5.6 INNOVATIONS BY THE FACULTY IN TEACHING AND LEARNING

The Department of Mechanical Engineering places significant emphasis on incorporating innovative teaching methodologies. At the beginning of each semester, a refresher program is conducted to facilitate knowledge sharing among faculty members regarding novel and enhanced course offerings for the semester. These brainstorming sessions enable faculty members to exchange best practices, ensuring continuous improvement in teaching methods. Discussions typically cover pedagogical approaches, innovative assessments, assignments, and content beyond the standard syllabus. Faculty members utilize LCD projectors for their presentations, effectively enhancing the teaching-learning experience. Instructors employ a diverse range of teaching tools, including traditional chalk-and-board methods, PowerPoint presentations, video lectures, models, charts, animations, and interactive techniques such as group discussions, seminars, tutorials, guest lectures, and live demonstrations. Additionally, the department actively integrates various innovative practices to further enrich the teaching-learning process.

Table 5.6.1: Innovations by the Faculty in Teaching and Learning

SL NO	ITEM	DESCRIPTION
a	Project based Learning	As part of the courses in each semester, students will complete a project-based learning and these will be graded using the rubrics. Open Day will be organized at the END of each semester; PROJECT EXHIBITIONS are held to display the project-based learning (PBL) work completed by students. The project demonstrates the students' capacity to put their knowledge of various real-world issues to use in solving them. Numerous initiatives in the flourishing fields of Advanced Manufacturing Systems, Finite Elements Methods, Additive Manufacturing System like 3D Printing, Thermal Engineering, Heat Transfer, Various Advanced Design Methods, Using Advanced Software’s like AUTO CAD Inventor, CATIA, PRO-E,

		ANSYS, etc. Link: https://bitswgl.ac.in/me/me
b	Modern Tools Usage (ICT)	LCD Projectors, Speakers, Systems with Keyboard and mouse, power point presentation, Laser Pointer, Slide changer, writing pads, Wi-Fi enabled classrooms and other student learning environments. Wi-fi enabled Tools. Link: https://bitswgl.ac.in/me/me
c	Innovative Learning practices	Various cutting-edge techniques, such as activity-based learning and project-based learning, were discussed throughout the lecture sessions. Like Role playing and brainstorming Assignments, Application Development, Poster Presentation, Mooc Course, Presentation, Poster Design, Partial Delivery, and Mini Project Review , Group Seminar, Collaborative Learning. Innovative Methods of Teaching Adopted • **Mind mapping**- A visual thing used for disseminating complex information to the students is used for some of the subjects • **Role playing** - Students are asked to complete the task by role playing by interacting with their peers and try to complete the task assigned to them in their specific role. Link: https://bitswgl.ac.in/me/me
d	Quality course materials	The digital library has expert video subject lectures given by a variety of notable resource people, which makes it easier for professors and students to use NPTEL's E-Tutorials, MOOCs, and other online resources.

		Link: https://bitswgl.ac.in/me/me
e	Industry Visits	Industry Visits will be organized once in a year for delivering the practical exposure to the students during Industry Visit. Link: https://bitswgl.ac.in/me/me
f	Internship	Internship will be conducted during the semester end before the start of next semester .student will be trained on the industry-oriented skills some of the students will be sent to the industry/company/organization for conduction the internships. Link: https://bitswgl.ac.in/me/me
g	Online platform	Faculty members use Google Drive, Google class rooms, Google forms and other platforms such as YOUTUBE. Link: https://bitswgl.ac.in/me/me
h	Open/Industry Courses/Skill/Enhancement Courses	These activity are provided by the ISE department for a set time during the academic year. Here, the student's proficiency with tools and software used in industry was improved. Open courses. Link: https://bitswgl.ac.in/me/me

a) PROJECT BASED LEARNING

The Department of Mechanical Engineering actively promotes Project-Based Learning (PBL) to enhance students' problem-solving skills, creativity, and practical knowledge. PBL provides a hands-on, experiential learning approach where students work on real-world projects, integrating theoretical concepts with practical applications.

- Key Features of PBL Implementation:
- Industry-Relevant Projects
- Collaboration with industries to develop projects that address real-world challenges.
- Encouragement to work on interdisciplinary projects incorporating AI, IoT, automation, and robotics.

- Team-Based Learning: Students collaborate in groups to foster teamwork, leadership, and communication skills. Faculty members act as mentors, guiding students throughout the project lifecycle.
- Integration with Curriculum
- PBL is incorporated into coursework through mini-projects, major projects, and capstone projects.
- Encouragement to participate in hackathons, technical competitions, and research-driven projects.

Sample Projects:

- **Engineering Sector: E-Auto Rickshaw**

Description:
Students designed and developed an **E-Auto Rickshaw**, an eco-friendly and cost-effective solution for urban and rural transportation. The project focused on addressing the growing need for sustainable mobility solutions while reducing carbon emissions.

Tools and Technologies Used:

- **AUTO CAD, CATIA, and Pro-E Design Software:** Students utilized these advanced design tools to create 3D models, simulate performance, and optimize the structural and mechanical components of the E-Auto Rickshaw.
- **Prototyping and Testing:** The team built a functional prototype, incorporating electric motors, battery systems, and lightweight materials to ensure efficiency and durability.

Learning Outcomes:

- Students gained hands-on experience in **product design, prototyping, and testing**.
- They developed a deep understanding of **electric vehicle (EV) technology** and its applications in real-world scenarios.
- The project emphasized **sustainability and innovation**, aligning with global trends in green transportation.

Impact:

The E-Auto Rickshaw project has the potential to revolutionize last-mile connectivity in both urban and rural areas, providing an affordable and environmentally friendly alternative to traditional fuel-based rickshaws.

Fig 5.6.a.1: Engineering Sector: E-Auto Rickshaw

- **Agriculture Sector: Automatic Alarm System for Crop Protection**
  Description:
  Students designed an **Automatic Alarm System** to protect crops from birds and insects, a common problem faced by farmers. The system uses sensors and alarms to deter pests without harming them, ensuring sustainable and eco-friendly crop protection.
  Tools and Technologies Used:
- **AUTO CAD and Pro-E Design Software:** Students designed the system's housing and components, ensuring durability and ease of installation in agricultural fields.
- **Sensor Integration:** The team incorporated motion and sound sensors to detect the presence of birds and insects.
- **Microcontroller Programming:** The system was programmed to trigger alarms and deterrents when pests are detected.
  Learning Outcomes:
- Students developed skills in **sensor integration, microcontroller programming, and system design**.
- They gained a deeper understanding of **agricultural challenges** and the role of technology in solving real-world problems.
- The project highlighted the importance of **innovation in agriculture** to improve crop yields and reduce losses.
  Impact:
  The Automatic Alarm System provides farmers with a cost-effective and non-invasive solution to protect their crops, ultimately contributing to food security and economic stability in rural communities.

Fig 5.6.a.2: Agriculture Sector: Automatic Alarm System for Crop Protection

b) MODERN TOOLS USAGE (ICT)

The Department of Mechanical Engineering integrates **Information and Communication Technology (ICT)** tools to enhance teaching and learning, making education more interactive, engaging, and effective.

i) Smart Classrooms & Digital Infrastructure

- All classrooms are equipped with **projectors, blackboards, and whiteboards** for an enriched learning experience.
- Faculty use projectors for **video lectures, simulations, and online expert talks** to improve conceptual understanding.

ii) Learning Management Systems (LMS)

- Platforms like **Moodle, Google Classroom, and Microsoft Teams** are used for sharing study materials, assignments, and assessments.
- Students can access lecture notes, quizzes, and recorded sessions anytime for **self-paced learning**.

Fig 5.6.b.1: Usage of Modern Tools (ICT)

iii) Online Learning & MOOCs

- Faculty and students actively participate in online courses through **NPTEL, Coursera, Udemy, and edX, Xplore**.
- Platforms like **Tech Transform and SWAYAM** are utilized to upskill students with emerging technologies.

Sample Certificates

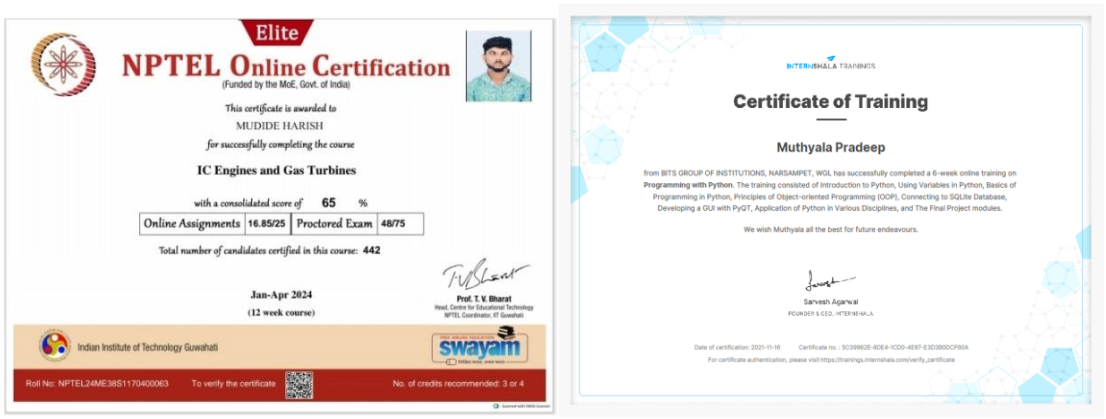


Fig 5.6.b.2: Certificates of Online Learning & MOOCs

iv) Virtual Labs &Software's

Virtual labs and software's in the Mechanical Engineering department provide interactive, computer-based environments for conducting experiments and analyzing engineering concepts without physical equipment. D**esign and Analysis tools like, Auto-CAD, Pro-E, SolidWorks, and ANSYS** enable students to model mechanical systems, test theories, and visualize complex phenomena. They enhance learning by offering a cost-effective, safe, and flexible alternative to traditional labs. Applications include Designing,Finite element, fluid dynamics, thermodynamics, and manufacturing analysis. Virtual labs bridge the gap between theoretical knowledge and practical application, improving problem-solving skills and preparing

students for real-world engineering challenges with hands-on digital experimentation.

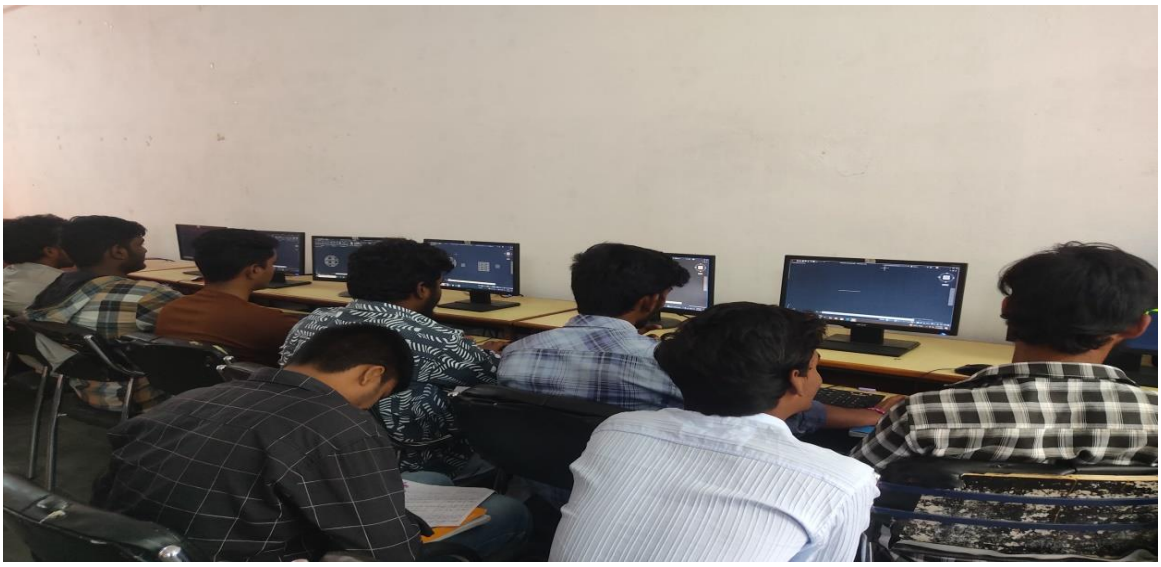


Fig 5.6.b.3: Usage of Software in Computer Lab

c) INNOVATIVE LEARNING PRACTICES

The Department Mechanical Engineering adopts **innovative learning practices** to enhance student engagement, foster critical thinking, and bridge the gap between theoretical knowledge and real-world applications. These methods create a dynamic and interactive learning environment, preparing students for future challenges.

Innovative learning practices such as activity-based learning (ABL) and project-based learning (PBL) have transformed traditional education by making it more engaging, practical, and student-centric. Techniques like role-playing, mind mapping, application development, poster presentations, mini-project reviews, group seminars, and collaborative learning are not just teaching methods but powerful tools that equip students with the skills and knowledge needed to thrive in a competitive world.

Role-playing and mind mapping encourage creativity and critical thinking. By simulating real-world scenarios, students learn to approach problems from multiple perspectives, fostering empathy and decision-making skills. Mind mappingsessions, on the other hand, promote teamwork and idea generation, helping students develop innovative solutions to complex challenges.

Application development and poster presentations bridge the gap between theory and practice. Through hands-on projects, students gain technical expertise and learn to apply theoretical concepts to real-world problems. Poster presentations enhance communication skills, as students must articulate their ideas clearly and concisely to diverse audiences.

These practices not only make learning more interactive and enjoyable but also prepare students for the demands of the modern workforce. They cultivate problem-solving, communication, teamwork, and leadership skills, ensuring students are well-rounded, confident, and ready to tackle global challenges.

Innovative methods of teaching adopted:

- **Mind mapping**- A visual thing used for disseminating complex information to the students is used for some of the subjects

Fig 5.6.c.1: Students adopting mind mapping Concepts

- **Role playing** - Students are asked to complete the task by role playing by interacting with their peers and try to complete the task assigned to them in their specific role.

Fig 5.6.c.2: Students adopting mind mapping Concepts

- **Seminar:** Encouraging students to present on recent advancements, research papers, or innovative projects. Improves communication, research, and public speaking skills.

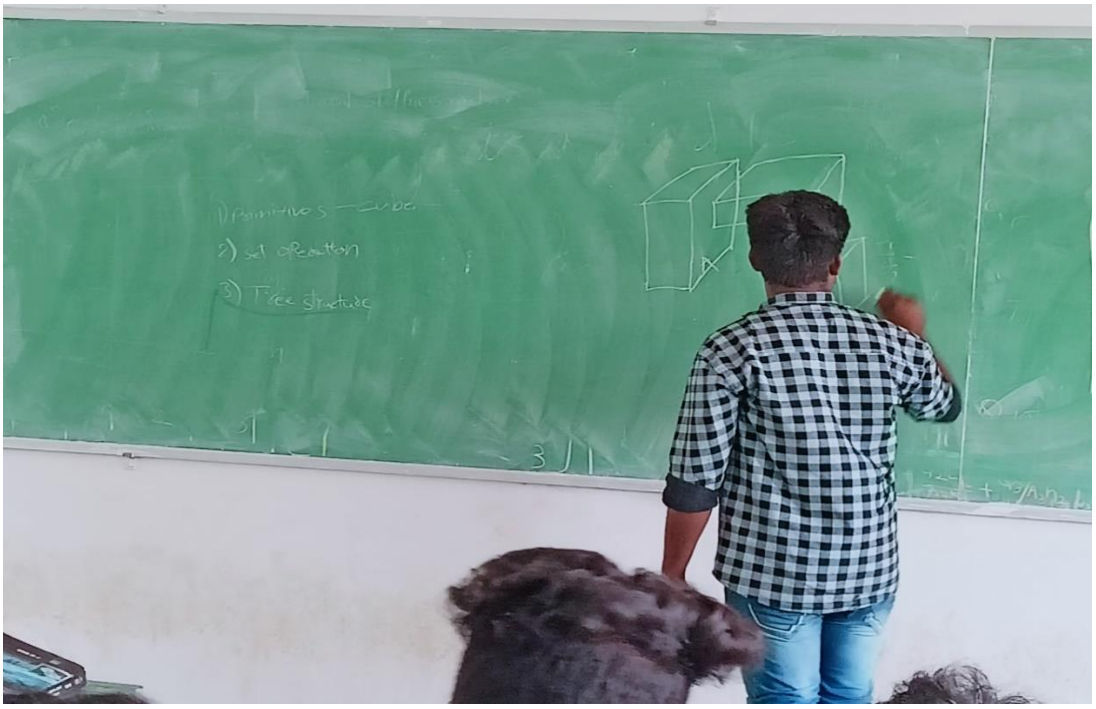


Fig 5.6.c.3: Innovative Methods of Teaching Adopted

Fig 5.6.c.4: Innovative Learning practicesat Computer Lab

d) QUALITY COURSE MATERIALS

The digital library offers high-quality course materials, including expert video lectures delivered by distinguished academicians and professionals. These resources

enhance learning for both professors and students by providing easy access to NPTEL's E-Tutorials, MOOCs, and other online educational content. With a well-equipped E-Studio, the platform ensures the production of comprehensive and engaging instructional videos, making complex subjects more accessible. These materials support self-paced learning, bridge knowledge gaps, and promote a deeper understanding of concepts. By integrating technology with education, the digital library fosters an interactive and enriched academic environment, ultimately improving the quality of teaching and learning experiences.

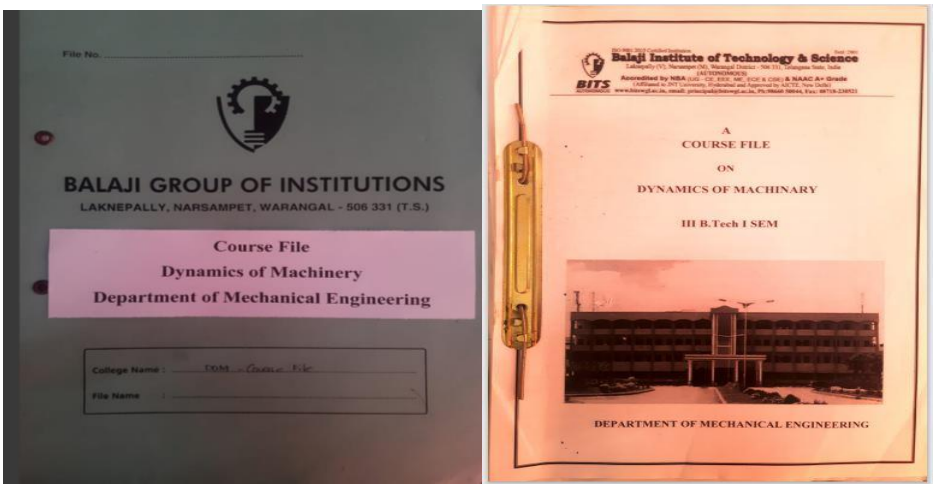


Fig 5.6.d.1: Course Materials

e) INDUSTRY VISITS

Industry Visits will be Organizing once a year is a transformative practice that provides students with **practical exposure** and a deeper understanding of real-world applications of their academic knowledge. Visits to renowned facilities like the **Siemens Product Development and Design Lab at NIT Warangal, Nagarjuna Sagar Dam, and Sriharikota Space Center** offer students a unique opportunity to witness cutting-edge technologies, innovative processes, and large-scale engineering marvels in action.

Siemens Product Development and Design Lab at NIT Warangal

Nagarjuna Sagar Dam

Sriharikota Space Center

Fig 5.6.e.1 Students at Industry Visits

f) **INTERNSHIP**

Internship will be conducted during the semester end before the start of next semester, or in the final year II semester student will be sent for Internship to be trained on the industry-oriented skills. Some of the students will be sent to the industry/company/organization for conduction the internships.Mechanical Engineering students use Internshala and other online platforms to secure internships, gaining industry exposure, practical skills, and hands-on experience.

Table 5.6.2: List of Students got Internship

S. No	Internship offered by	No. of students enrolled	Duration
1	Prathi Raj Metal Masters Pvt. Ltd	8	6 months
2	Amritha Tool crafys Pvt. Ltd	9	6 months
3	Sundaram Fasteners Limited	7	6 months
4	MRF	3	6 months
5	Warehouse Now	5	1 year
6	Anjor Foundation Trust	10	2 months
7	South central Railway, Diesel Loco shed, Kazipet	20	45 days

Fig 5.6.f.1: 22C35A0319, Sai Teja. T, Internship at Prathi Raj Metal Masters Pvt. Ltd

Fig 5.6.f.2: 21C31A0313, Harish.M, Internship at Prathi Raj Metal Masters Pvt. Ltd

Fig 5.6.f.3: 21C31A0309, Sandeep. K, Internship at Prathi Raj Metal Masters Pvt. Ltd

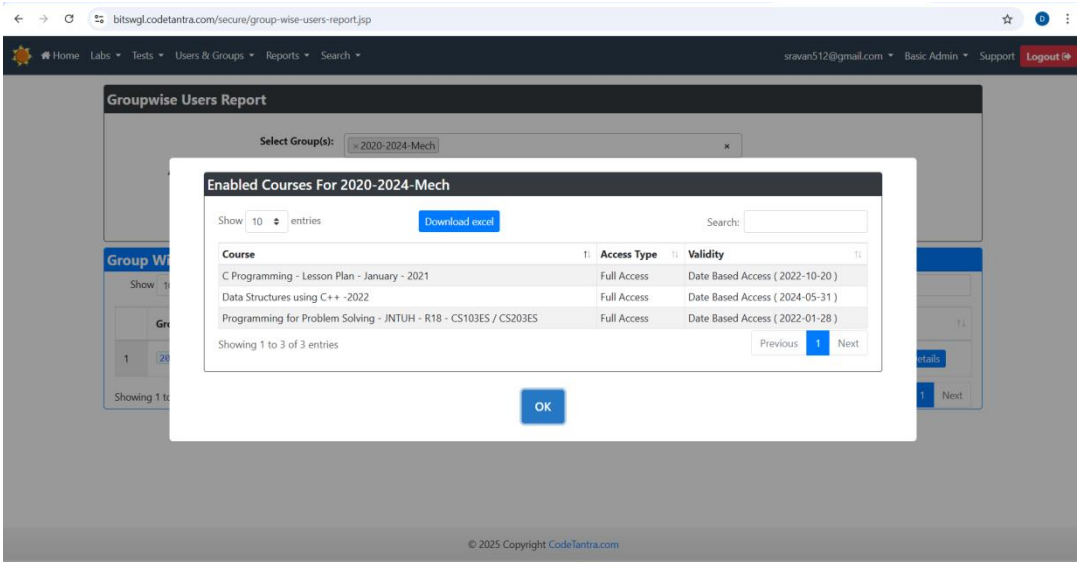
Fig 5.6.f.4: Students at Sundaram Fasteners Limited

g) ONLINE PLATFORM

In today's educational landscape, online platforms play a crucial role in enhancing teaching and learning. Faculty members utilize various Google tools, such as Google

Drive, Google Classroom, and Google Forms, to create an interactive and efficient learning environment. Google Drive acts as a central repository for storing and sharing course materials, ensuring easy student access. Google Classroom facilitates communication, assignment distribution and promoting seamless collaboration. Google Forms enables the creation of quizzes and surveys, allowing educators to assess student understanding and gather feedback effectively. Additionally, platforms like Code Tantra and Xplore further support online learning and engagement.

https://bitswgl.codetantra.com/secure/group-wise-users-report.jsp



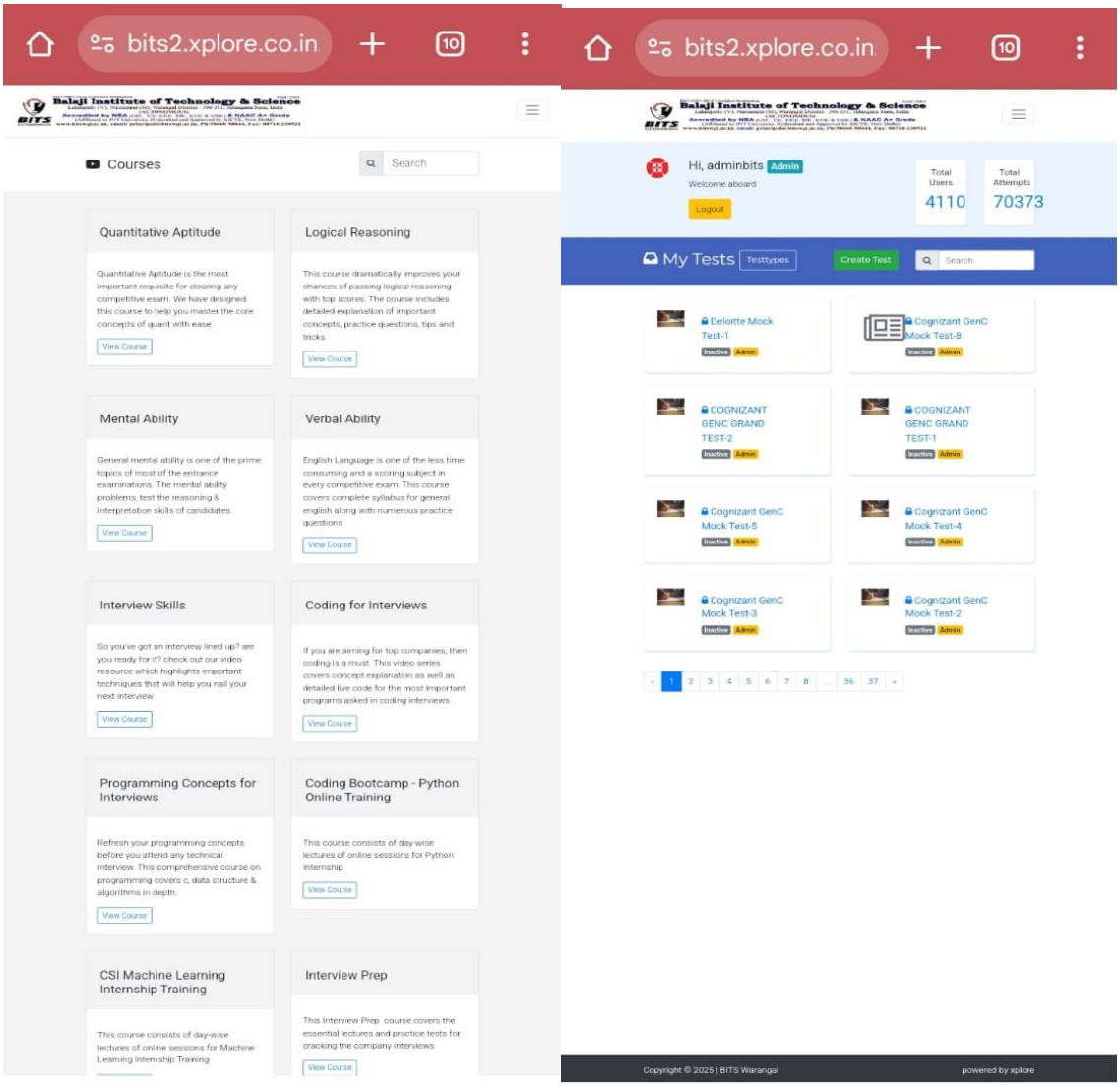


Fig 5.6.g.1: Online platform Used in Mechanical Engineering Department

h) OPEN/INDUSTRY COURSES/SKILL/ENHANCEMENT COURSES

The Department of Mechanical Engineering offers Open Courses, Industry-Oriented Programs, and Skill Development Initiatives as part of its commitment to bridging the gap between academia and industry. These courses are strategically designed and conducted throughout the academic year to provide students with hands-on experience in industry-relevant tools, software, and technologies.

Through these programs, students develop expertise in CAD/CAM software (AutoCAD, SolidWorks, CATIA, ANSYS), CNC programming, robotics, additive manufacturing (3D printing), finite element analysis (FEA), computational fluid dynamics (CFD), and automation technologies. Additionally, courses on data analytics,

IoT, and AI applications in mechanical systems ensure students stay ahead in the evolving technological landscape.

Fig 5.6.h.1: Students Participation in Industry Courses/Skill Enhancement Courses