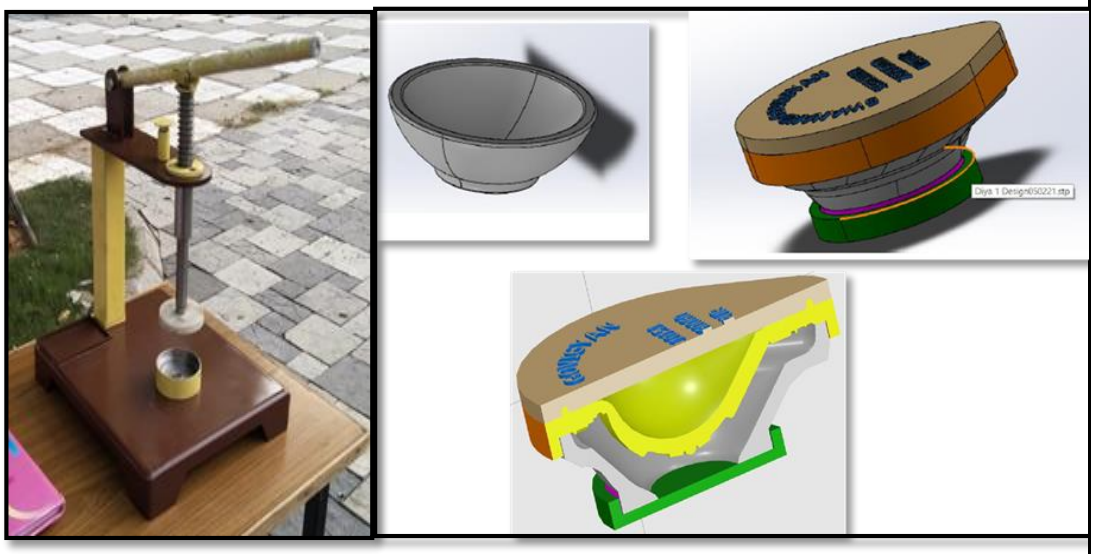
Department of Mechanical Engineering

Development Activities

Product Development: Faculty and Students of the department have contributed towards Product Development, new lab facilities, development of instructional materials and working model.

Table 1 Details of Development Activities

Development Activities	Faculty Details/Remarks
A. Product Development ● ***Development of Hand operated Die press Machine and molds for Govigyan Anusandhan kendra*** The Department of Mechanical Engineering designed and developed a hand press machine for various cow dung products such as Padma Kund, Diya - nearly four types, and Shree Yantra for Govigyan Anusandhan Kendra Nagpur. **Figure 1 Prototype and CAD Models Developed**  ● ***Design, development and testing of electric All-Terrain Vehicle*** Mechanical Engineering students actively contribute to the development of all-terrain vehicles that compete in the various competitions hosted by SAE. Every year, students on campus design and build the entire vehicle. Both engine-driven and	Dr. V. V. Shukla

battery-powered student-built vehicles are available on campus for demonstrations and further research.

Figure 2 Electric All-Terrain Vehicle Developed

Dr. A. K. Jha, Prof. S. A. Patil, Prof. B.C. Bissa

- ***Design and Development of ETC-CPC solar cooker***

Figure .3 ETC-CPC Solar Cooker

- Dr. S. S. Joshi

Department has designed and developed a low-cost and innovative ETC -CPC solar cooker. The cooker has been tested to cook food using sunlight. ***The IPR is filed***, and further development into a commercial product is currently underway.

- ***Self-cooled PV module***

An efficient system for the cooling of PV modules by ONAN technique has been designed, developed and tested in the laboratory. ***The IPR is under examination at the Indian Patent Office. The Product was showcased at Students' Innovation Festival (SIF) at MNIT Bhopal. Student also won 3rd Prize at National Talent Fest 2023organized by L&T Edutech Chennai***

- Dr. S. S. Joshi

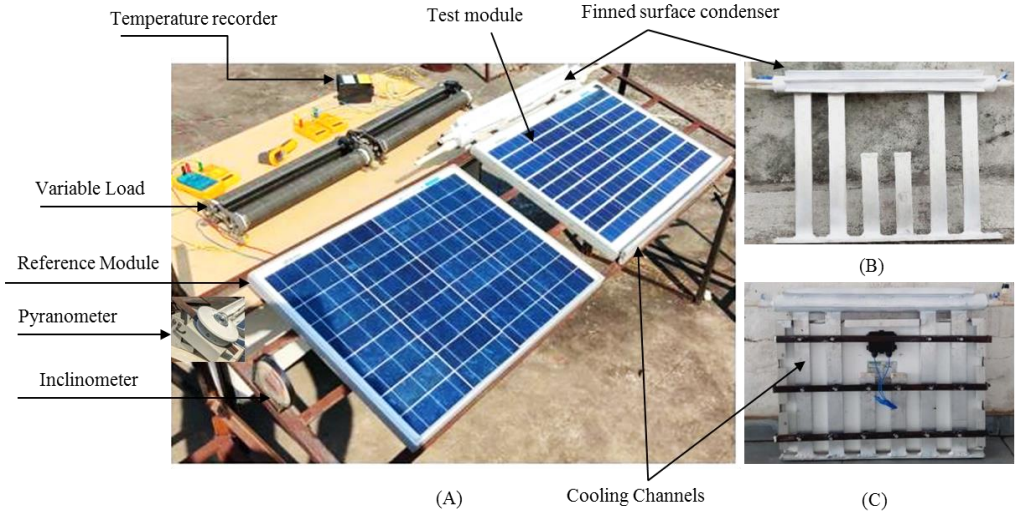


Figure .4 Setup of Self Cooled PV Module

- ***Innovative Battery Pack***

Two different designs of battery packs with improved battery cooling systems have been designed, developed and tested in the laboratory. ***The IPR is under examination at the Indian Patent Office. The roduct was showcased at National events such as CII MILCA, KPIT Sparkle Grand Finale at Pune.***

- Dr. S. S. Joshi

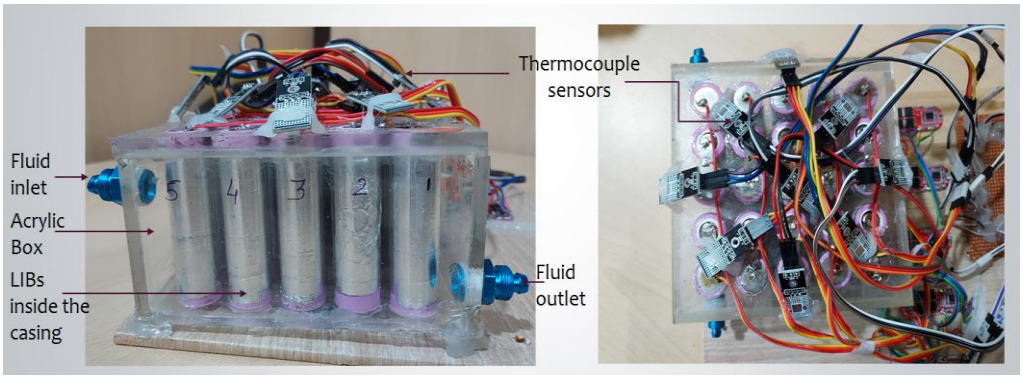


Figure .5 Experimental Setup for Innovative Battery Cooling Pack

- ***Design of Fall arrester***

The department has designed and developed an innovative fall arrester, and the actual product has been fabricated and tested in the laboratory. ***The IPR is under examination at the Indian Patent Office. The product was showcased at the India Science Congress at RTM Nagpur University in January 2023.***

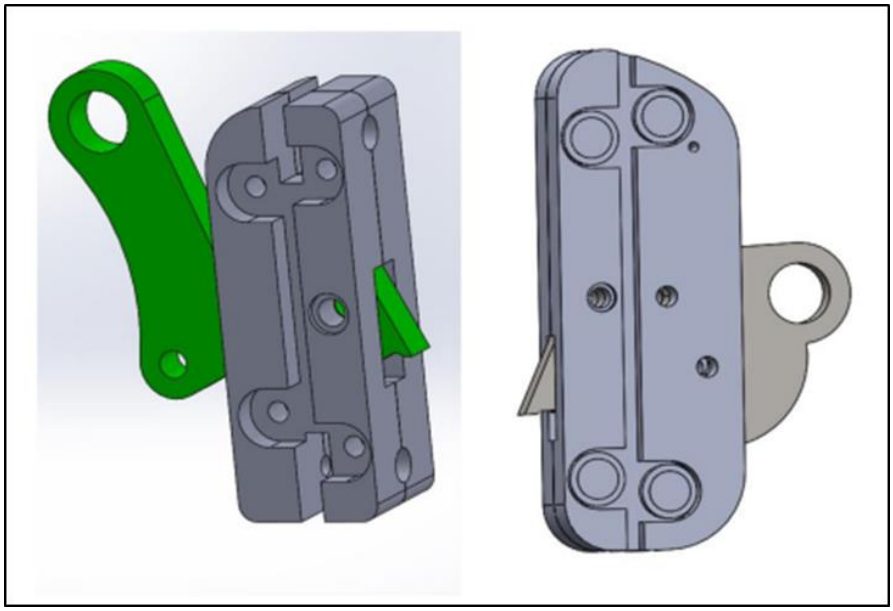


Figure .6 CAD Model of Indigenous Fall Arrester

- Dr. V. V. Shukla

• ***Dimension measuring system for 3-D Printers and Development of 3-D Printer***  **Figure .7 Development of 3-D Printer with Dimension Measuring System**	• Dr. V. V. Shukla
• ***DEVELOPMENT OF BAMBOO EPOXY COMPOSITE*** Research Internship - Bhavesh Verma Project- Himanshu Trivedi, Amisha KaremoreThe use of natural fibers in reinforced plastic materials as a composite has had a favorable impact on the development of green composites in our daily lives. One of the most serious issues that has arisen is the deterioration of polymeric composites when exposed to environmental factors such as humidity and temperature. Natural FRP composites are biodegradable, lightweight, and robust were testing a bamboo epoxy resin composite with a high resin-to-bamboo-fiber ratio, then comparing the results to man-made fibre composites using various tensile tests. OBJECTIVES: The main objective is to investigate and analyze the mechanical properties of a composite material using bamboo fiber. To explore the processing feasibility of bamboo fiber composites by different techniques and to study the resulting fiber and composite properties. To carry out a systematic study of the influence of processing parameters on the mechanical properties	• Dr. V. V. Shukla

Figure .8 Development of Bamboo Epoxy Composite

Some of the other developed products are

- Design and Development of Packaging machine for Sensors and Systems Pvt, Ltd
- Human Powered Flywheel Motor Driven Multipurpose Machine
- Desert cooler with earthen pot heat exchanger
- Bamboo Boards

B. Research laboratories

- ***RCOEM-TATA Technologies - Center for Invention, Innovation, Incubation & Training (CIIIT)***

- RCOEM-TATA Technologies - Center for Invention, Innovation, Incubation & Training (CIIIT) is at par with the world class technologies and has a main share of Mechanical Engineering. The major objective of CIIIT is, hand-holding of inventors, innovators, entrepreneurs to develop professional and industry centric technical skills. The facilities at CIIIT are

A. <u>Innovation Design and Incubation</u>

- Dr. G.R. Nikhade,
- Dr. A. K. Jha
- Dr. Y.M Sonkhaskar
- Prof. S. S. Deshmukh

- Design and Engineering
- Virtual Verification and Analysis
- Product Lifecycle Management

B. Integrated Advance Manufacturing Center

- Computer Integrated Manufacturing
- Industrial Robotics
- Manufacturing Execution Systems
- Advance Manufacturing
- Reverse Engineering
- Plastic Additive Manufacturing
- Internet of things
- Autonomous Driving

C. Machine Learning and Internet of Things

- E-Learning Platform i-Get-it
- IOT IDE (ESP-01, Arduino Nano and Rasberry PI)
- The major laboratories available at RCOEM-TATA CIIIT are:
- Digital Manufacturing Laboratory
- Computer Aided Manufacturing Laboratory
- Multi Body Dynamics Laboratory
- Product Life Management Laboratory
- Machine Learning Laboratory
- Industrial Robotics and Sensor Technology Center
- Computer Aided Drafting Laboratory
- Computational Fluid Dynamics Simulation Center
- Welding, fabrication and computerized Machine Shop
- Computer Aided Engineering (CAE) and Finite Element Analysis (FEA) Laboratory

All the above laboratories and skill-development centers are shared by the students and faculty of Mechanical, Industrial,

Computer Science, Information Technology, Electronics and Communication, Electrical and Civil Engineering Departments.

The major machines and equipments at CIIIT are:

- Vertical Machining Center (VMC-ACE Micromatic AS-430 V)
- Arc welding Robot (YASKAWA)
- 3-D Printer (Ultimaker 3 Extended)
- 3-D Scanner (Ein Scan)
- Manufacturing Execution System (12m Long Conveyor with PLC)
- Pick and place Robot (Brabo)

The complete professional Softwares suites available at CIIIT are:

- Dassault Systems
  1. Catia V6 PLM
  2. Delmia
  3. 3-D Experience
- MSC
  1. Adams Machinery studio
  2. Nastran & Patran
  3. Marc
  4. Easy5
  5. ScFlow
- FEAST by ISRO
- i-Get-it by TATA Technologies Ltd

Figure .9 Advanced Manufacturing Center at CIIIT RCOEM

- ***Concentrated Solar Thermal System (Inclusion of IOT enabled data acquisition system for performance monitoring)***

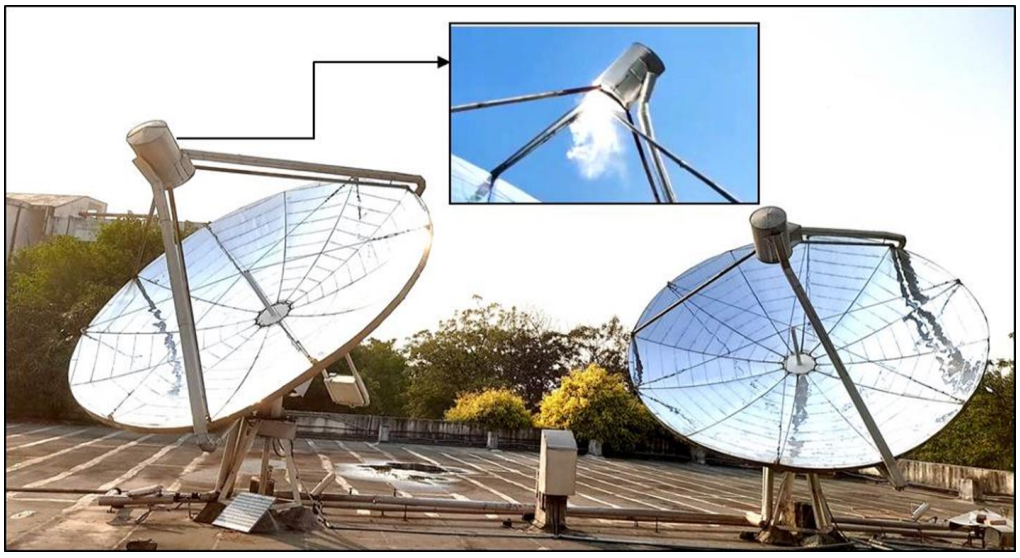


Figure.10 Concentrated Solar Thermal System Installed at RCOEM

The research facility consists of two parabolic-dish solar concentrators, each with a 16 square-meter aperture area and a carefully designed helical coil cavity receiver to maintain the concentration ratio above 300. The dish collectors, along with the tracking gears and motors, are positioned on the rooftop of the Hostel mess on campus, using a specifically designed tripod type foundation. The dish collectors are made of fiber reinforced plastic (FRP) material and highly reflective anodized aluminum sheets to reduce the total weight of the system and auxiliary

- Dr. S. S. Joshi

power usage. As a result, the 4 x 40 W PMDC motors can balance the entire tracking system while providing enough torque and rpm. To reduce convective heat losses, the receiver and working medium circuit are insulated with light resin bonded (LRB) Rock wool material.

The dish collectors have a fully automatic Aurdino-based two-axis tracking system that tracks the direction of the sunrays so that all captured solar radiation must concentrate at the collector's focal point. The entire system is fully automatic and controlled via an IoT-enabled graphical user interface (GUI). There is adequate online data monitoring capability in place, which is used to monitor the plant live performance via a specifically built data acquisition system and IoT interface. During non-cloudy weather, the temperature at the receiver comfortably rises up to 200 degrees Celsius. A high temperature in line vertical pump, a 300 litre stainless steel accumulator with a built- in coiled tube heat exchanger, expansion tank, pressure switches, a 2 HP air compressor, and two direct sparged stainless steel cooking vessels are also included in the system. The installed system is set up in such a way that researchers can use the entire 32 square metre collecting area or each individual dish collector for any comparative study.

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CST facility installed at RCOEM Nagpur

■ Business Bureau

RCOEM Nagpur is working diligently to create renewable energy facilities on campus for utility, demonstration, training, and research. A state-of-the-art facility of Concentrated Solar Thermal (CST) system has been installed in the campus recently.

The facility consists of two parabolic-dish solar concentrators, each with a 16-square-meter aperture area and a carefully designed helical coil cavity receiver to maintain the concentration ratio above 300. The dish collectors have a fully automatic Aurdino-based two-axis tracking system that tracks the direction of the sunrays so that all captured solar radiation concentrate at the collector's focal point.

The entire system is fully automatic and controlled via an IoT-enabled graphical user interface (GUI). During non-cloudy weather, the temperature at the receiver comfortably rises up to 250 degrees Celsius.

The project coordinators Dr Sandeep Joshi and Dr Vishal Shukla of Department of Mechanical Engineering further informed that the research facilities will benefit the students on campus to execute various research projects utilizing solar thermal energy.

RCOEM Nagpur has self-funded the entire project. The project coordinators have expressed their heartfelt gratitude to the college management and Principal - RCOEM Nagpur for their thoughtfulness in fostering a sustainable research culture on campus.

नवभारत

रामदेव बाबा कॉलेज में कंसन्ट्रेटेड सोलर थर्मल

■ नागपुर, व्यापार प्रतिनिधि. नागपुर. रामदेव बाबा कॉलेज ऑफ इंजीनियरिंग एंड मैनेजमेंट ने अपारंपरिक ऊर्जा के क्षेत्र में विकास, रिसर्च और जागरूकता के महत्व को समझते हुए सोलर फोटोवोल्टिक और कंसन्ट्रेटेड सोलर थर्मल के उपयोग के लिए सुविधा विकसित की है. इसके विकास के लिए 460 केडब्यूपी का सोलर फोटोवोल्टिक प्लांट स्थापित किया गया है. सोलर ऊर्जा से विद्युत निर्मिति के अलावा, सोलर ऊर्जा से थर्मल हिट का निर्माण में उपयोगी हो सकता है. देश में 50 प्रतिशत ऊर्जा हिटिंग के काम आती है जिसमें कुकिंग, प्रोसेस हिट, स्पेस हिट और कारखानों, संस्थानों और औद्योगिक आस्थापनाओं में कूलिंग के काम आती है. ऊर्जा के भविष्य के महत्व को देखते हुए इस क्षेत्र में और विकास के दृष्टि से अत्याधुनिक, आईओटी पे आधारित पूर्ण स्वयंचलित रिसर्च सुविधा स्थापित की गई है. इस प्रोजेक्ट के समन्वयक डॉ. संदीप जोशी और विशाल शुक्ला हैं. यह सुविधा ग्रेजुएट, अंडर ग्रेजुएट और आचार्य के अभ्यासकों के लिए है.

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Figure .11 Local Media Coverage of Concentrated Solar Thermal System Installed at RCOE

- Dr. G. R. Nikhade

- **Miniature Industrial Production System (MIPS)**

A combination of all the technologies used in the lab, the Miniature Industrial Production System (MIPS) is complete platform to learn about industrial automation.

It includes a combination of various motors, motor drivers, sensors, pneumatic and linear actuators, etc. to build a small manufacturing unit that performs a specific task.

Figure 12 Demonstration of MIPS

C. Instructional materials

Video lectures of all faculty members

- Video lectures, you tube channels, demo models of KOM DOM, Automobile Engg.

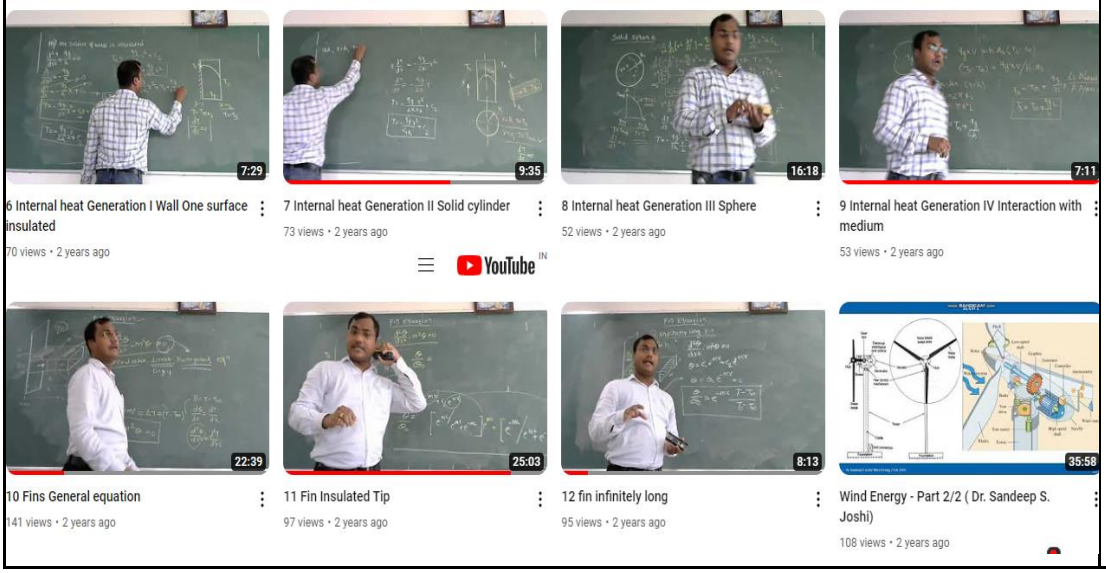

Figure .13 Video Lectures on You tube Channel of Faculty Member of the Department

D. Working models/charts/monograms etc.

- Automobile engineering - Hands on components
- KDoM- Models
- Design of Machine Elements

- ***Mini Project- working models***

Figure .14 Demonstration of Mini Projects at Mechanical Engineering Department