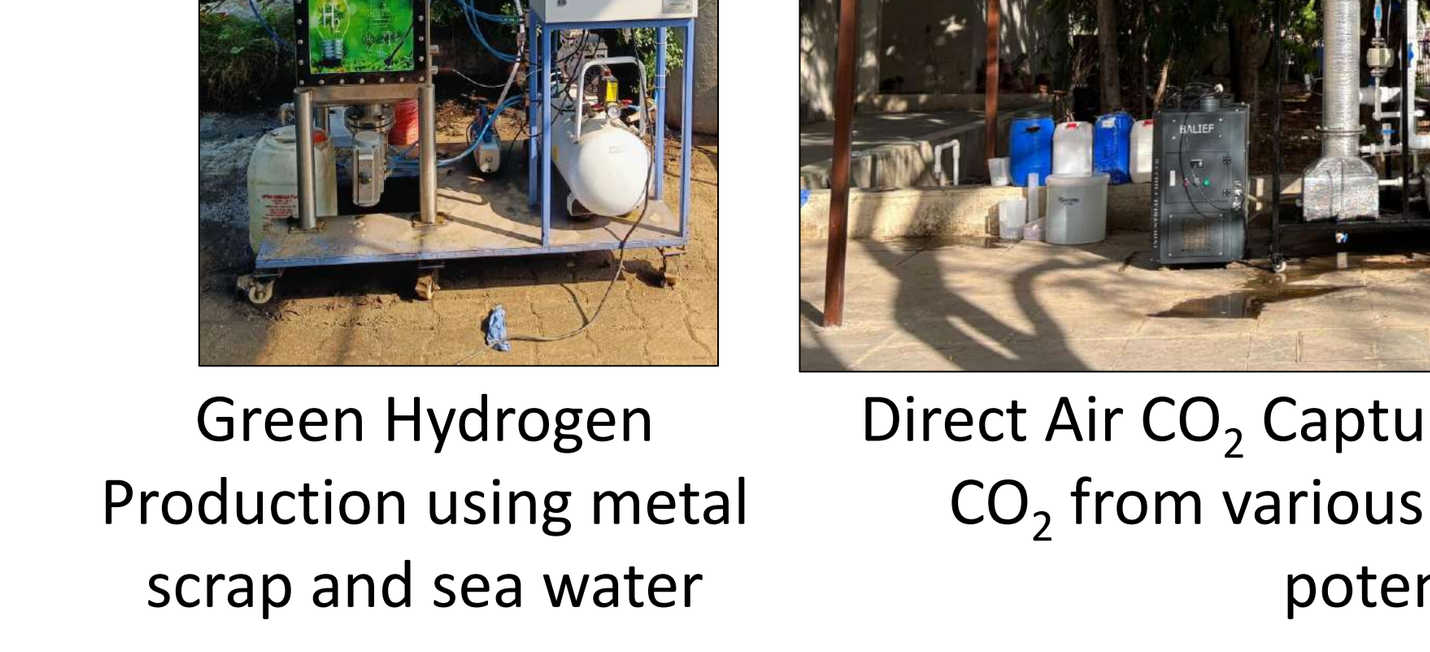
Green Hydrogen Production, Direct Air CO_2 Capture & Battery Recycling

PANDIT DEENDAYAL ENERGY UNIVERSITY
A RESERVOIR OF KNOWLEDGE

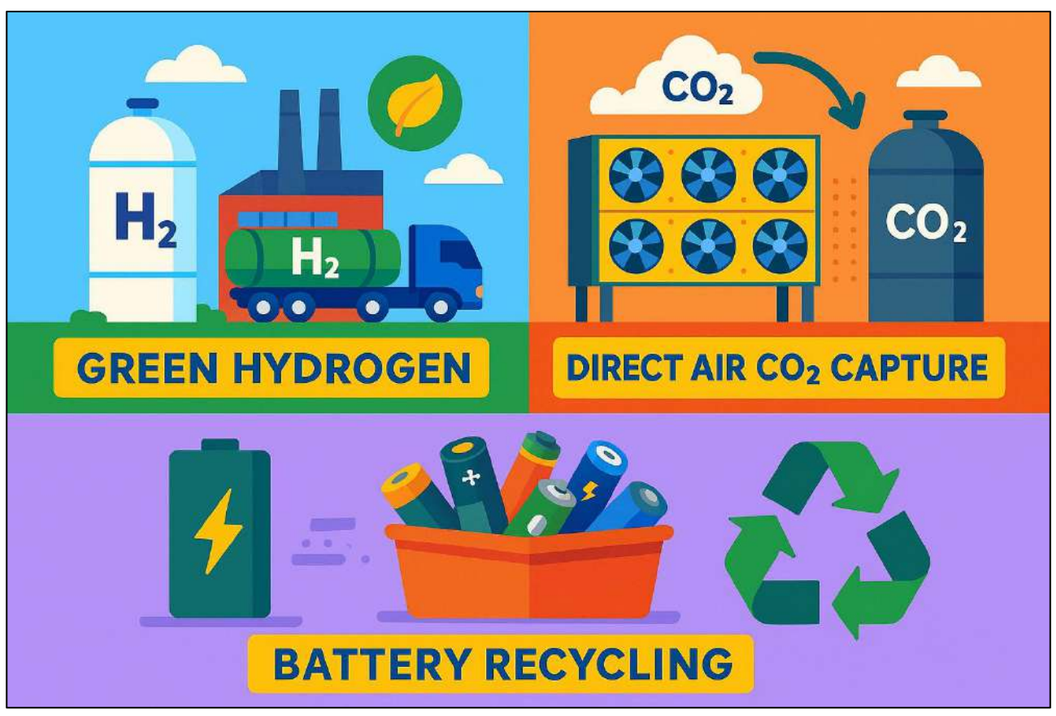
Green Hydrogen Production using metal scrap and sea water

Direct Air CO_2 Capture Plant – Enable to capture CO_2 from various locations using different potential solvents



Battery Tester – Evaluates battery performance, health, and efficiency

Applications of Projects



Salient Features of the projects

1. Green Hydrogen Project

- ✓ Produces hydrogen using **seawater and metal scrap**, without electricity.
- ✓ Emphasizes low-carbon footprint and renewable resource utilization.

2. Direct Air CO_2 Capture Project

- ✓ Employs chemical or physical sorbents to capture CO_2 from ambient air.
- ✓ Designed for scalable and energy-efficient CO_2 removal.

3. Battery Recycling Project

- ✓ Focuses on recovering valuable materials from used batteries.
- ✓ Develops cost-effective and sustainable recycling methods.

Financial Support By

We acknowledge the financial support of Shell Energy India Pvt. Ltd. And Dept. of Mechanical for conducting this research work.

Contact us for more details

Dr. Ramesh K. Guduru
Associate Professor, Department of Mechanical Engineering
Ramesh.Guduru@sot.pdpu.ac.in
+91 8555931327

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Department of Mechanical Engineering

Evacuated Tube Collector Trainer

Bench-top trainer, allows trainees to investigate the fundamental principles of Evacuated Tube Collector

PANDIT DEENDAYAL ENERGY UNIVERSITY
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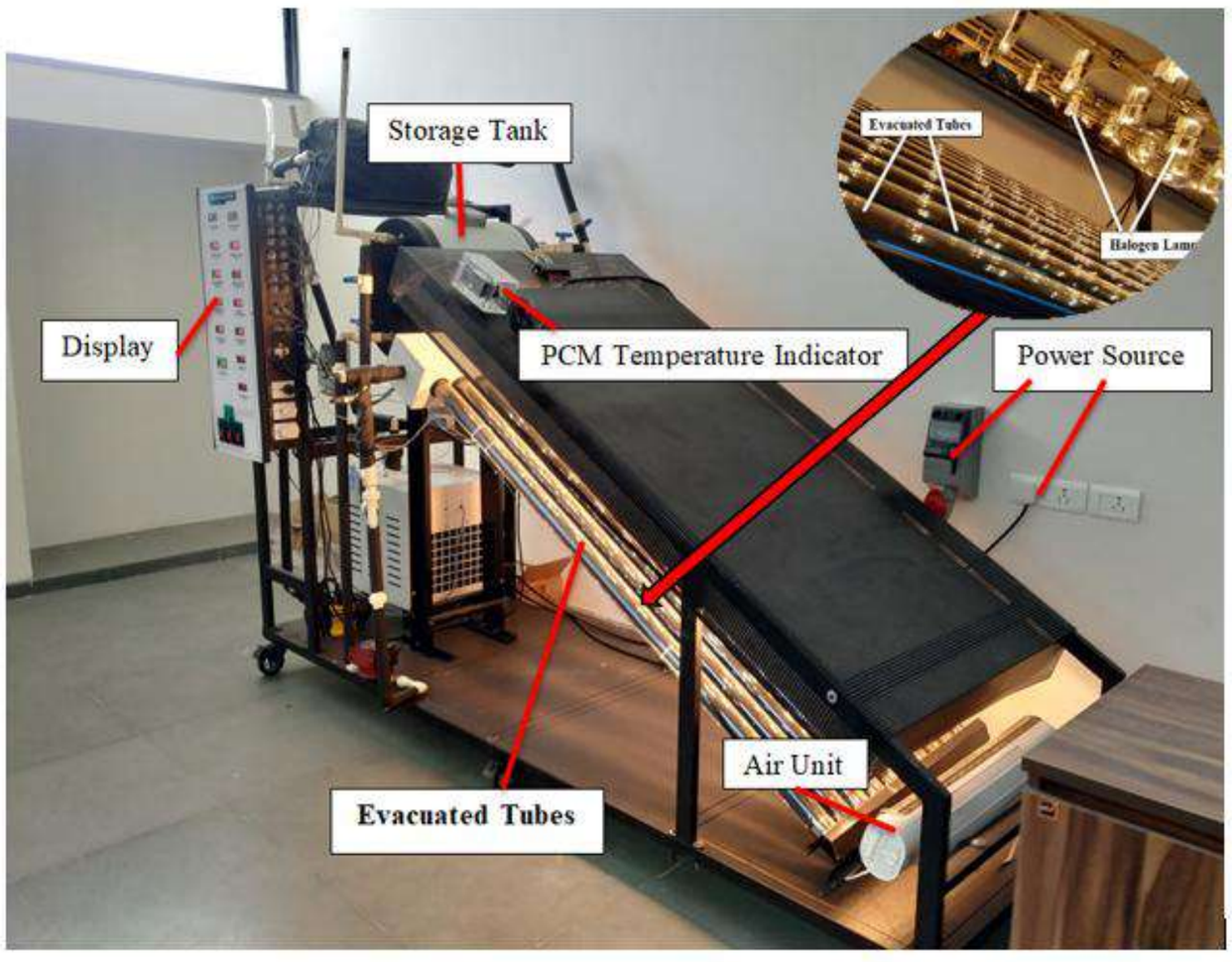
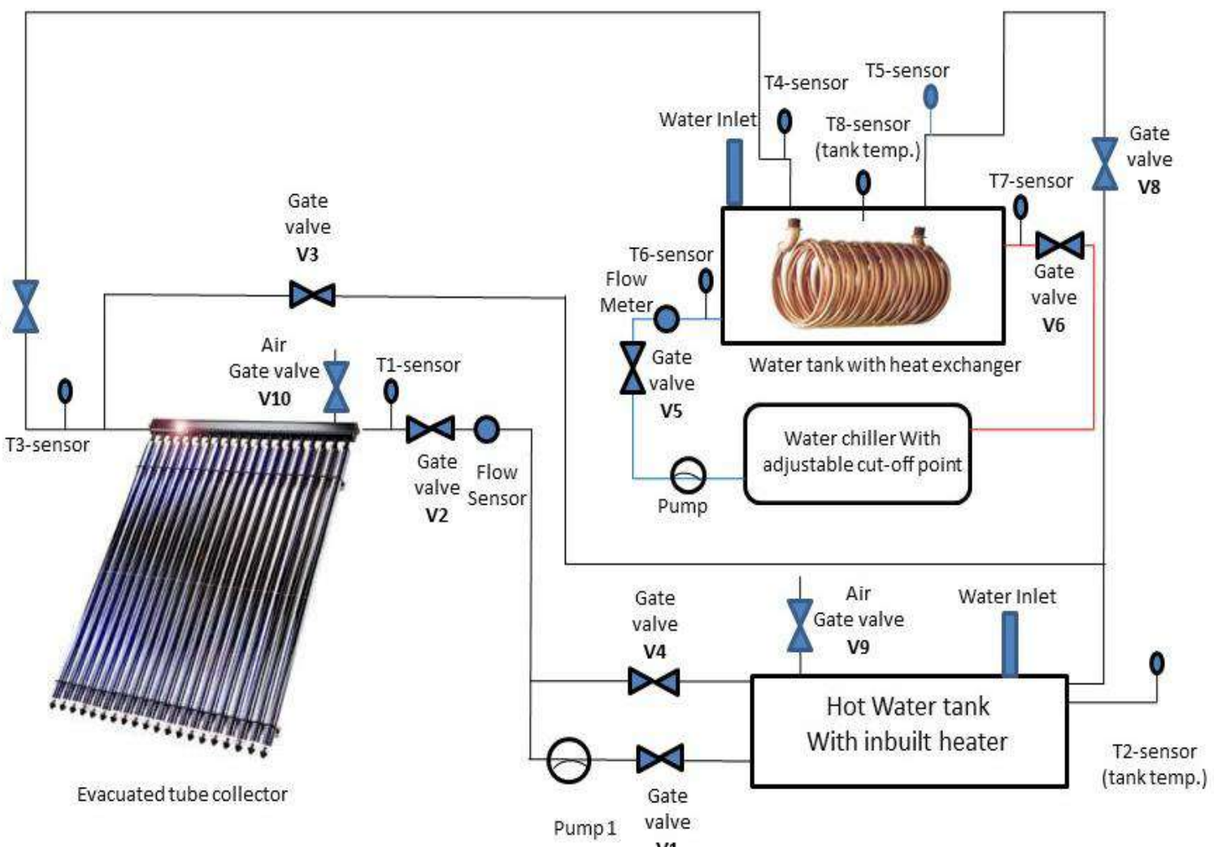


Evacuated Tube Collector

Specifications

- **Heat Generating Unit:** 36 halogen lamps, 5400W total power with dimmer control.
- **Solar ETC System:** 10 borosilicate glass tubes, 100 LPD(Liters/Day) capacity, high absorptance coating.
- **Control Panel:** Comprehensive control and monitoring.
- **Measurement Unit:** Temperature meter (0-200°C) and flow meter (0-15 LPM(Liters/Min)) for monitoring.
- **Cooling System:** 0.3 TR chiller tank along with 0.3 HP water pump and tower fan.
- **Accessories:** Radiation meter, IR temperature gun, and anemometer for accurate reading.
- **Power & Space Requirements:** 15A socket, 63A MCB, and water supply connection required.



Schematic diagram

Important features

- **Dual-Purpose Application** – For laboratory and training usage, facilitating research with water and nano liquids. It can facilitate storage incorporation studies.
- **Sunlight Simulator** – Mimics solar radiation using an adjustable halogen light source for accurate experimental conditions.
- **Measurement & Control System** – Fitted with temperature, flow rate, solar radiation, and wind speed sensors to monitor system performance.
- **Nano Fluid Compatibility** – Facilitates the use of high-end nano fluids to increase thermal efficiency and heat transfer rates.
- **Durability & Safety** – Designed to last through environmental exposure with redundant safety features for pumps, heaters, and valves.

Beneficiaries of the ETC Trainer

- **University Students & Researchers** – Utilized for educational learning, experiments, and complex research on thermal systems.
- **Technicians and Practitioners:** Technicians for updating skills and knowledge.
- **Industry Professionals** – Aid in the development of skills for engineers and technicians employed in solar power and thermal applications.
- **Academics and Educators:** University and technical institute educators.
- **Government & Policy Makers** – Can assist research for policy-making in renewable energy technologies for water heating.

Applications of ETC

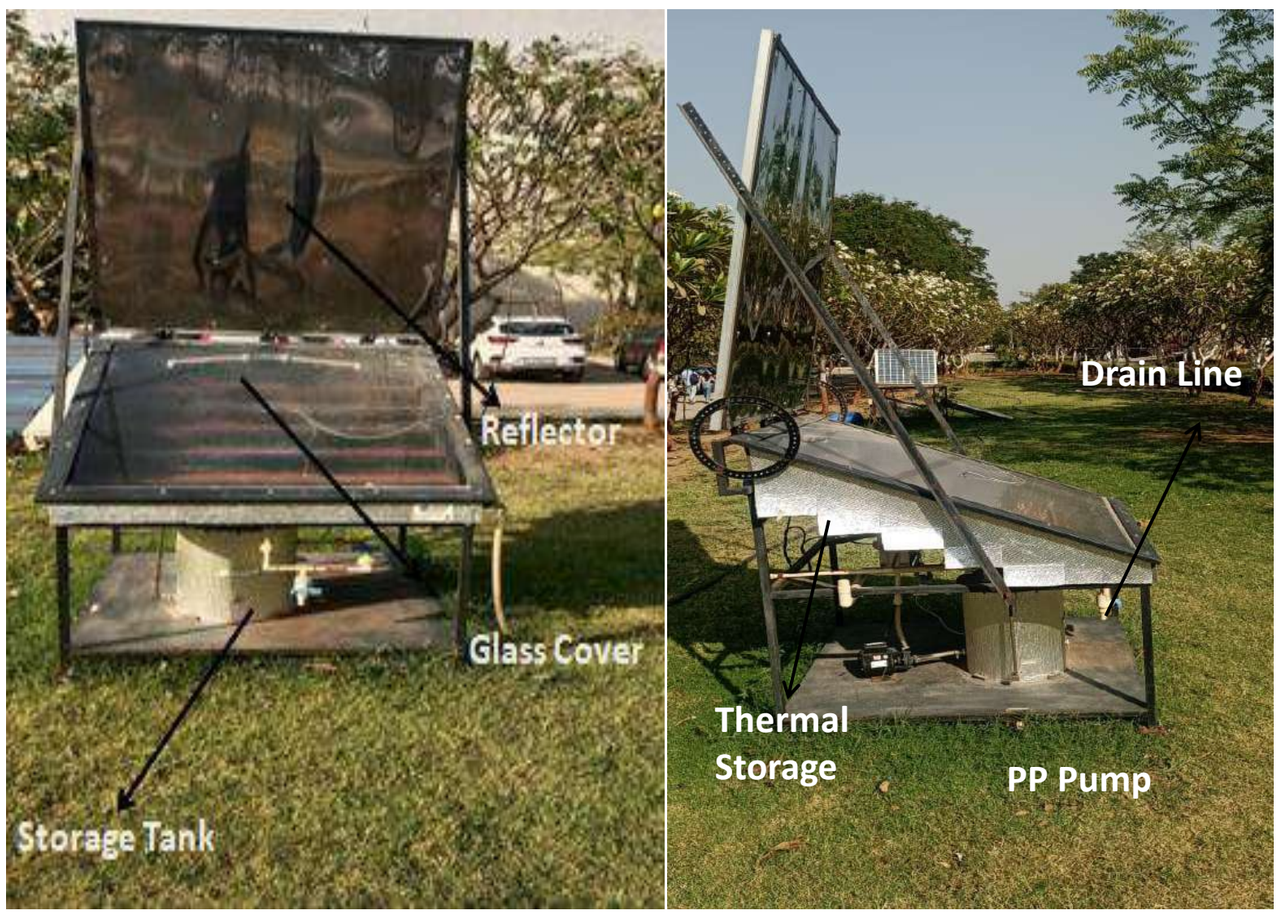
Contact us for more details

Dr. Rajat Saxena
Professor, Department of Mechanical Engineering
Rajat.Saxena@sot.pdpu.ac.in
9015607618

Dr. Jatin Patel
Associate Professor, Department of Mechanical Engineering
Jatin.patel@spt.pdpu.ac.in
9428415422

Department of Mechanical Engineering

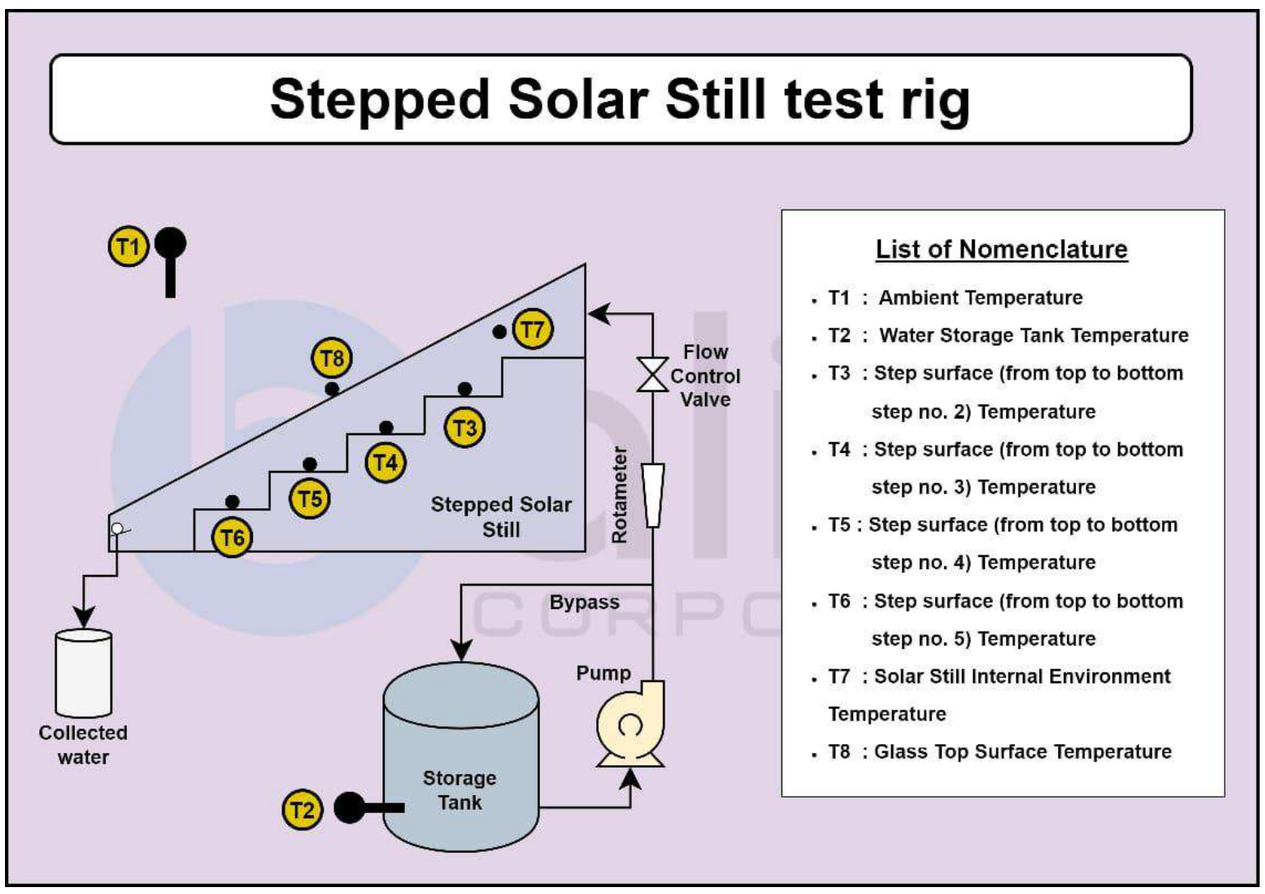
Stepped Solar Still



Stepped Solar Still

Specifications

Sr. No.	Part name	Technical specification
1.	PP pump	•**Make & Model** : Tullu Top-15 •**Power :** 28 W • **Max. Current :** 0.3 A max. •**Flow Rate :** 300 LPH • **Voltage :** 230 (1-Ph)
2.	Water Storage Tank	**25 Litre SS 304 tank with Insulation**
3.	Glass	Thickness : 5 mm Dimension: 995 X 1165 mm
4.	Temperature sensors (8 NOS)	RTD Pt-100 Temperature Sensors
5.	Rotameter	**Flow Rate :** 20 - 200 LPH



Line Diagrams Stepped Solar Still Test rig.

Important features

- **Multi-Step Basin Design:** Enhances water flow and evaporation efficiency by creating a cascading effect.
- **Extended Exposure to Solar Radiation:** Increases surface area for better absorption and evaporation.
- **Integrated Thermal Storage:** Provision for storage incorporation extends operating hours post sunset. Integration of different storage materials can be studied.
- **High Energy Utilization Efficiency:** Reduces thermal losses through insulation and optimized heat retention mechanisms.
- **Optimized Condensation System:** Uses inclined glass covers and cooling mechanisms to enhance freshwater collection rates.
- **Self-Sustained and Eco-Friendly:** Uses solar energy without external power sources, making it ideal for off-grid areas.

Applications

Potable Water Supply for Remote Areas: Provides clean drinking water in water-scarce regions with limited infrastructure.

Disaster Relief and Emergency Response: Offers immediate access to purified water during natural disasters or humanitarian crises.

Agricultural and Industrial Use: Supports irrigation, livestock hydration, and industrial applications requiring distilled water.

Marine and Coastal Use: Suitable for desalination in coastal communities, reducing reliance on energy-intensive reverse osmosis systems.

Wastewater Treatment: Can be integrated into decentralized wastewater recycling systems for sustainable water management.

Contact us for more details

Dr. Rajat Saxena
Assistant Professor,
Department of Mechanical Engineering
Rajat.Saxena@sot.pdpu.ac.in
9015607618

Dr. Jatin Patel
Associate Professor,
Department of Mechanical Engineering
Jatin.patel@spt.pdpu.ac.in
9428415422

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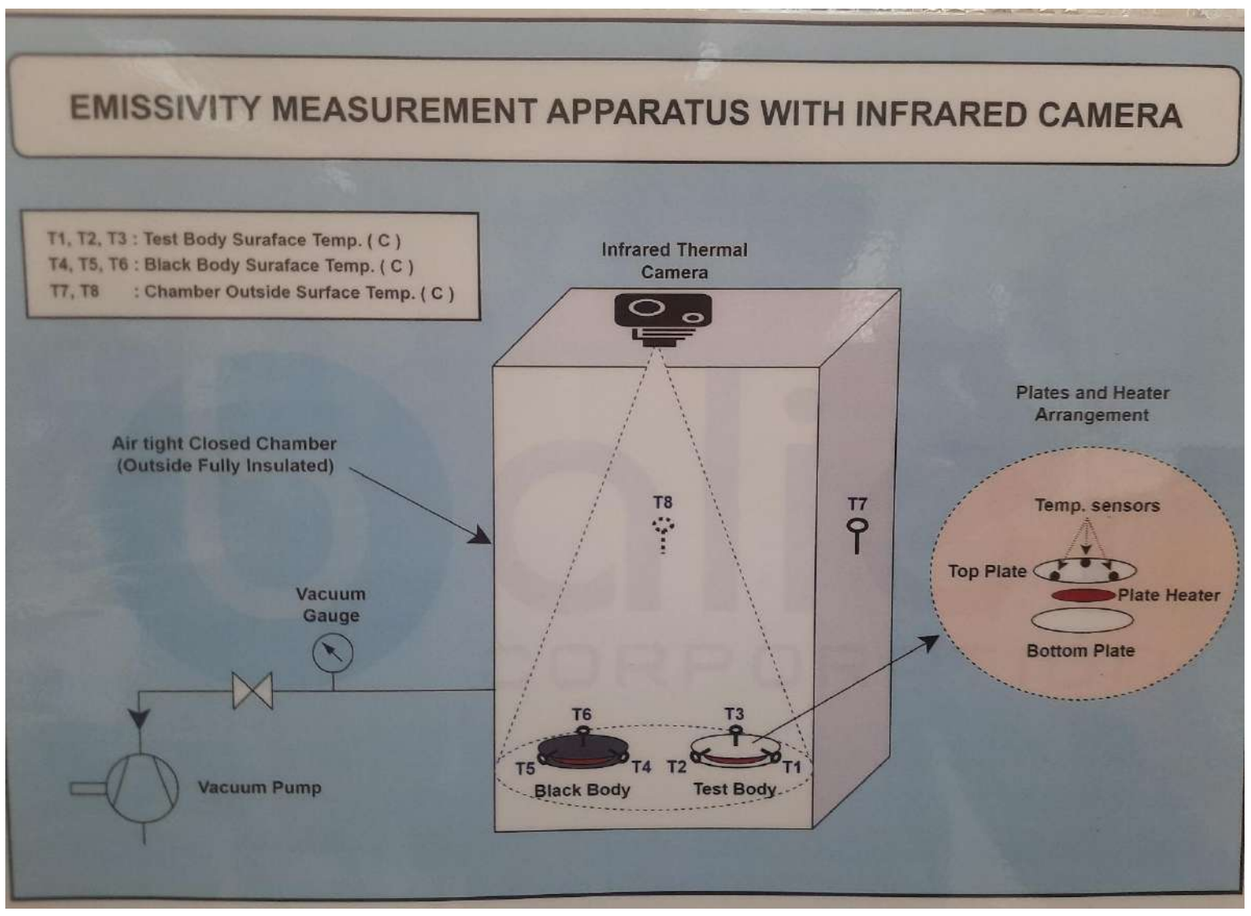
Emissivity Measurement Apparatus

Emissivity Measurement Apparatus with Vacuum Pump

Specifications

- **Interchangeable Test plates:** Flexible test section to set different test plates.
- **Power and Temp Display:** Monitors system performance.
- **Control Panel:** Comprehensive control and monitoring.
- **Infrared Camera:** Capturing images for analysing.
- **Air Tight Chamber :** Test section chamber is fully insulated with XLPE.
- **Vacuum Pump:** To maintain proper vacuum in test chamber to focus on radiation. 1.8 CFM capacity, ¼ HP power, 230V AC supply
- **Temperature Sensors**: 8 RTD Pt-100 sensors for precise thermal readings.



Salient features

- **Infrared Camera-Based Measurement**: Enables non-contact and real-time thermal imaging for accurate emissivity assessment.
- **Vacuum Chamber Setup:** Eliminates convective heat transfer for precise radiative heat exchange analysis.
- **Multiple Test Samples:** Supports emissivity measurement of various materials, including metals, ceramics, and plastics.
- **Controlled Heat Source:** Equipped with electric plate heaters to study emissivity variations with temperature.
- **Reference Blackbody Calibration**: Ensures accurate emissivity calculations by comparing test samples with a known blackbody reference.

Beneficiaries of the System

- **Students & Academic Institutions:** Provides hands-on experience in thermal emissivity studies and heat transfer analysis.
- **Research Laboratories:** Supports advanced research in material science, thermal characterization, and radiative heat transfer.
- **Industrial R&D & Quality Control Units**: Aids in emissivity testing for high-temperature applications, aerospace materials, and thermal coatings

Applications

- **Material Science Research:** Helps in characterizing the thermal emissivity of various materials under controlled conditions.
- **Heat Transfer & Thermal Analysis:** Supports studies on radiation heat transfer in different environments.
- **Industrial Process Optimization:** Used in industries for verifying emissivity properties of materials in high-temperature processes.
- **Building & Insulation Studies:** Useful for testing energy-efficient materials and thermal insulation coatings.

Contact us for more details

Dr. Rahul Deharkar
Professor, Department of Mechanical Engineering
Rahul.deharkar@sot.pdpu.ac.in
8141145618

Dr. Jatin Patel
Associate Professor, Department of Mechanical Engineering
Jatin.patel@spt.pdpu.ac.in
9428415422

SOT
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Department of Mechanical Engineering

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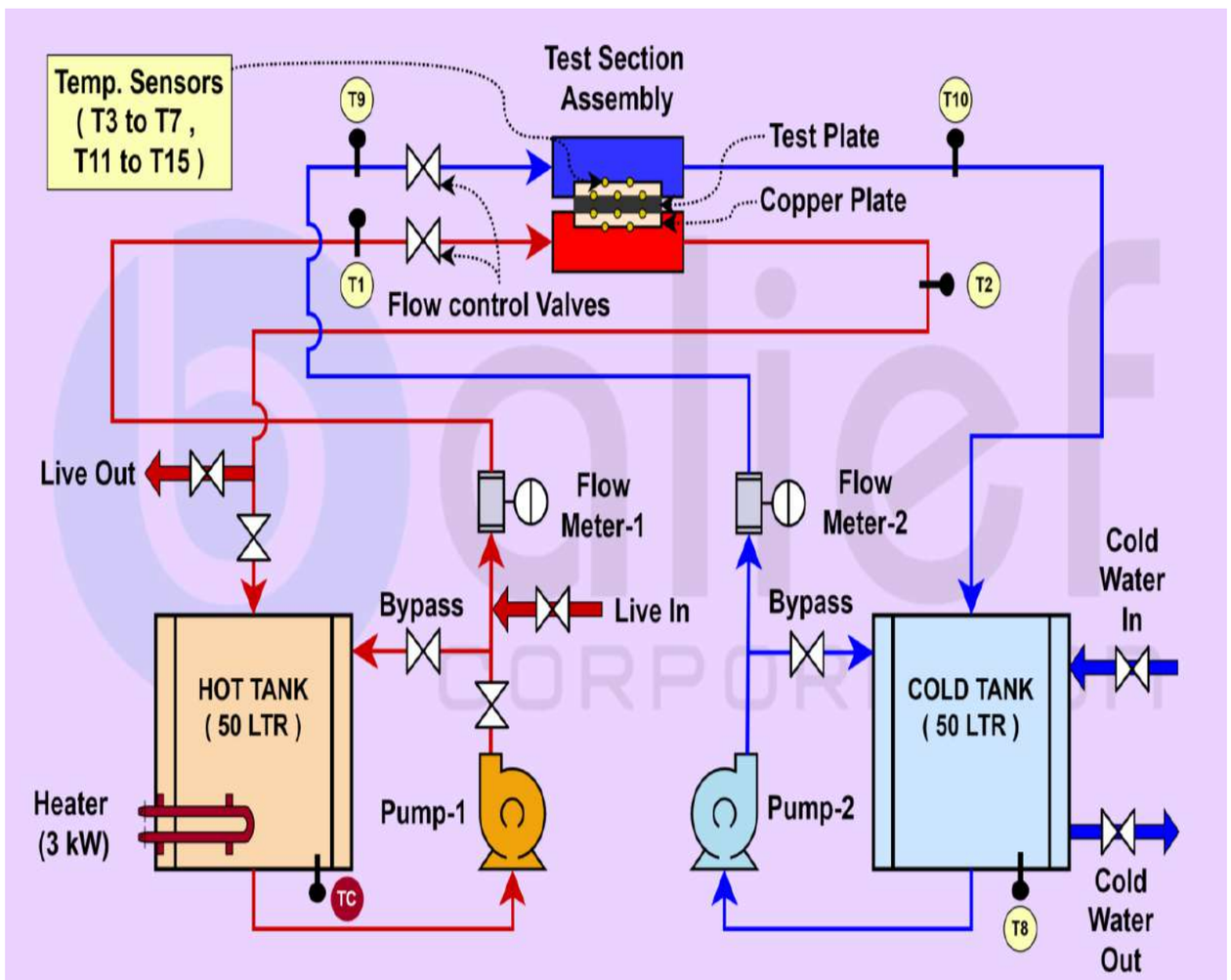
Guarded Hot Plate Apparatus

Thermal conductivity measurement of a test material using Guarded Hot Plate Method

Specifications

- **Interchangeable Test Sections:** Supports testing of 100 mm diameter sections with thicknesses ranging from 5 to 10 mm.
- **Control Panel:** Comprehensive control and monitoring.
- **Data logger:** Automatic data logger of 16 channels.
- **Flow meters:** Electro-magnetic flow meters to measure Hot & Cold fluid flow.
- **Temperature Sensors**: Multiple sensor locations for accurate data



Salient features

- **Hands-On Learning Experience:** Provides students with *practical exposure* to thermal conductivity estimation using a hot guarded plate setup.
- **Precision Temperature Control:** Equipped with a hot temperature regulator to maintain accurate temperature settings within the *30°C to 70°C range*.
- **High-Accuracy Measurement:** Integrated with *precision* mass flow rate *sensors* for reliable thermal conductivity evaluation.
- **Versatile Application:** Designed for undergraduate *training* while also supporting research in thermal conductivity assessment.
- **Industry-Ready Testing:** Capable of conducting professional-grade thermal conductivity evaluations for *consultancy* projects.

Beneficiaries

- **Engineering Students:** Mechanical, electrical, Thermal engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals
- **Academics and Educators:** University and technical institute educators.

Applications of System

- **Undergraduate Education:** Provides hands-on training for students in thermal conductivity estimation.
- **Research & Development**: Facilitates experimental studies on thermal properties of various materials.
- **Industrial Consultancy**: Enables accurate thermal conductivity testing for unknown materials used in manufacturing and engineering applications.
- **Material Characterization:** Assists in
- evaluating insulation materials, composites, and construction materials.
- **Heat Transfer Studies:** Helps in analyzing heat conduction behavior under controlled conditions.

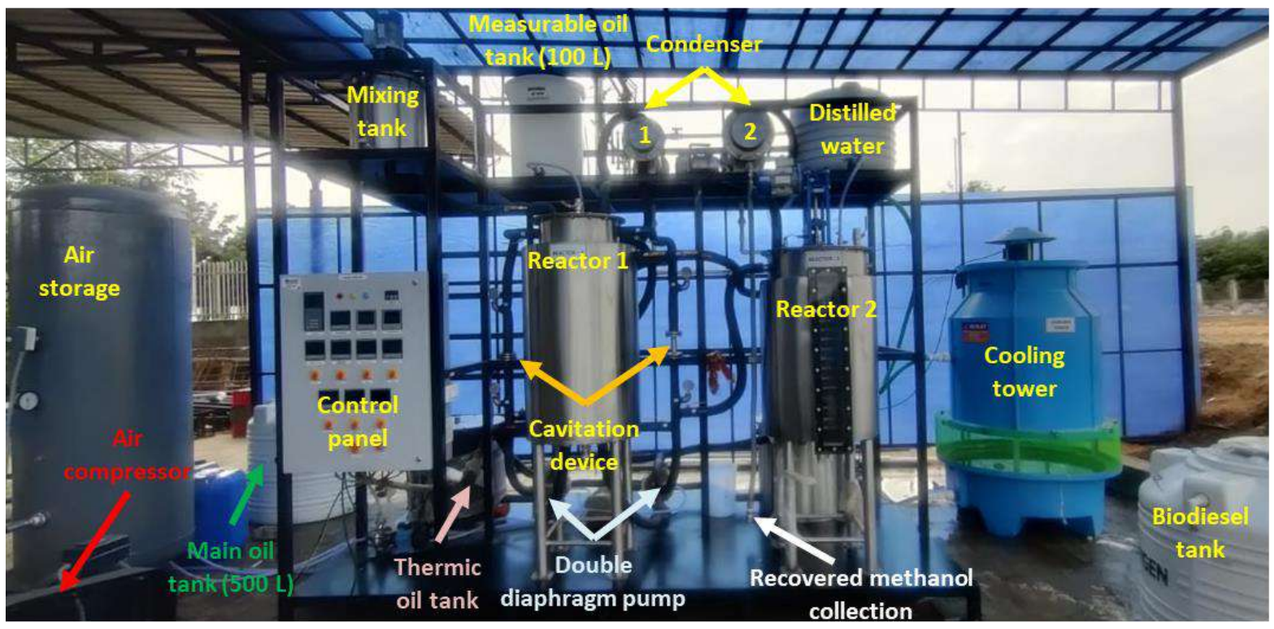
Contact us for more details

Dr. Rahul Deharkar
Professor, Department of Mechanical Engineering
Rahul.deharkar@sot.pdpu.ac.in
8141145618

Dr. Jatin Patel
Associate Professor, Department of Mechanical Engineering
Jatin.patel@spt.pdpu.ac.in
9428415422

Biodiesel Pilot Plant of Capacity 100 L/batch

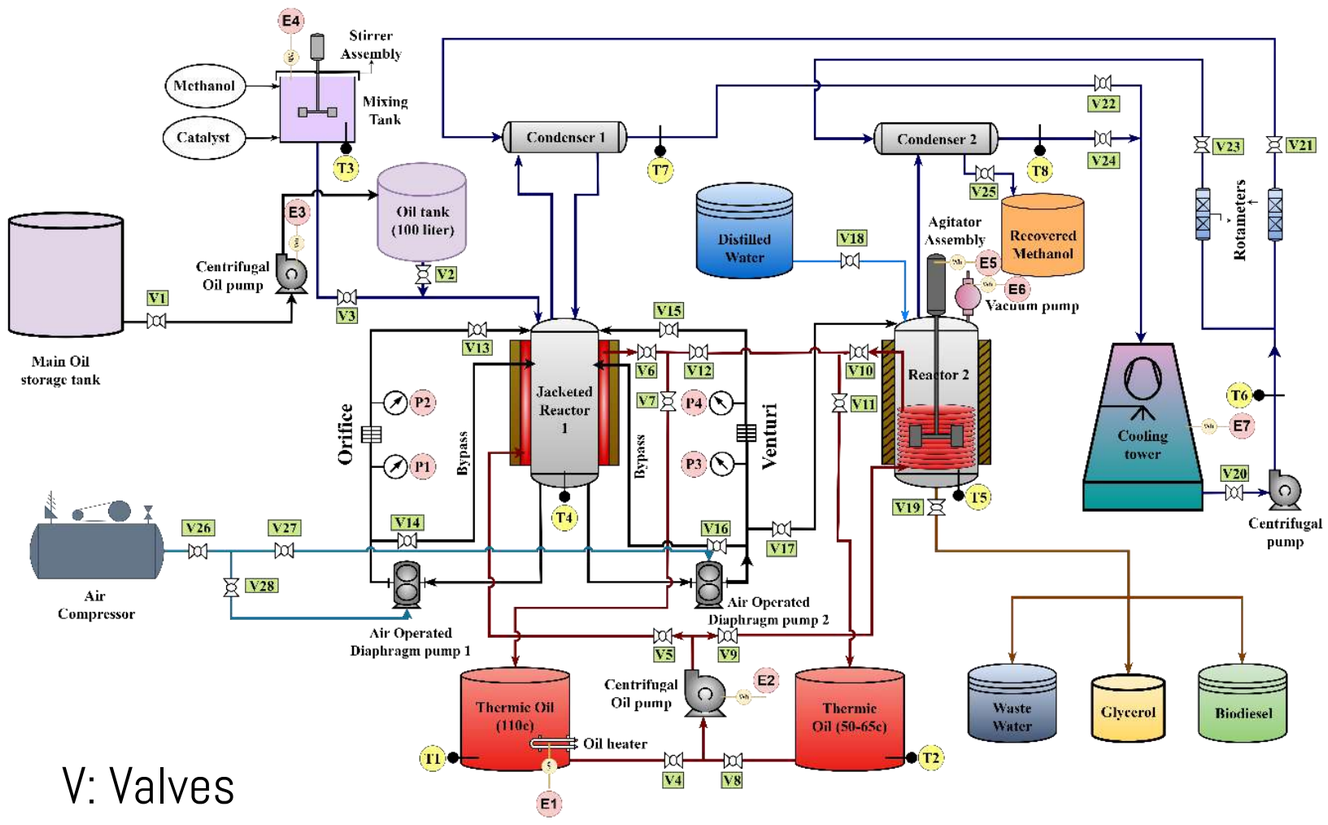
Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock



Hydrodynamic cavitation based biodiesel pilot plant of capacity 100 L/batch

Specifications

- **Capacity:** 100 L/Batch
- **Pressure:** Upto 7 bar
- **Cavitation device:** Orifice & Venturi
- **Hole dia. of orifice:** 1 mm
- **Throat dia. of venturi:** 3 mm
- **MOC of two tanks, piping, agitator (most parts):** SS 316
- **MOC of frame:** Mild Steel
- **Insulation thickness & material:** 1" & fibreglass
- **Jacket fluid:** Thermic oil
- **Pumps:** Double diaphragm pump & centrifugal pump
- **Control Panel:** Comprehensive control and monitoring.
- **Temperature Sensors**: Multiple sensor locations for accurate data



V: Valves
E: Energy meters
T: Temperature sensors
P: Pressure gauges

Flow diagram for biodiesel production employing hydrodynamic cavitation mechanism

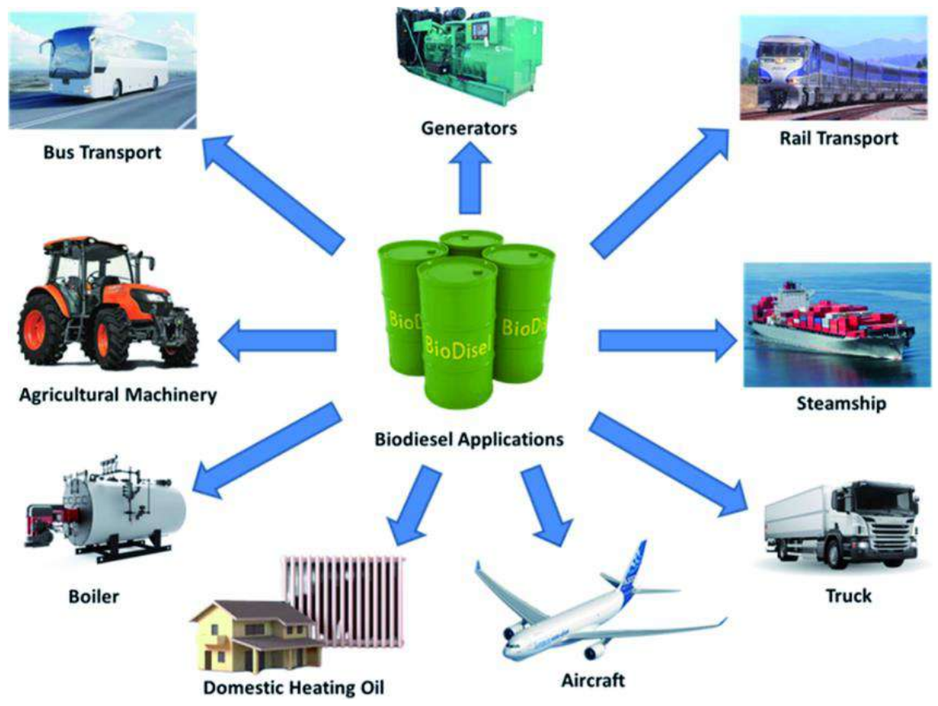
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production at industrial scale, pressure control, flow measuring, handling of control panel
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.
- **Pressure:** At 3 bar inlet pressure, obtained greater than 96.5% biodiesel yield.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the Hydrodynamic cavitation reactor

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Hydrodynamic cavitation based biodiesel pilot plant maintenance personnel training.

Applications of Biodiesel



Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

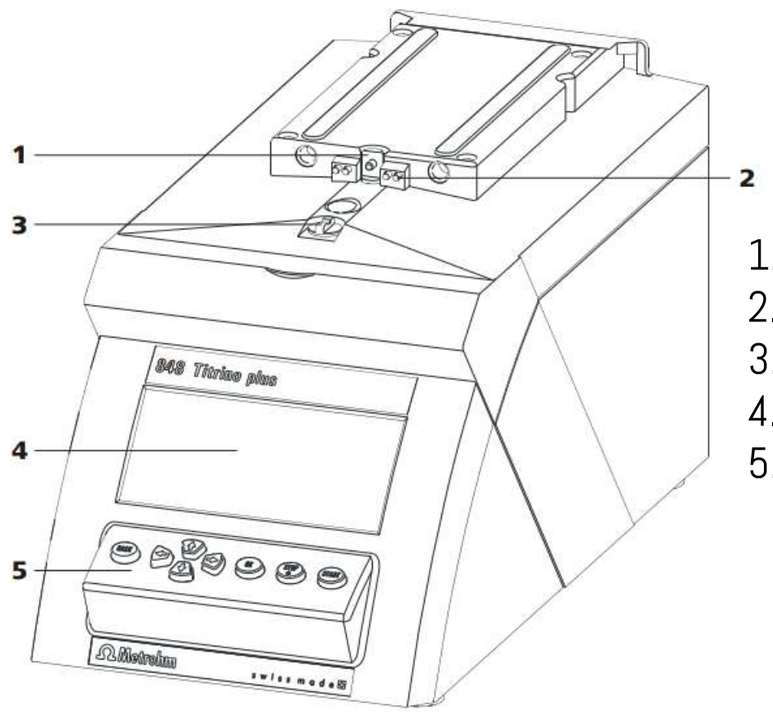
Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Auto Titrator

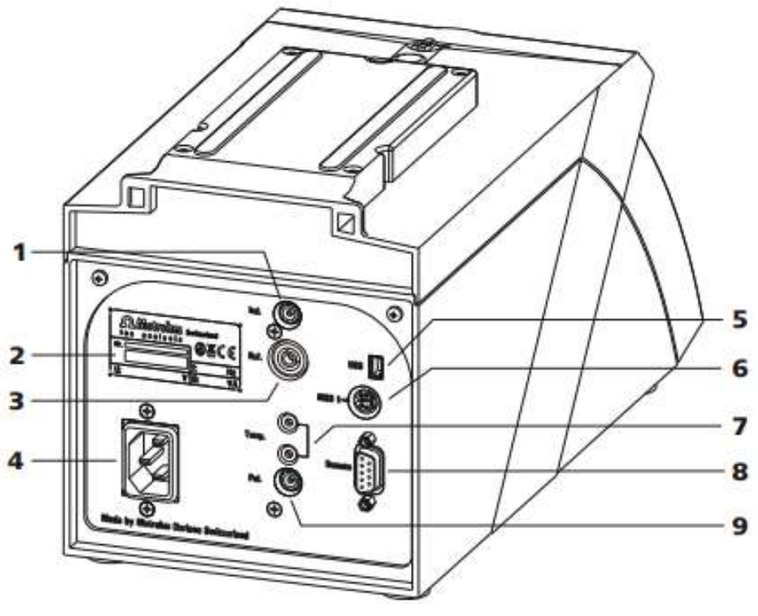
Bench-top trainer, allows trainees to measure acid value of fuel (biodiesel/diesel/oil)

Auto Titrator Specifications

- **Model number:** µ848 Titrino Plus
- **Brand:** Metrohm
- **Measuring cycle:** 100 ms
- **Dosing drive:** 10,000 Steps per cylinder volume
- **Aqueous and non-aqueous acid/base titrations**
- **Measuring temperature range:** -150 to 250 °C



1. Piston road
2. Contact pins
3. Coupling
4. Keypad
5. Display



1. Electrode connector (Ind.)
2. Type plate
3. Electrode connector (Ref.)
4. Mains connection socket
5. USB connector
6. MSB connector
7. Temperature sensor connector
8. Remote connector
9. Electrode connector (pol.)

Parts of Auto Titrator

Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, testing fuels, voltage measurement
- **State Change Visualization:** Nil
- **Temperature Display:** Nil
- **Displaying live potential difference in eV**
- **Measurement:** The result shown in mgKOH/gm.

Beneficiaries of the Auto Titrator

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Auto Titrator maintenance personnel training.

Applications of Auto Titrator

- Used to measure the acid value of biodiesel or diesel or oil.

Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

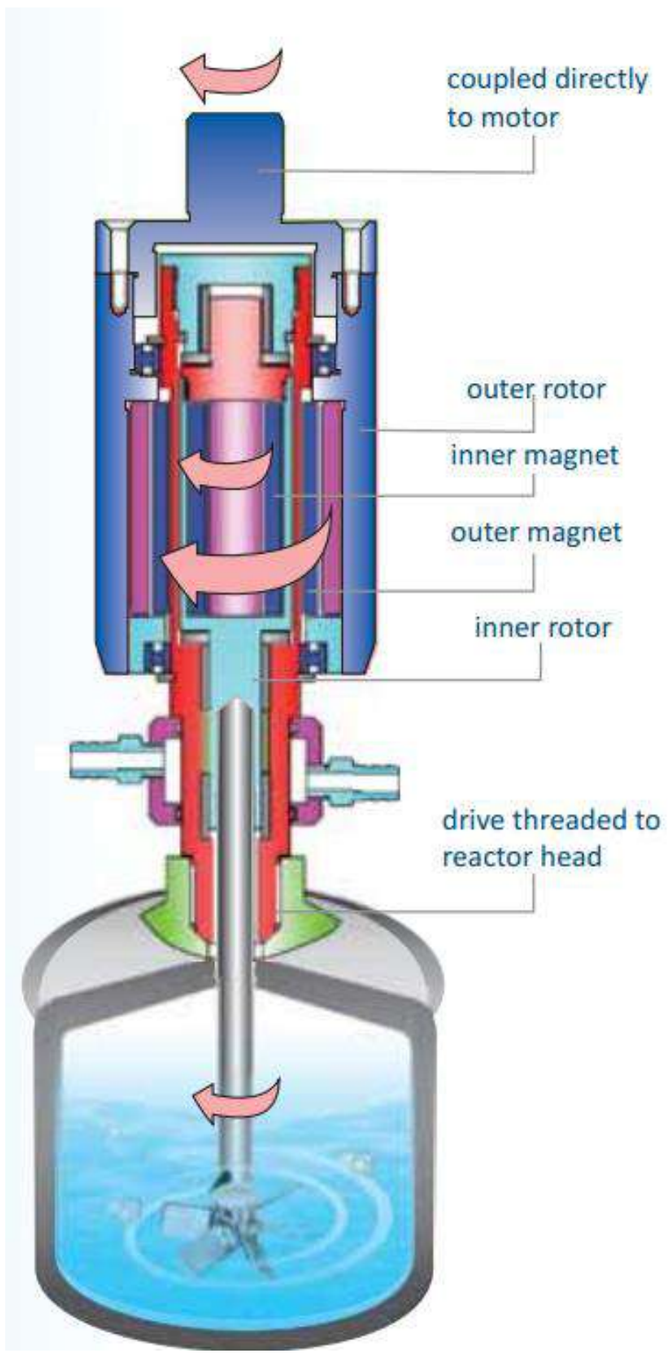
Supercritical Reactor (Autoclave)

Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock

Supercritical Reactor (Autoclave)

Specifications

- **Capacity:** 250 ml
- **Vessel design pressure:** 300 bar
- **Vessel design temperature:** 400 °C
- **Stirrer:** 4 bladed turbine with 100-1450 RPM
- **Supply voltage:** 1 Phase, 220 V AC
- **Floor area:** 0.8× 0.4 m^2
- **Control Panel:** Comprehensive control and monitoring.



Reactor assembly for autoclave system

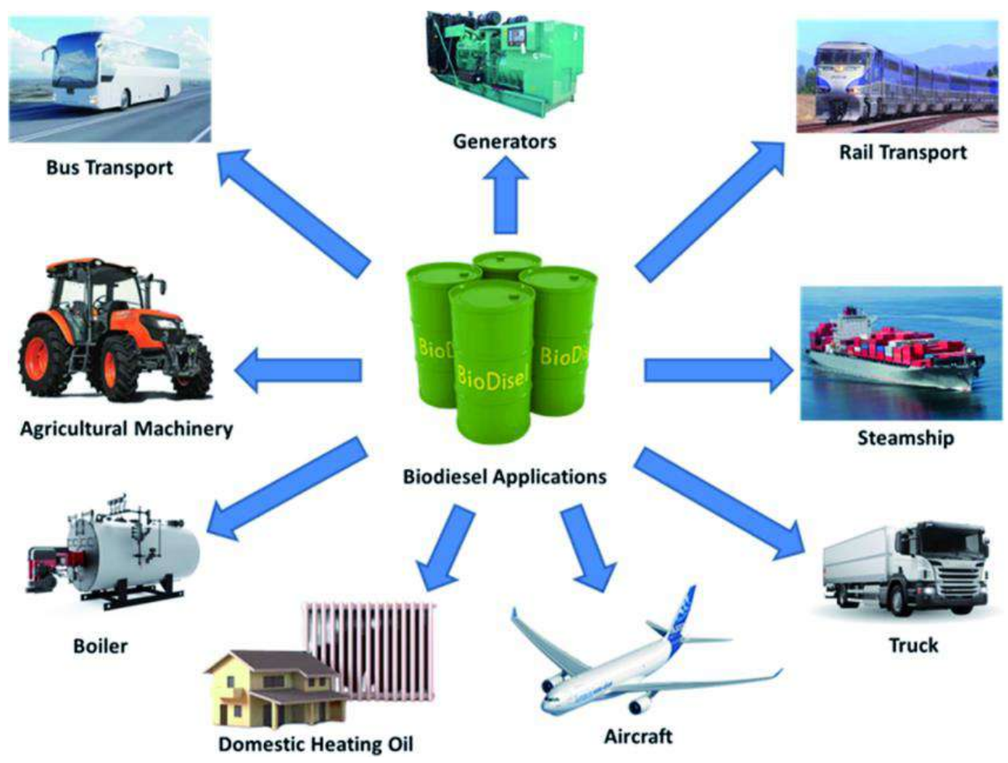
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production, handling of high pressure and temperature reactor
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Temperature Display:** Real-time display of temperature of the system.
- **Performance parameters:** Glycerol free biodiesel production without use of catalyst

Beneficiaries of the supercritical reactor

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Supercritical reactor maintenance personnel training.

Applications of Biodiesel



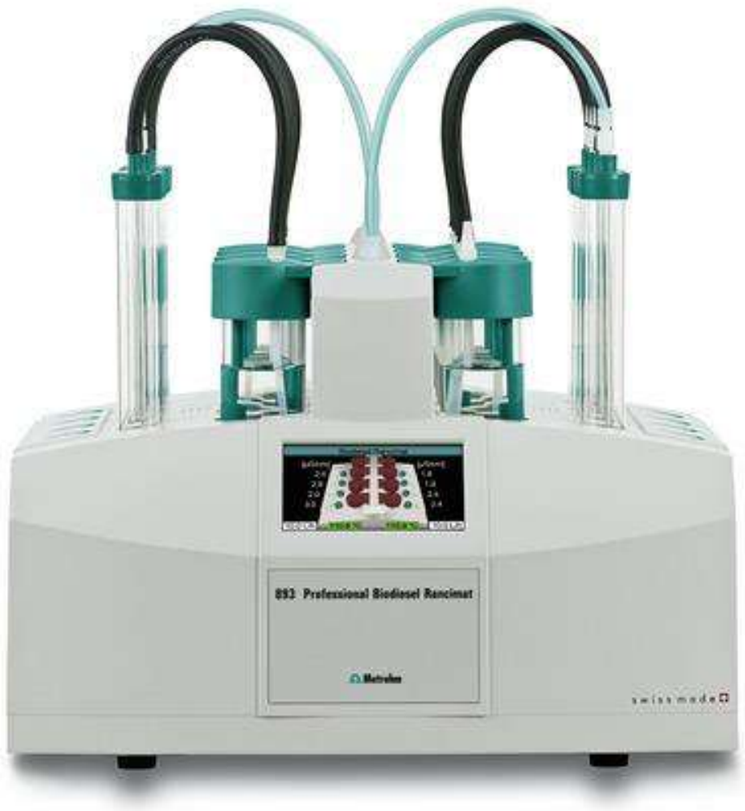
Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Professional Biodiesel Rencimat:893

Bench-top trainer, allows trainees to measure oxidation stability of fuel (biodiesel/diesel/oil)



Professional Biodiesel Rencimat

Salient features

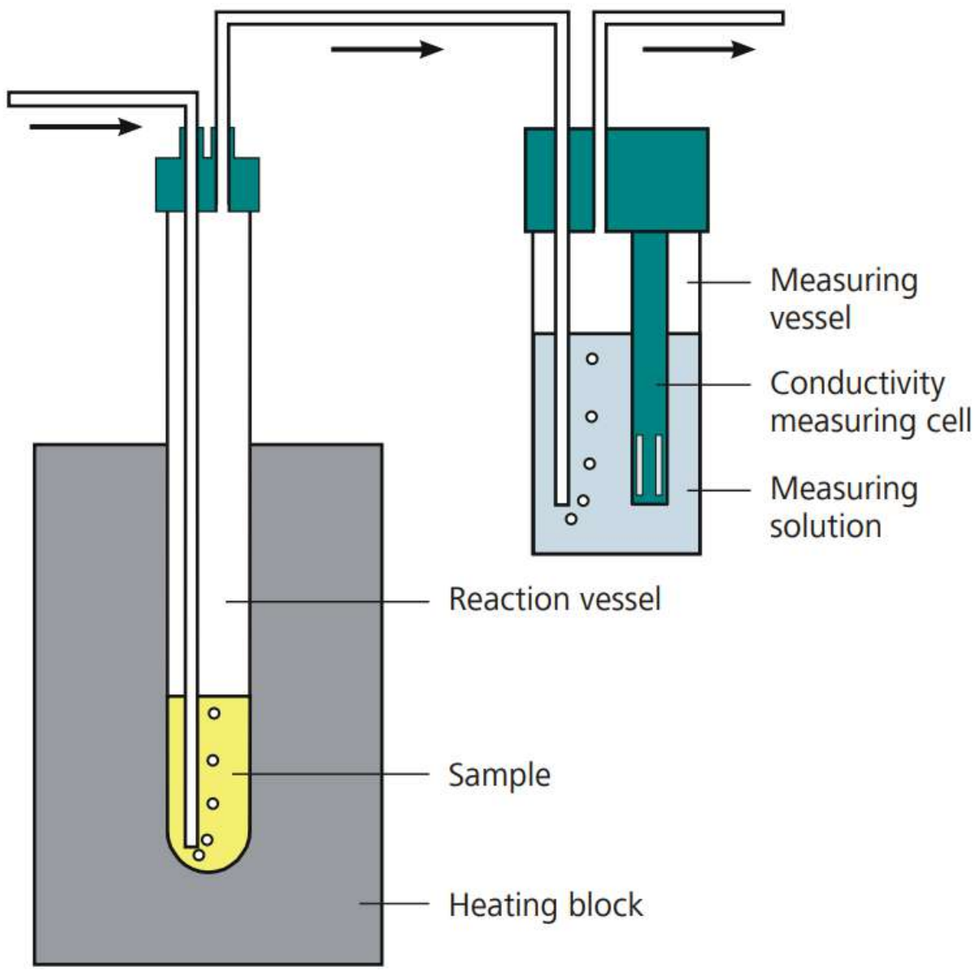
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, testing fuels
- **State Change Visualization:** Nil
- **Temperature Display:** Nil
- **Measurement:** The result shown in hr.

Specifications

- **ASTM Standards:** ASTM D 7467
- **Two individually heated aluminum heating blocks**
- **Temperature range:** 50 - 150 °C, can be set in steps of 1 °C
- **Gas flow range:** 1 - 25 L/h
- **Conductivity measurement:** 0 - 400 µS/cm
- **Interface:** USB

Beneficiaries of the Biodiesel rencimat

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Biodiesel rencimat maintenance personnel training.



Mechanism of Professional biodiesel rencimat

Applications of Biodiesel Rencimat

- Used to measure the oxidation stability of biodiesel or diesel or oil.

Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

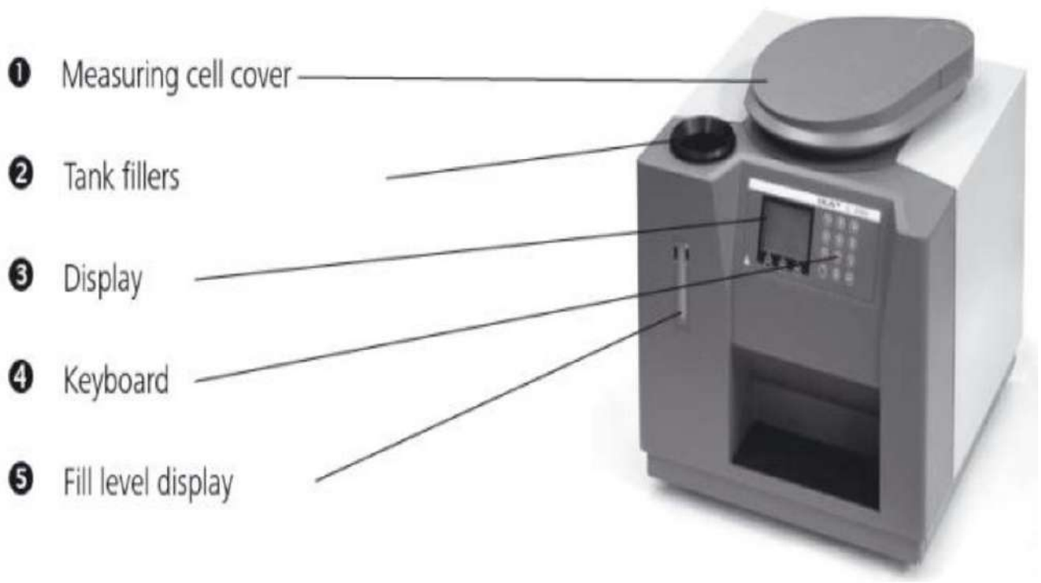
Bomb calorimeter

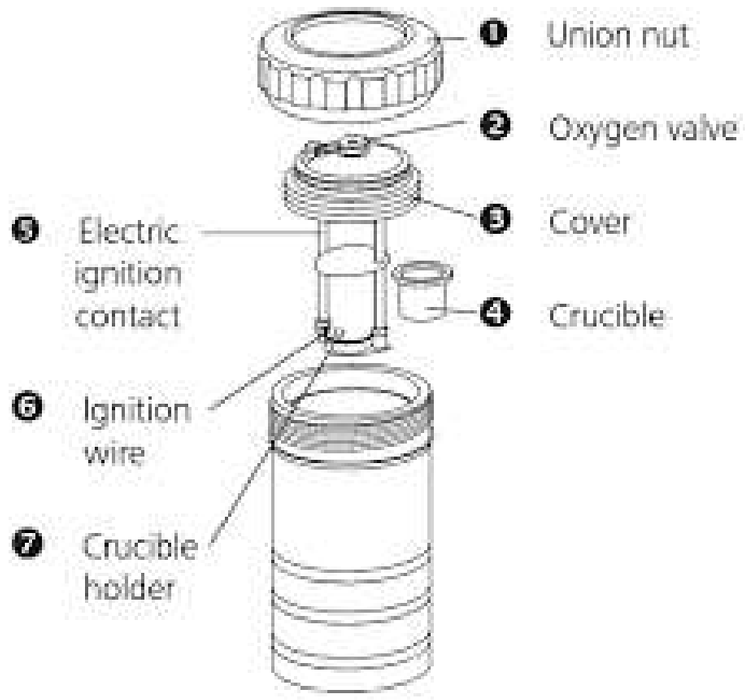
Bench-top trainer, allows trainees to test calorific value of fuel (biodiesel/diesel/oil)

Bomb Calorimeter

Specifications

- **Permissible ambient temperature:** 20 - 25 °C
- **Permissible relative humidity:** 80 %
- **Power input:** 120 W
- **Sample size**: 1 gm
- **ASTM standard:** ASTM D4868





Schematic diagram of bomb calorimeter

Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like feeding water, handling instrument, testing fuels
- **State Change Visualization:** Nil
- **Temperature Display:** Showing live temperature of the sample and water
- **Performance parameters:** It takes 15-20 minutes for showing result in MJ/kg or kJ/gm.

Beneficiaries of the Bomb calorimeter

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Bomb calorimeter maintenance personnel training.

Applications of Bomb calorimeter

- Used to measure the calorific value of biodiesel or diesel or oil.

Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Flash Point Tester

Bench-top trainer, allows trainees to measure flash point of fuel (biodiesel/diesel/oil)

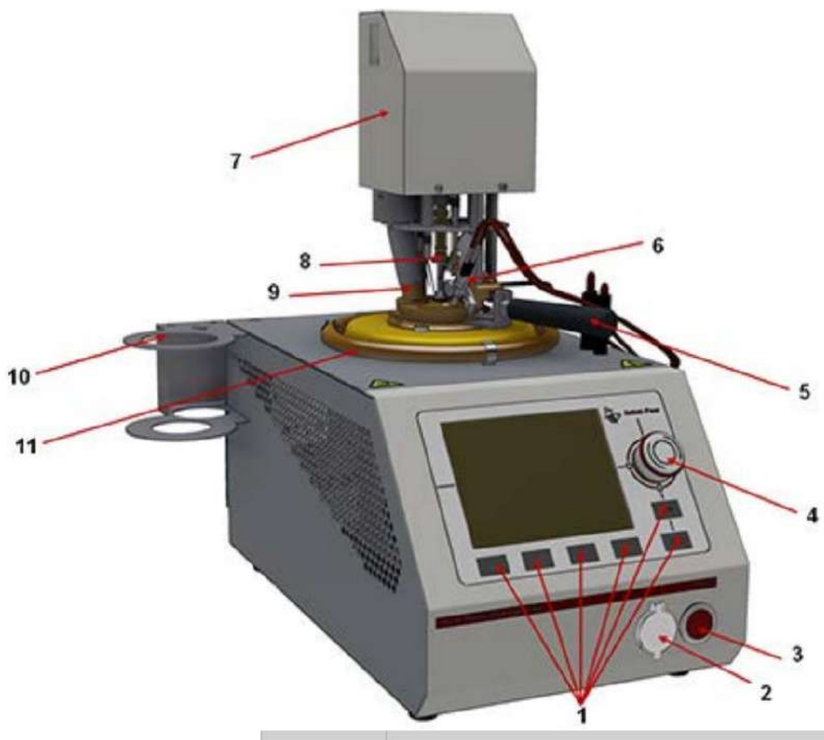
Pensky Martyn Flash Point Tester

Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, testing fuels
- **State Change Visualization:** Nil
- **Temperature Display:** Live temperature of sample is showing on display
- **Measurement:** The result shown in °C.

Specifications

- **Model:** PMA5
- **ASTM Standard:** ASTM D93
- **Application range:** up to 405 °C
- **Ignition:** Gas and electric (interchangeable)
- **Cooling:** forced air (fan)
- **Flash detection:** Thermocouple
- **Barometric pressure correction:** Automatic correction
- **Safety:** Overheat protection, automatic shut-off, fire-extinguishing system, password
- **Interfaces:** 3x USB, 1x RS232, 1x LAN
- **Gas supply:** 50 mbar of propane or butane



No.	Description
1	Softkeys
2	USB port
3	Fire extinguisher button (for manual release)
4	Jog shuttle
5	Handle for hot test cup
6	Electric igniter
7	Multi-function head
8	Stirrer
9	Multi-detector
10	Test cup holder
11	Fire extinguisher

Parts of Flash point tester

Beneficiaries of the Flash point tester

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Flash point tester maintenance personnel training.

Applications of Flash point tester

- Used to measure the flash point of biodiesel or diesel or oil.

Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

High speed grinder

Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock

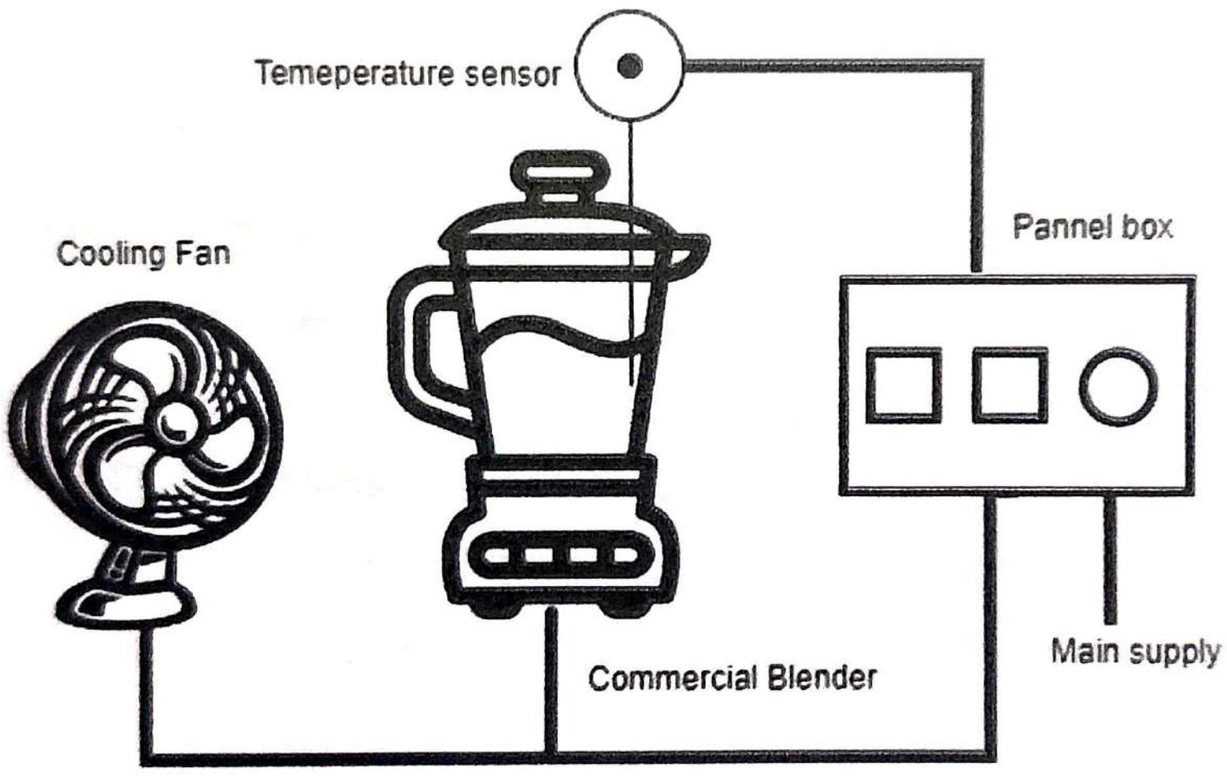
High speed grinder

Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production, speed control,
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature for the system.
- **Speed of rotor:** At speed of 15000 RPM , obtained greater than 97% biodiesel yield.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Specifications

- **Make:** Balief corporation
- **Grinder make:** Celfrost blender
- **Speed range:** 6000-28000 RPM
- **Capacity:** 2 L/batch
- **Power:** 1.6 kW
- **Number of speed:** 7
- **Digital non-contact tachometer:** Range: 60 to 100000 RPM; Accuracy: ±0.05 %
- **Temperature sensor**
- **Cooling Fan:** Power:1/7 hp; Motor speed: 1425 RPM

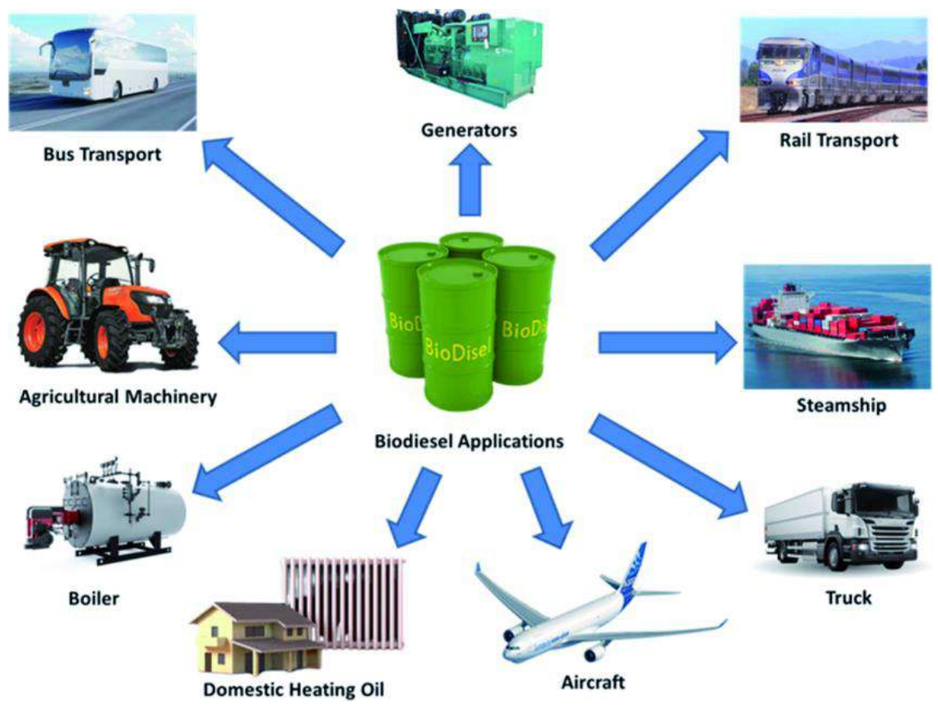


Schematic diagram of biodiesel production employing high speed grinder

Beneficiaries of the High speed grinder

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Grinder reactor systems maintenance personnel training.

Applications of Biodiesel



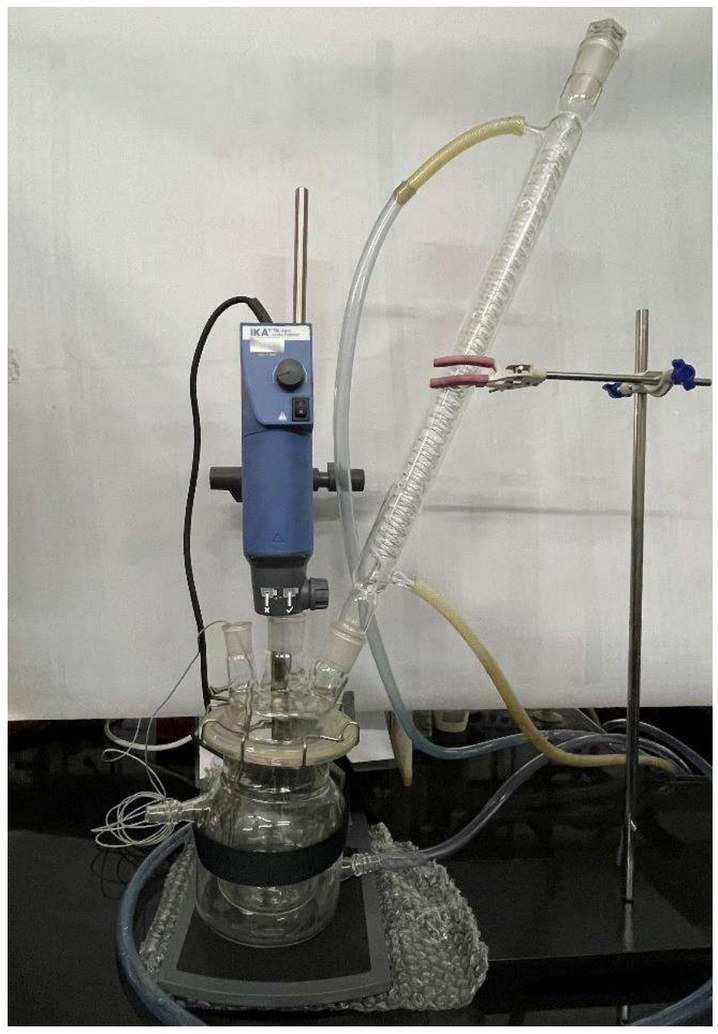
Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

High speed homogenizer

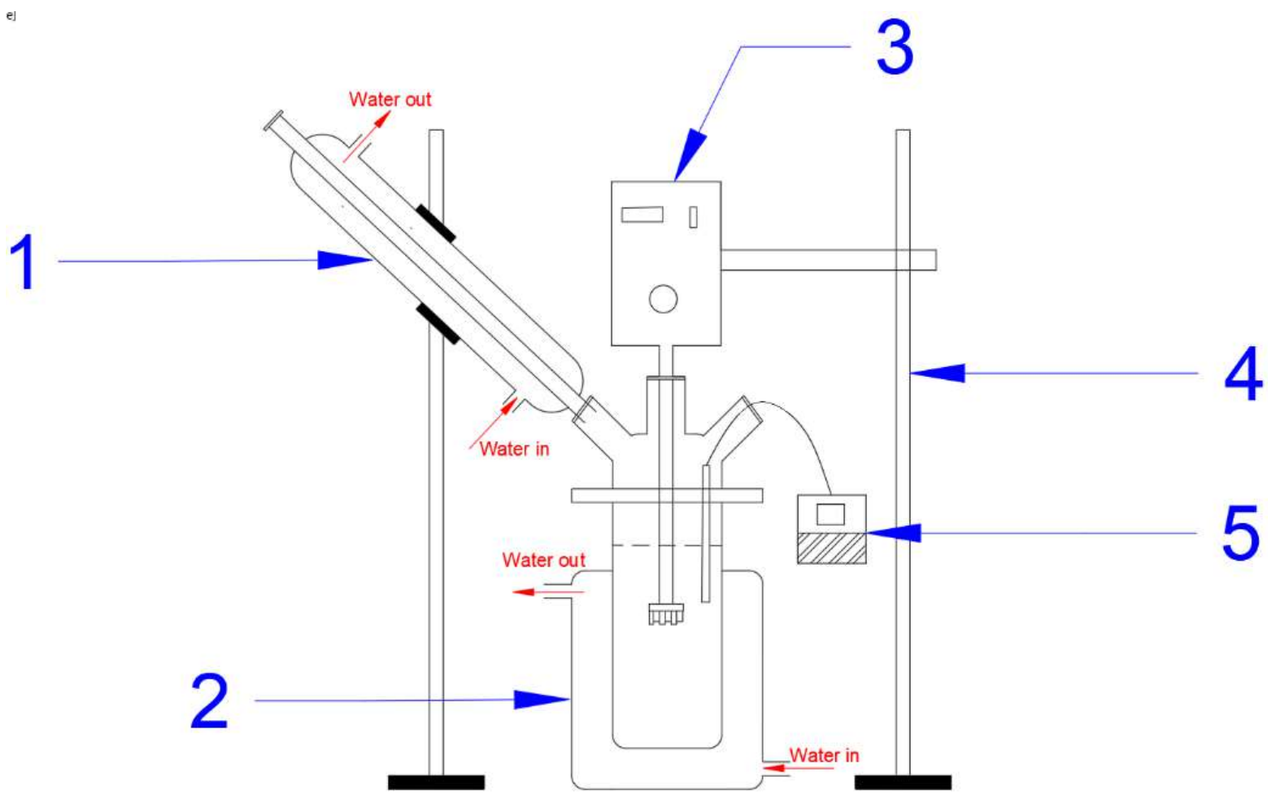
Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock



High speed homogenizer

Specifications

- **Model:** IKA T25 ULTRA TURAX
- **Homogenizer capacity:** 2 Litre
- **3 neck jacketed reactor capacity:** 800 ml
- **Power input:** 800 W
- **Speed range:** 3000-25000 RPM
- **Temperature sensor:** One temperature sensor for mixture
- **Reflux Condenser (water cooled):** 300 mm size
- **Dimensions:** 87 x 271 x 106 mm
- **Speed deviation:** 1%



Schematic diagram of biodiesel production employing high speed homogenizer

(1. Coil condenser, 2. 3-neck glass jacketed reactor, 3. Homogenizer, 4. Support-Stand, 5. Temperature sensor)

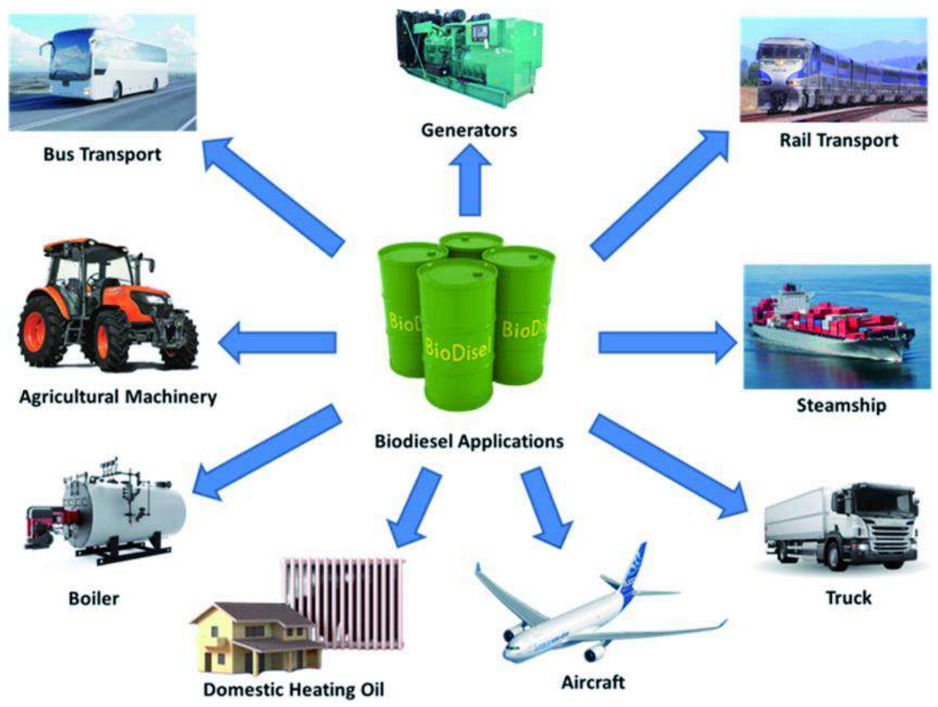
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production, speed control, water flow
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature for the system.
- **Speed of rotor:** At speed of 14000 RPM , obtained greater than 97% biodiesel yield.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the High speed homogenizer

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Homogenizer reactor systems maintenance personnel training.

Applications of Biodiesel



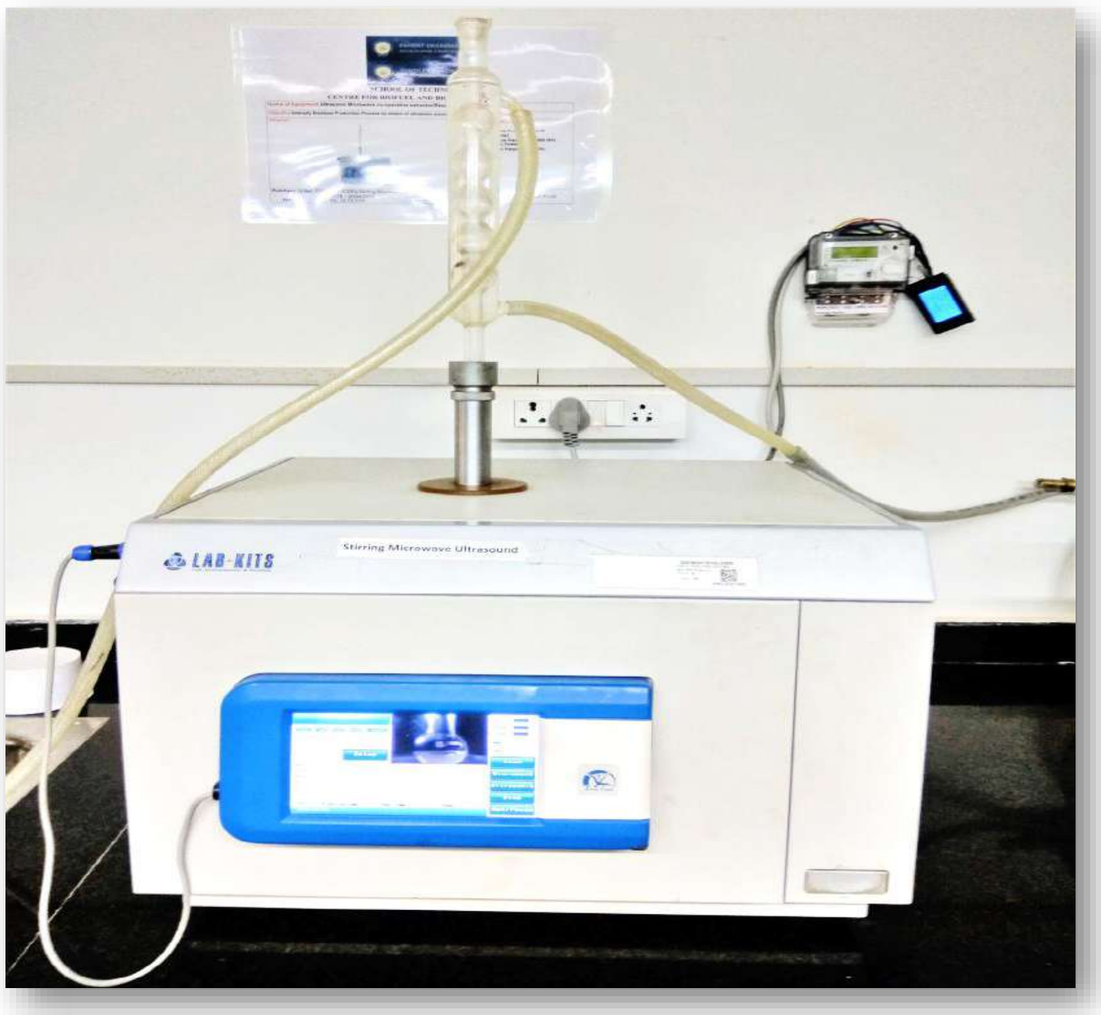
Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Hybrid reactor (Ultrasonic Microwave co-operative extractor/Reactor)

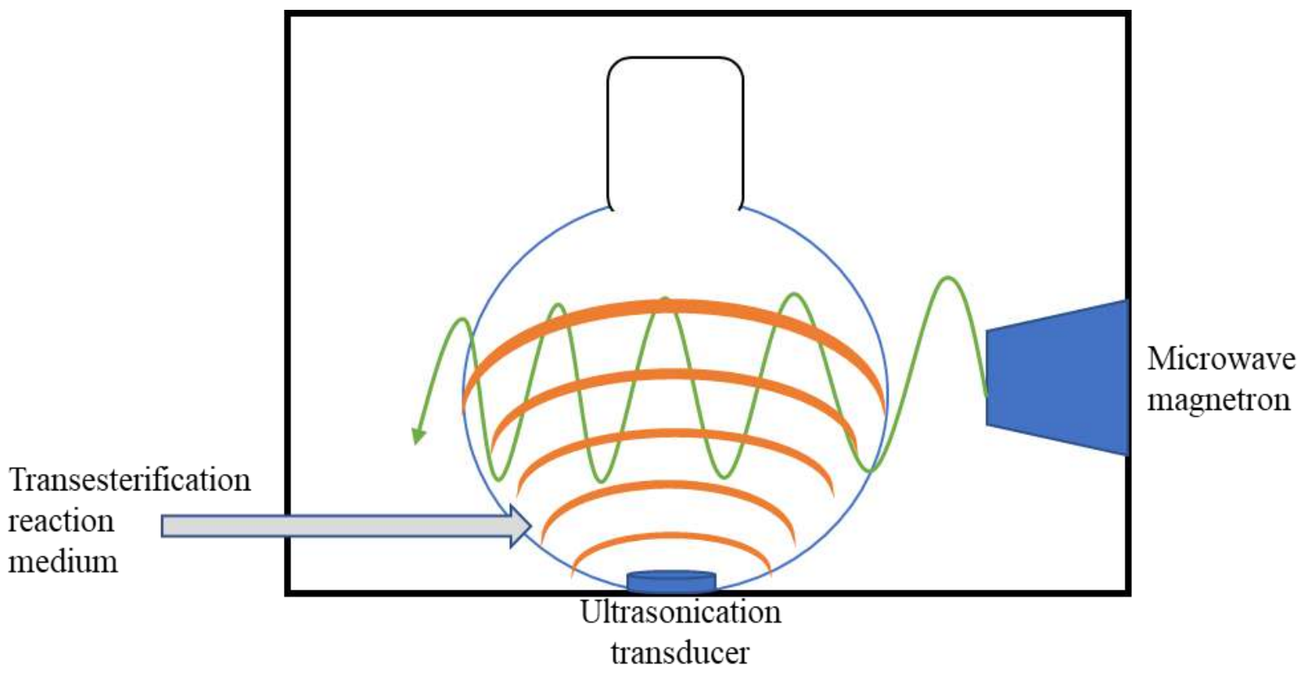
Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock



Hybrid reactor (combination of Ultrasound and Microwave technique)

Specifications

- **Microwave Power:** 10-800 W (adjustable)
- **Microwave Frequency:** 2450 MHz
- **Ultrasonic Power:** 50W
- **Ultrasonic Frequency:** 40kHz
- **Reactor chamber:** 27 L
- **Dimensions of chamber:** 0.43 m × 0.51 m × 0.51 m
- **Temperature sensor**



Schematic diagram of biodiesel production employing Hybrid reactor (combination of ultrasound and hybrid reactor)

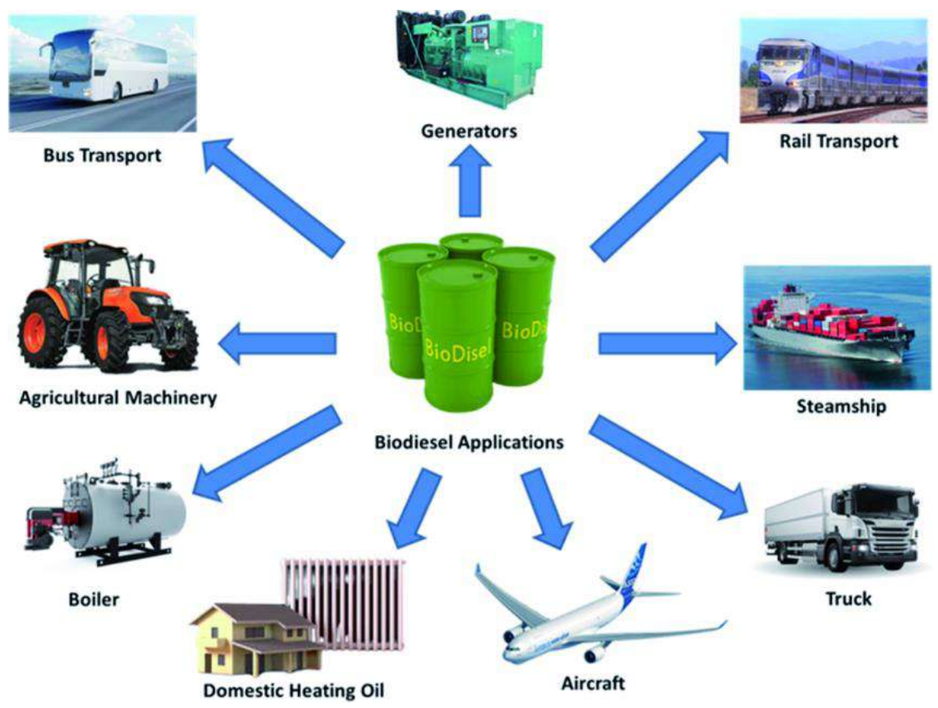
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production, speed control, microwave power control
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature for the system.
- **In-situ transesterification for biodiesel production from seed**
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the Hybrid reactor

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Hybrid reactor systems maintenance personnel training.

Applications of Biodiesel



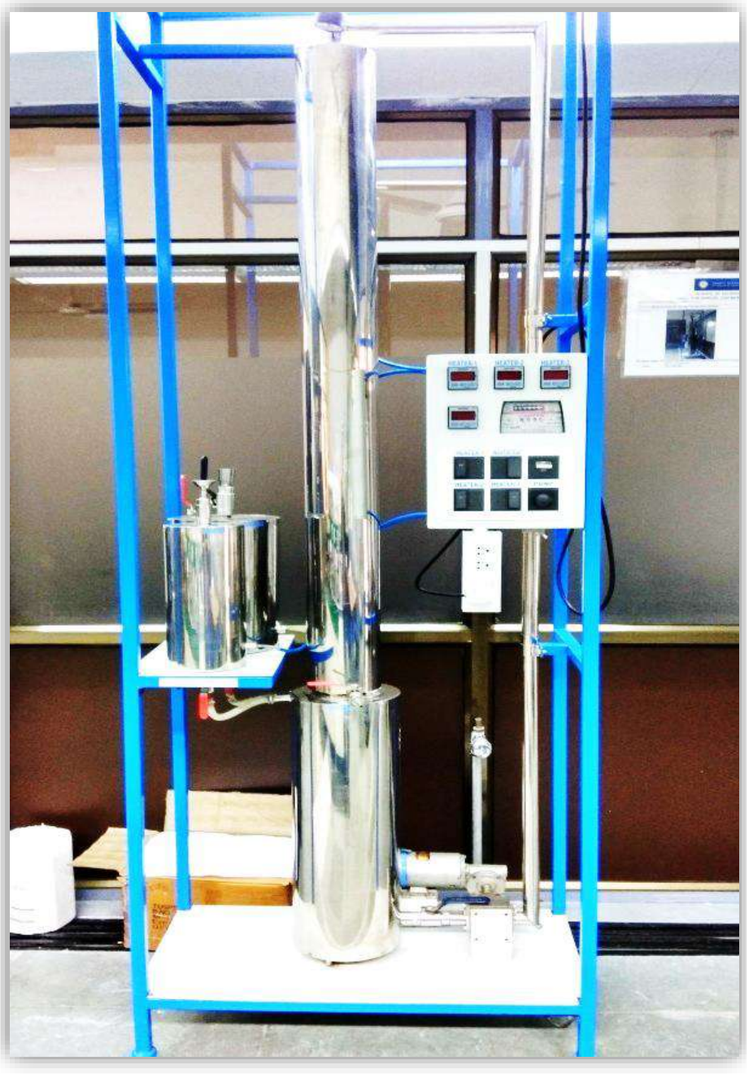
Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Hydrodynamic Cavitation Reactor

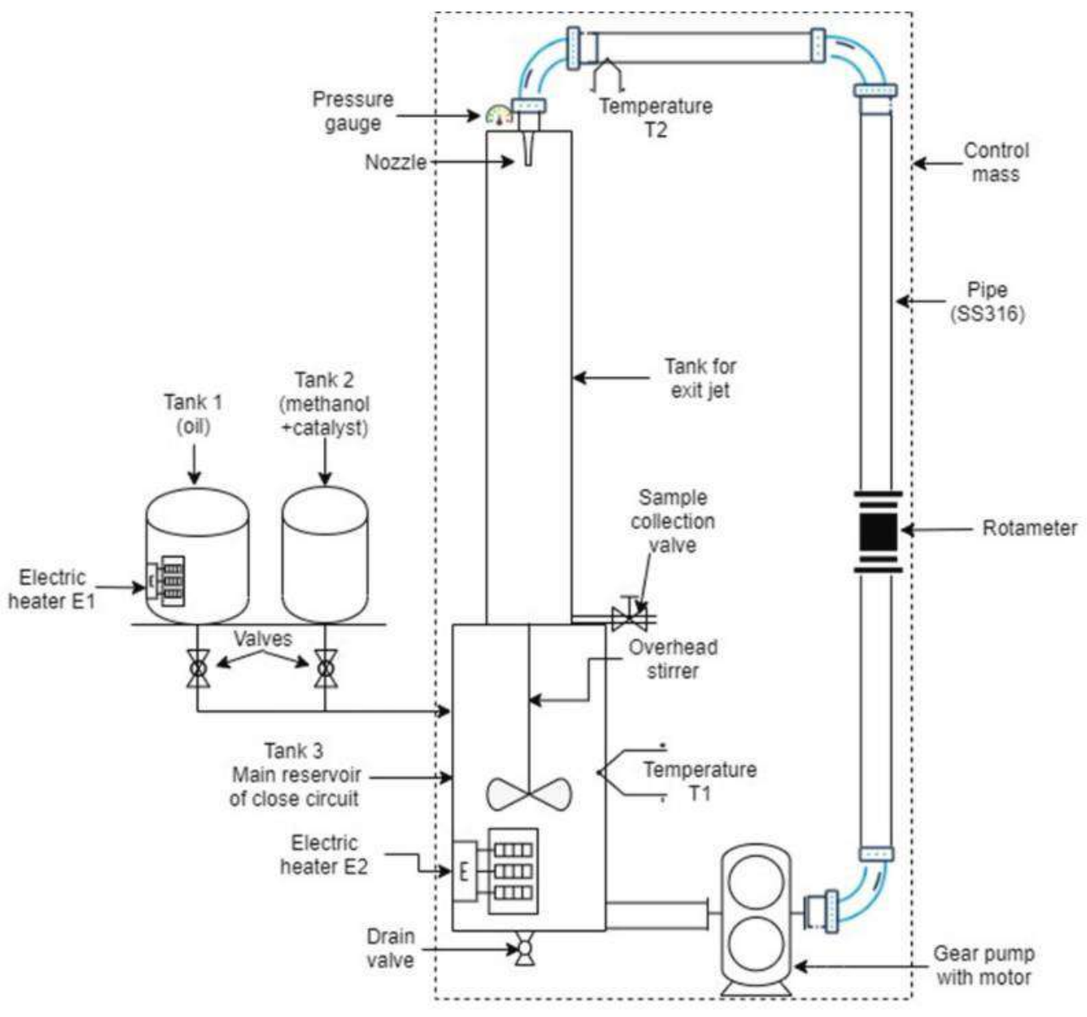
Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock



Hydrodynamic Cavitation Reactor

Specifications

- **Capacity:** 10 L/Batch
- **Pressure:** Upto 4 bar
- **Pump:** 0.5 hp
- **Cavitation device:** Nozzle
- **Nozzle dia.:** 1 mm
- **Electric heater:** 1 kW
- **Height:** 2.5 m
- **Floor area:** 0.8×0.4 m^2
- **Control Panel:** Comprehensive control and monitoring.
- **Temperature Sensors**: Multiple sensor locations for accurate data



Schematic diagram of biodiesel production employing hydrodynamic cavitation reactor

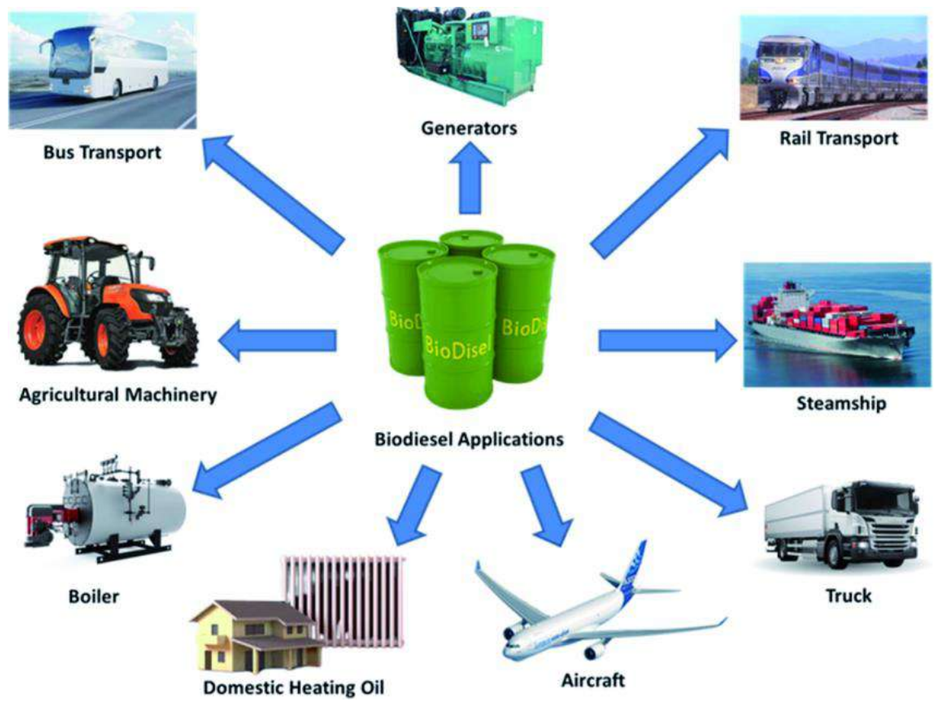
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling biodiesel production, pressure control, flow measuring, handling of control panel
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.
- **Pressure:** At 3 bar inlet pressure, obtained greater than 97% biodiesel yield.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the Hydrodynamic cavitation reactor

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Hydrodynamic cavitation reactor systems maintenance personnel training.

Applications of Biodiesel



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9574242576

Karl Fischer Titrator

Bench-top trainer, allows trainees to measure moisture content of fuel (biodiesel/diesel/oil)

Karl Fischer Titrator

Salient features

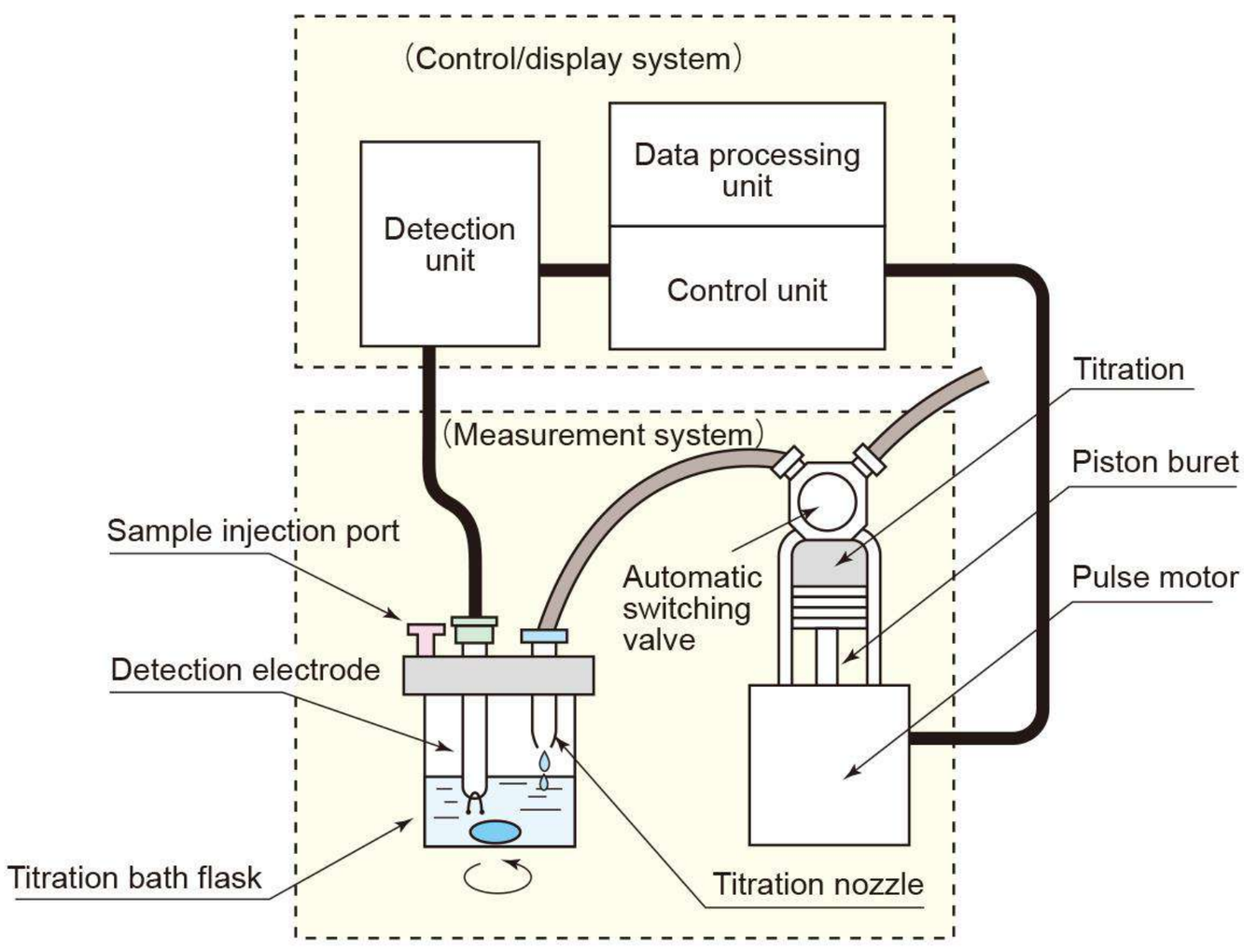
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, testing fuels
- **State Change Visualization:** Nil
- **Temperature Display:** Nil
- **Displaying live consumption of Karl Fischer Reagent**
- **Measurement:** The result shown in ppm or %.

Specifications

- **Model number:** µAquaCal100
- **Make:** Analab
- **HSN Code:** 90278990
- **Suitable for any type of fuel**
- **Method of detection:** Conductometric/ Volumetric
- **Display of reading:** Moisture in ppm & percentage (%)
- **Range of moisture detection:** More than 100 ppm
- **ASTM Standard:** ASTM D6304

Beneficiaries of the Karl Fischer Titrator

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Karl Fischer Titrator maintenance personnel training.



Mechanism of Karl Fischer Titrator

Applications of Karl Fischer Titrator

- Used to measure the moisture content of biodiesel or diesel or oil.

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Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

Brookfield Viscometer

Bench-top trainer, allows trainees to measure kinematic viscosity of fuel (biodiesel/diesel/oil)

Brookfield Viscometer

Salient features

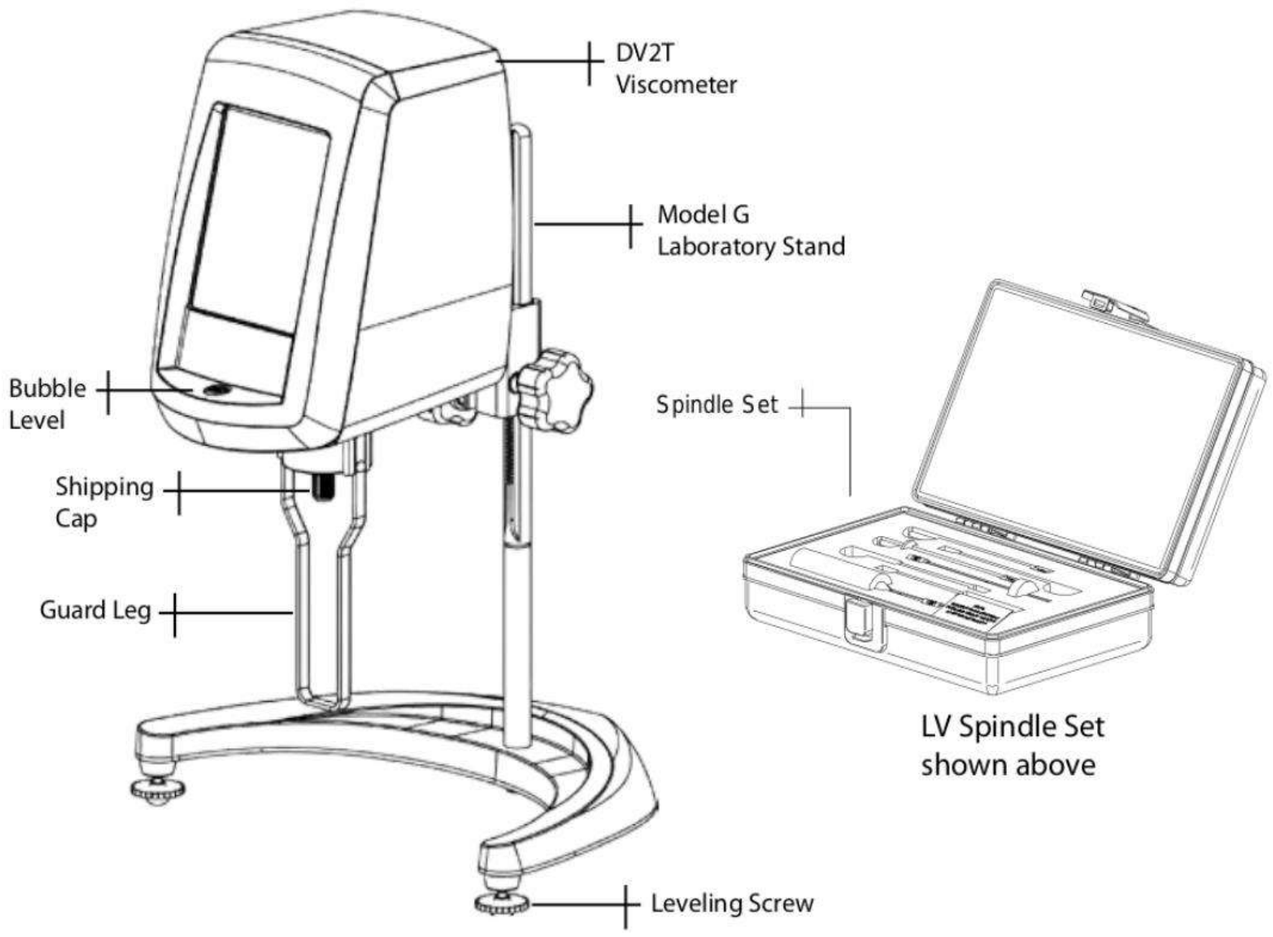
- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, testing fuels
- **State Change Visualization:** Nil
- **Temperature Display:** Showing live temperature of the sample and water
- **Performance parameters:** It is showing the live torque, shear stress and kinematic viscosity. The result shown in cP or mm^2/s.

Specifications

- **Model:** DV2LT
- **5-inch full color, touch screen display supports multiple languages**
- **Displayed info includes**
  1. viscosity (cP/mP·s)
  2. temp. (°C/°F), (Range: max. 100 °C)
  3. shear rate/stress,
  4. % torque, spindle/speed,
  5. step program status
- **Viscosity rpm:** 0.1-200 RPM
- **Accuracy:** ±1% range
- **Repeatability:** ±0.2%
- **USB PC interface**

Beneficiaries of the Brookfield Viscometer

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Brookfield Viscometer
- maintenance personnel training.



Schematic diagram of Brookfield viscometer

Applications of Brookfield Viscometer

- Used to measure the kinematic viscosity of biodiesel or diesel or oil.

Contact us for more details

Prof. Surendra Singh Kachhwaha
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7567622800

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Member, Centre for Biofuel and Bioenergy Studies (CBBS)
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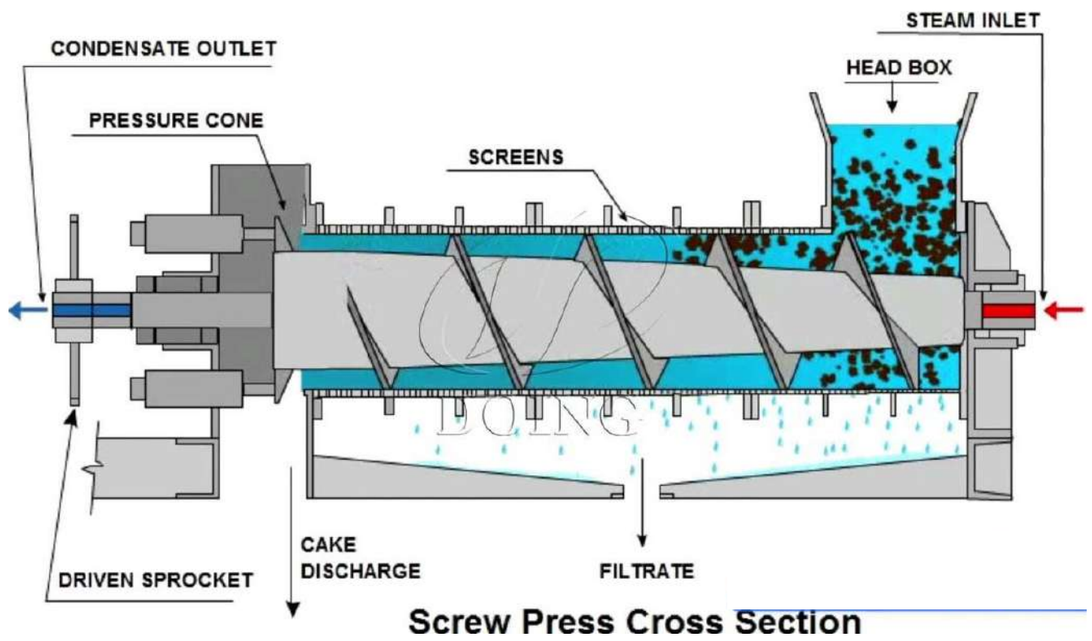
9574242576

Oil Press Machine

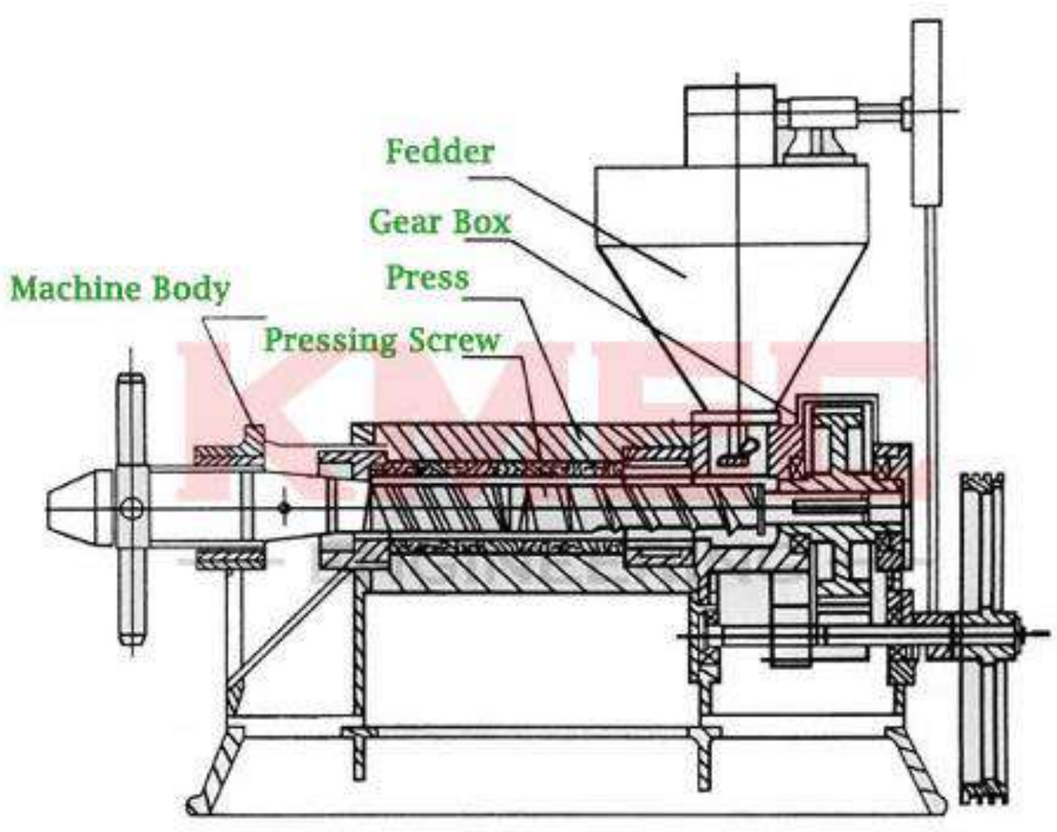
Bench-top trainer, allows trainees to extract oil from seeds

Oil Press Machine Specifications

- **Model number:** EPS TC 602
- **Capacity:** 4-8 kg/hr
- **Voltage:** 220 V
- **Motor Power:** 250 W
- **Wattage:** 600 W
- **Heater Power:** 350 W
- **Net weight:** 11.5 kg



Screw Press Cross Section



Mechanism and parts of oil press machine

Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like handling instrument, extracting oil from seeds
- **State Change Visualization:** Nil
- **Temperature Display:** Showing live temperature of machine

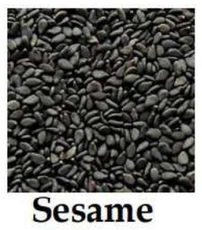
Beneficiaries of the Oil Press Machine

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in fuel testing.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Oil press machine maintenance personnel training.

Applications of Oil Press Machine

- Used to extract oil from varieties of seeds


Peanut


Sesame


Coconut


Almond


Flaxseed


Mustard


Sunflower Seed


Castor Seed


Soybean Seed

Contact us for more details

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7567622800

Dr. Pravin Kodgire
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Pravin.Kodgire@sot.pdpu.ac.in
9574242576

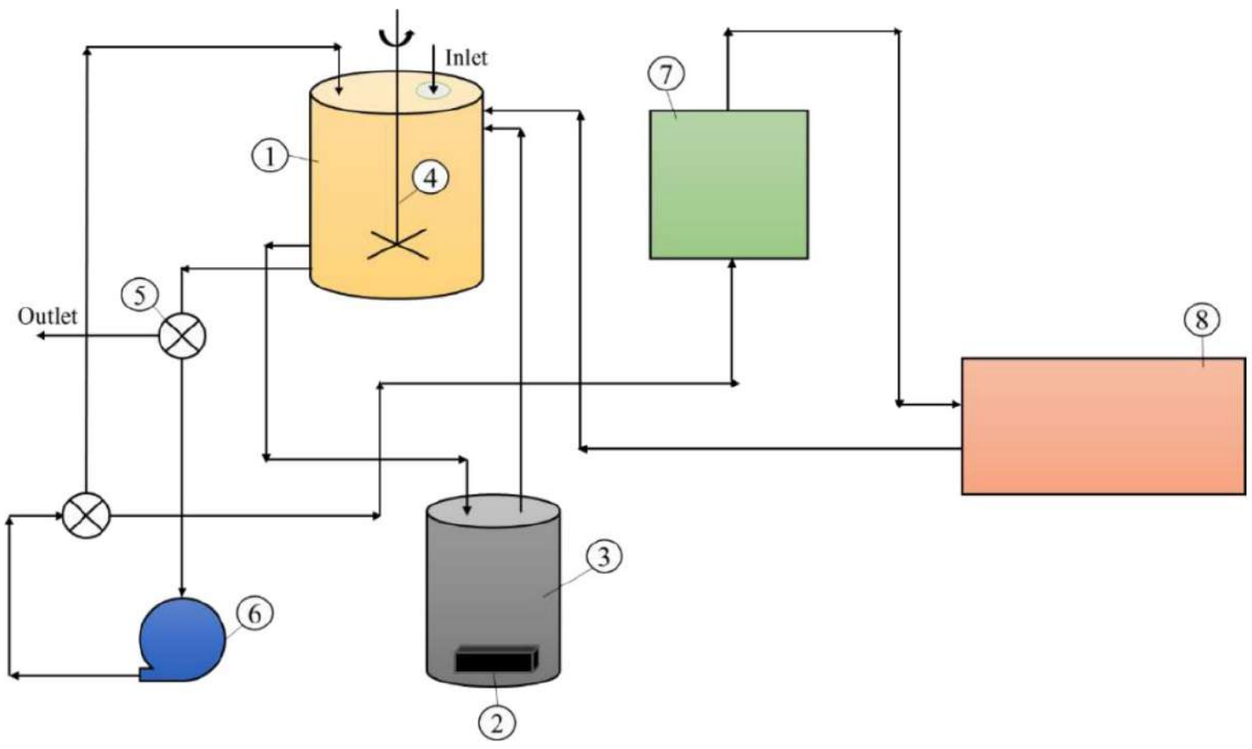
Sequential Reactor (Ultrasound and Microwave)

Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock

Sequential Reactor (Ultrasound and Microwave)

Specifications

- **Capacity:** 20 L/Batch
- **Ultrasonic Generator**
- **Ultrasound (Frequency:** 20 kHz and 40 kHz; **Power:** 600 W)
- **Microwave (Power:** 1000 W)
- **Mechanical Stirrer (Speed range:** 0-5000 RPM)
- **Water tank:** 20 L
- **Floor area:** 1.5×0.5 m^2
- **Control Panel:** Comprehensive control and monitoring.
- **Temperature Sensors**: Multiple sensor locations for accurate data



Schematic illustration of biodiesel production employing sequential ultrasound and microwave.

1: Oil tank, 2: Heater, 3: Water tank, 4: Stirrer, 5: By-pass valve, 6: Pump, 7: Ultrasound, 8: Microwave

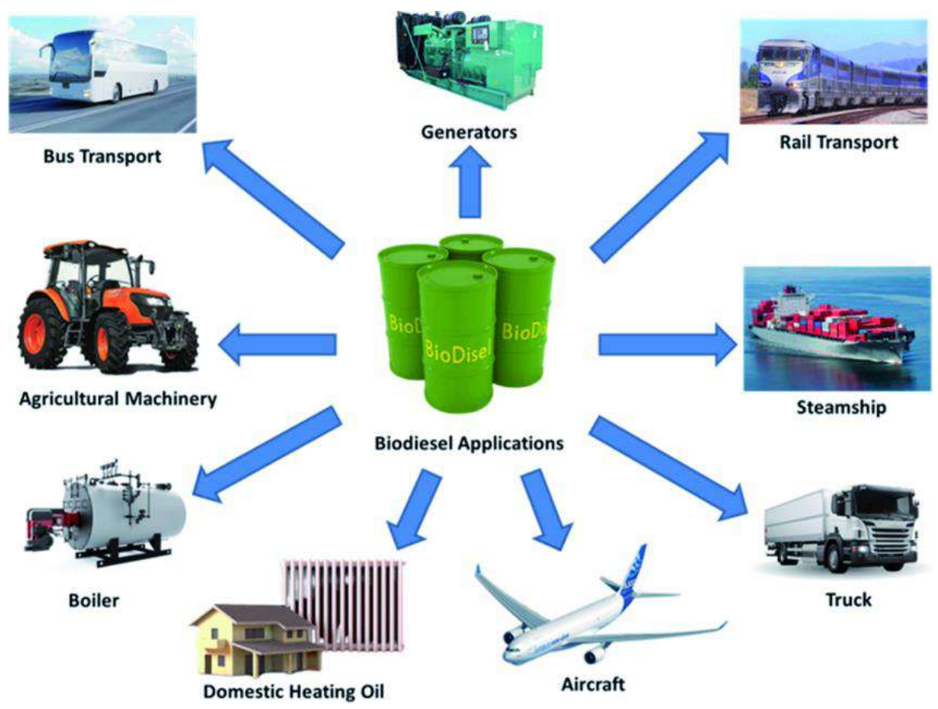
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like biodiesel production, controlling reaction, handling of control panel
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the Sequential Reactor (Ultrasound and Microwave)

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Sequential reactor (Ultrasound and Microwave) systems maintenance personnel training.

Applications of Biodiesel



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Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

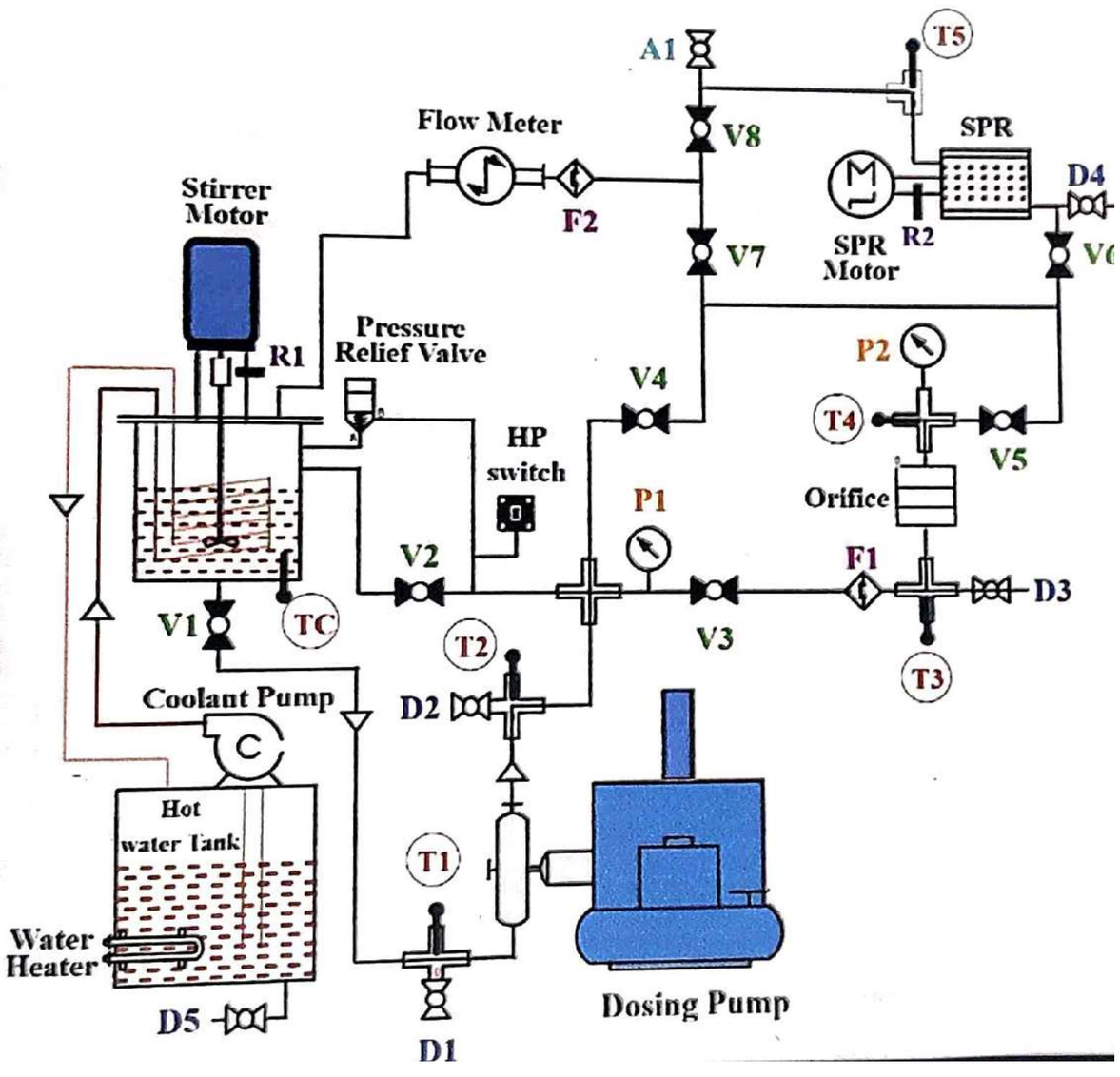
Shockwave Power Reactor

Bench-top trainer, allows trainees to produce biodiesel from varieties of feedstock

Shockwave Power Reactor

Specifications

- **Capacity:** 15 L/Batch
- **Shockwave power reactor motor:** Power: 1 hp/0.75 Kw; Motor speed: 2845 RPM
- **Stirrer motor:** Power: 0.5 hp; Motor speed: 1440 RPM
- **Orifice device:** 1 mm hole dia., 25 number of holes
- **Main pump:** Power: 3 hp; Motor speed: 1425 rpm
- **Control Panel:** Comprehensive control and monitoring
- **Temperature Sensors**: Multiple sensor locations for accurate data



Schematic diagram of biodiesel production employing shockwave power reactor

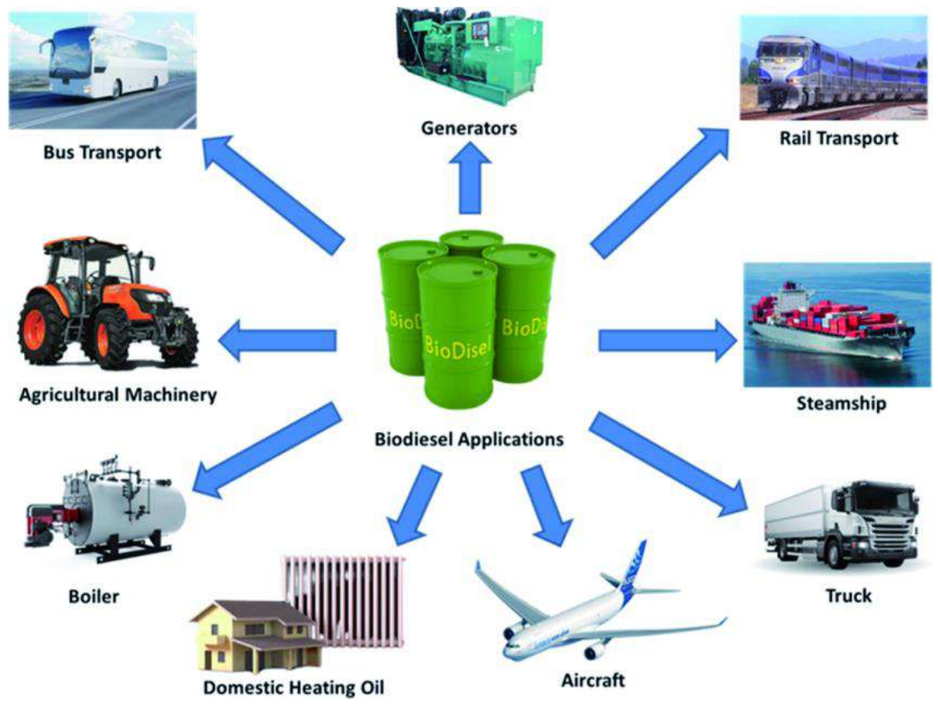
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like raw material handling, biodiesel production, flow control, speed control, handling of control panel
- **State Change Visualization:** Allows comparative studies between conventional techniques and process intensification technique.
- **Energy and Temperature Display:** Real-time display of energy consumption and temperature at various points in the system.
- **Speed of rotor:** At speed of 2200 RPM , obtained greater than 98% biodiesel yield.
- **Performance parameters:** Obtained higher biodiesel yield in less reaction time, cost efficient, energy efficient and time efficient technique

Beneficiaries of the Shockwave Power Reactor

- **Engineering Students:** Mechanical, Chemical, Petroleum, Biotechnology engineering students.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in biodiesel production.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Shockwave power reactor systems maintenance personnel training.

Applications of Biodiesel



Contact us for more details

Prof. Surendra Singh Kachhwaha
Lab Incharge, Centre for Biofuel and Bioenergy Studies (CBBS)
Surendra.Singh@sot.pdpu.ac.in
7567622800

Dr. Pravin Kodgire
Member, Centre for Biofuel and Bioenergy Studies (CBBS)
Pravin.Kodgire@sot.pdpu.ac.in
9574242576

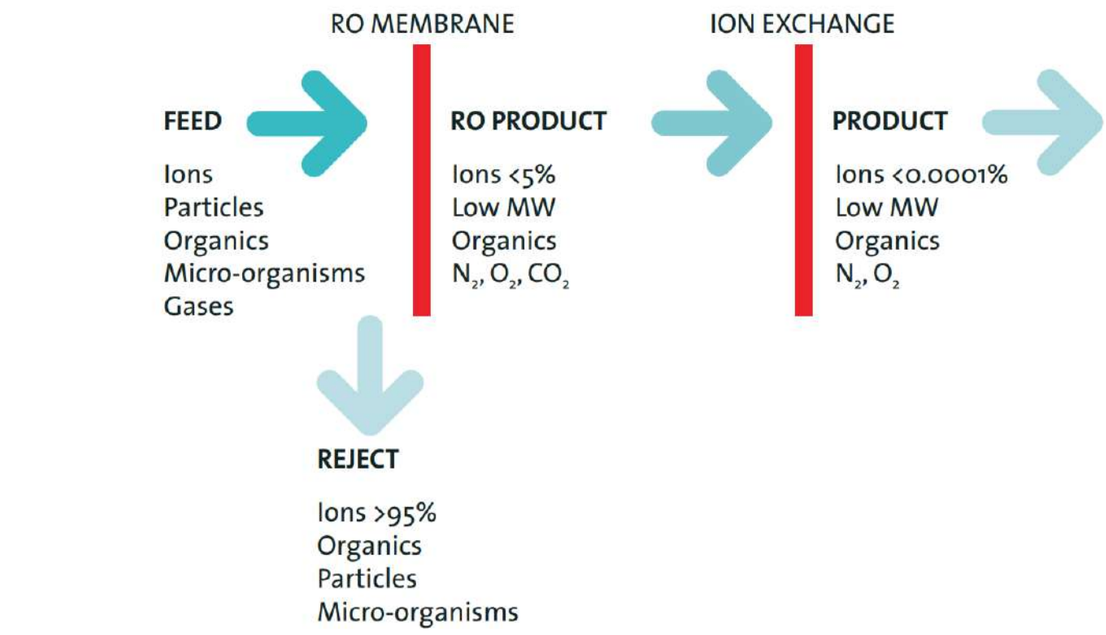
Water purification system

Bench-top trainer, allows trainees to produce distilled water

Water purification system

Specifications

- **Make:** Elga, England
- **Source quality:** Portable mains water supply
- **TDS maximum:** 1400 µS/cm
- **Free chlorine maximum:** 0.5 ppm
- **Heavy metals maximum:** 0.05 ppm
- **Silica maximum:** 30 ppm
- **Temperature:** 1-35 °C
- **Flowrate (max. requirement):** 78 l/hr
- **Height ×Width ×Depth:** 460×550×270 mm



Schematic diagram and mechanism of water purification system

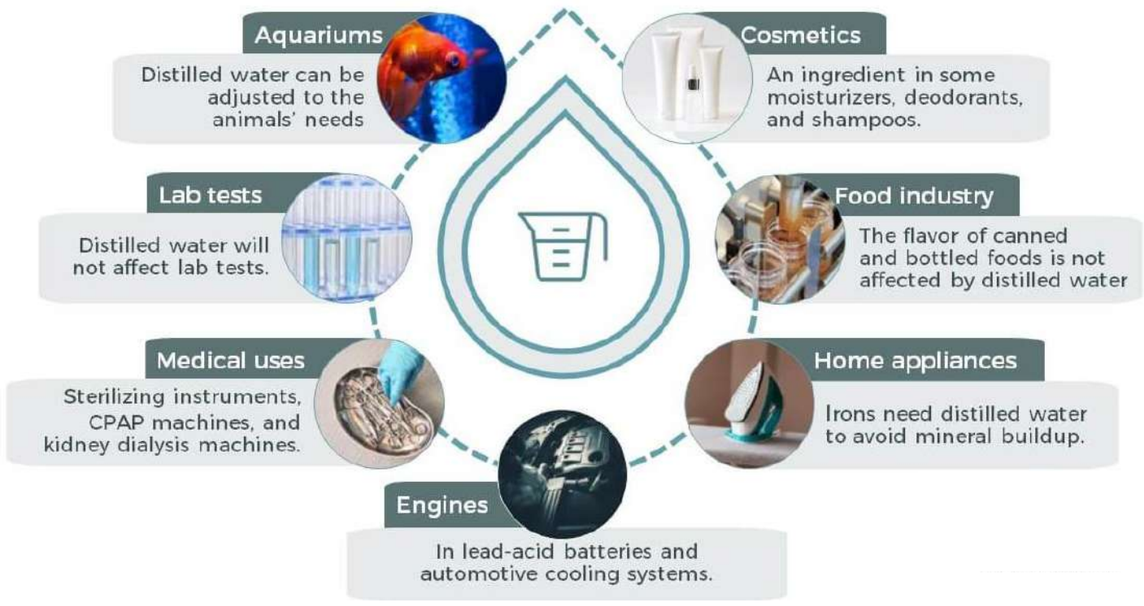
Salient features

- **Hands-On Practical Training:** Enables trainees to engage in practical exercises like feeding water, testing water quality, handling instrument
- **State Change Visualization:** Nil
- **Energy and Temperature Display:** Nil
- **Performance parameters:** Good conductivity of water displaying in µS/cm. Also, displays water storage quantity.

Beneficiaries of the Water purifying system

- **Engineering Students:** For all departments of university.
- **Technicians and Practitioners:** Technicians updating skills and knowledge.
- **Industry Professionals:** Industry professionals in water treatment.
- **Academics and Educators:** University and technical institute educators.
- **Maintenance Personnel:** Water purification systems maintenance personnel training.

Applications of Distilled Water



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Surendra.Singh@sot.pdpu.ac.in
7567622800

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Pravin.Kodgire@sot.pdpu.ac.in
9574242576

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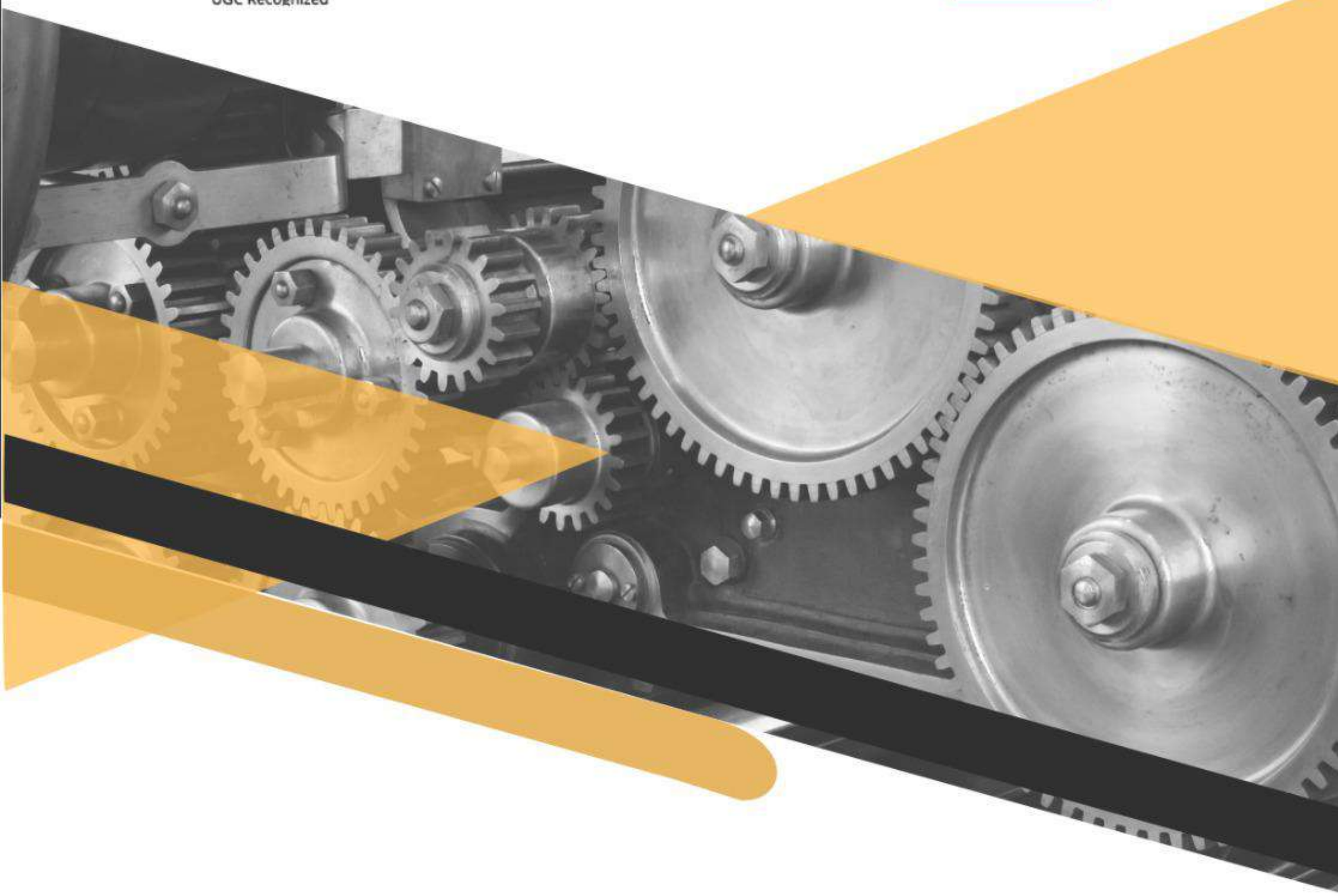

DEPARTMENT SUMMARY

Mechanical Engineering is a cornerstone of the engineering curriculum, producing 21st-century engineers with diverse capabilities. As one of the oldest and broadest disciplines, it covers the principles of heat and mechanical power for designing, producing, and operating a wide range of machines and tools. At PDEU, the Department of Mechanical Engineering is recognized for its excellence in education and research. The faculty through the state-of-the-art lab facilities foster an innovative culture with cutting-edge research for innvovation

CONTACT

+91 9428 415 422

jatin.patel@spt.pdpu.ac.in
jrpmech@gmail.com