

A Report on Industrial Visit to
"Central Manufacturing Technology Institute"
Organized by
Department of Mechanical Engineering
on 11.08.2026.



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1. Introduction

As part of the academic curriculum and to provide students with practical exposure to advanced manufacturing and emerging technologies, the III B.Tech. students of the Department of Mechanical Engineering undertook an industrial visit to the **Central Manufacturing Technology Institute (CMTI), Bengaluru, on 11 August 2026**. The visit was conducted under the guidance of **Dr. G. Bala Narasimha, Assistant Professor, and Mr. Mohammed Rizwan Ali, Assistant Professor**.

The industrial visit was organized with the objective of bridging the gap between theoretical knowledge acquired in the classroom and its practical application in advanced industrial and research environments. The students had an opportunity to observe sophisticated equipment, laboratories, manufacturing processes, metrology systems, sensor development technologies, nanotechnology facilities, and aerospace-related technologies.

2. About CMTI

The Central Manufacturing Technology Institute (CMTI), Bengaluru, is a Government of India society and an autonomous Research and Development organization under the administrative control of the Ministry of Heavy Industries. CMTI focuses on providing advanced technology solutions to the manufacturing sector and plays an important role in applied research, technology development, and industrial technology advancement.

The primary objective of CMTI is to address the 4P challenges—Product, Process, People and Production—through science- and technology-driven solutions. Its activities include development of emerging manufacturing technologies, customized machines and processes, high-value technical services, skill development, technology licensing, incubation, entrepreneurship, and open innovation.

The vision of CMTI is “Achieving Manufacturing Technology Excellence through S&T driven solutions to 4P (Product-Process-People-Production) challenges of Industry.” Its purpose is to undertake research, technology development, training and application activities that help industries achieve excellence in technology and improve productivity while contributing to the economic growth of the country.

CMTI has a wide range of advanced R&D facilities covering areas such as Advanced Material Characterisation, Precision Metrology, Sensors Technology Development, Micro-Nano System Engineering, Smart Manufacturing and IIoT, Precision

Manufacturing, Surface Engineering and Laser Processing, Additive Manufacturing, Control Systems, Aerospace Test Rigs and Calibration, among others.

3. Guidance during the Visit

The students and faculty members were guided through the various centres and laboratories by Mr. Yashwanth and Mr. Manjunath, staff members of CMTI. They explained the working principles, applications and significance of the advanced equipment and technologies available in the respective laboratories. The interaction with the CMTI staff provided students with valuable insights into the practical applications of engineering concepts in research and industrial environments.



4. Visit to the Centre for Nano Technology

The visit initially commenced with the **Centre for Nano Material Characterization**, where the students were introduced to advanced facilities used for material characterization, surface analysis and micro- and nano-scale investigations.

The students observed sophisticated equipment such as:

- Scanning Electron Microscope (SEM)
- Fourier Transform Infrared Spectrometer (FTIR)
- Ellipsometer
- X-Ray Diffraction (XRD)
- Scanning Transmission Electron Microscope (STEM)
- Atomic Force Microscope (AFM)
- Confocal Microscope
- Other advanced characterization and nanotechnology facilities

The students learned how these instruments are used to study surface morphology, microstructure, crystal structure, chemical composition, surface characteristics and other material properties. They were also introduced to controlled laboratory environments, including Class 1, Class 10 and Class 100 cleanroom facilities, highlighting the importance of contamination control in micro- and nano-scale manufacturing and characterization.

This exposure helped the students understand how concepts from materials science, manufacturing, physics and mechanical engineering are integrated in advanced research and product development.

5. Visit to the Precision Metrology Laboratory

The students were subsequently taken to the **Precision Metrology Laboratory**, where they were introduced to highly advanced measurement and calibration facilities.

The students observed the calibration and precision measurement of instruments such as:

- Vernier calipers
- Micrometers
- Slip gauges
- Gauges and other precision measuring instruments

The staff explained the use of laser-based technologies and advanced measurement systems for achieving high levels of accuracy and precision. The visit helped students understand the importance of metrology in manufacturing, quality control, dimensional inspection and calibration.

The students could relate their classroom knowledge of engineering measurements and metrology to the sophisticated systems used in industrial and research applications.

6. Visit to the Sensors Technology Development Centre

The next part of the visit was to the Sensors Technology Development Centre, where students were introduced to the development and fabrication of advanced sensors.

The students observed various facilities associated with sensor modelling, microfabrication and sensor development. They were introduced to processes and equipment such as:

- Wafer dicing
- Wet etching
- Dry etching
- X-Ray inspection
- Helium Leak Detector
- Bond Tester
- E-Beam Welding
- Wafer Bonder
- Flip chip bonder
- Microfabrication processes
- Sensor modelling and development facilities

The staff explained how sensors are designed and fabricated at micro-scale levels and how different fabrication processes are used to obtain the required geometries and functional characteristics.

The visit provided students with an understanding of the integration of mechanical engineering, electronics, materials science, microfabrication and sensing technologies, particularly in the development of modern smart sensors.

7. Visit to Aerospace Test Rig & Calibration Laboratories

The students were also introduced to aerospace-related laboratories and technologies developed and supported by CMTI. They gained exposure to advanced technologies associated with sensing and actuation systems used in aerospace applications, including aircraft and missile-related systems.

The staff explained the importance of accurate sensing, reliable actuation, precision measurement, testing and calibration in aerospace systems, where high levels of reliability and performance are essential.

This exposure enabled students to understand how advanced manufacturing, sensors, control systems, metrology and precision engineering contribute to the development and testing of aerospace technologies.

8. Opportunities for Students

The visit also provided students with an awareness of several opportunities available at advanced R&D organizations such as CMTI.

Internship Opportunities:

Students can explore internship and training opportunities in areas such as advanced manufacturing, precision engineering, metrology, sensors, nanotechnology, additive manufacturing, automation and other emerging technologies.

Research Opportunities:

The advanced laboratories and multidisciplinary research activities at CMTI provide opportunities for students interested in pursuing project work, higher studies and research in emerging areas of manufacturing and engineering technology.

Career Opportunities:

The visit familiarized students with the diverse career opportunities available in R&D organizations, advanced manufacturing industries, precision engineering, sensor technology, metrology, aerospace technology and Industry 5.0-related domains.

9. Learning Outcomes

After completing the industrial visit, the students were able to:

1. Understand the role and importance of advanced R&D organizations in the manufacturing sector.
2. Understand the importance of nanotechnology and advanced material characterization in engineering.
3. Identify the applications of SEM, FTIR, XRD, AFM, STEM, ellipsometry and confocal microscopy.
4. Understand the importance of precision metrology and calibration in manufacturing and quality control.
5. Gain an overview of laser-based precision measurement and calibration techniques.
6. Understand the basic concepts involved in sensor modelling, fabrication and microfabrication.
7. Gain awareness of processes such as wafer dicing, wet etching and dry etching used in sensor fabrication.
8. Understand the role of sensing and actuation technologies in aerospace applications.
9. Appreciate the multidisciplinary integration of mechanical engineering, materials science, electronics, sensors, manufacturing and automation.
10. Develop awareness of internship, research and career opportunities in advanced manufacturing and R&D organizations.
11. Recognize the importance of innovation, precision, research and emerging technologies in the future of engineering.

10. Conclusion

The industrial visit to CMTI, Bengaluru, was highly informative and provided the III B.Tech. students with valuable exposure to advanced manufacturing technologies and research facilities. The visit enabled students to observe the practical implementation of concepts related to materials characterization, nanotechnology, precision metrology, sensor fabrication, microfabrication, sensing, actuation and aerospace technologies.

The interaction with CMTI scientists and staff members helped students gain a better understanding of current technological developments and their industrial applications. The visit also motivated students to explore internships, research projects, higher studies and career opportunities in advanced engineering and manufacturing domains.

Overall, the industrial visit successfully enhanced the students' practical knowledge, technical awareness and understanding of the role of emerging technologies in modern engineering and manufacturing.

11. Acknowledgement

The Department of Mechanical Engineering sincerely thanks the management and authorities of Central Manufacturing Technology Institute (CMTI), Bengaluru, for providing the students with an opportunity to visit the institute and gain valuable practical exposure. The department also expresses its gratitude to Mr. Yashwanth and Mr. Manjunath for their guidance, technical explanations and support throughout the visit.