5.6 Innovations by the faculty in Teaching and learning

In the Department of Electronics and Communication Engineering, much importance is given for incorporating innovative techniques in teaching. At the beginning of every semester, a refresher program is conducted to share the innovative practices followed by other faculties about a new/enriched course offered in the semester. Such brainstorming sessions help transfer the best practices among faculties in the department. Pedagogies, Innovative Assessments, Assignments, and Content-out-of-Syllabus are typically discussed in the sessions. A snip of one of the meetings conducted for one of the courses "Problem Solving using MATLAB". Faculty members use the LCD Projectors for their presentations. The faculty members use these aids to take the teaching-learning process to the next level.

Lectures are presented by faculty members using a variety of teaching tools such as chalk and board, PowerPoint presentation, video lectures, models, charts, animation, and other teaching techniques such as lecture, group discussion, seminar, tutorials, guest lectures, and demonstration. Apart from this, the following are the various innovative practices followed at ECE department to enhance Teaching- Learning.

Innovative method by faculty in Teaching and Learning

SL NO	ITEM	DESCRIPTION
1	Project-based Learning	As part of their 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 student's capacity to put their knowledge of various real-world issues to use in solving them. Numerous initiatives in the burgeoning fields of Embedded systems, VLSI, Digital Signal Processing, Image Processing, wireless communication,etc. https://bitswgl.ac.in/ece/ece
2	Modern Tools Usage (ICT)	LCD Projectors, Speakers, Systems with Keyboard and mouse, PowerPoint presentation, Laser Pointer, Slide changer,

		writing pads, Wi-Fi enabled classrooms, and other student learning environments. Wifi enabled Tools: https://bitswgl.ac.in/ece/ece
3	Innovative Learning practices	Various cutting-edge techniques, such as activity-based learning and project-based learning, were discussed throughout the lecture sessions, role-playing and brainstorming Assignments, Application Development, Poster Presentation, Mooc Course, Presentation, Poster Design, Partial Delivery, and Mini Project Review, Group Seminar, Collaborative Learning https://bitswgl.ac.in/ece/ece
4	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. E-Studio: https://bitswgl.ac.in/ece/ece
5	Industry Visits	Industry Visits will be organized once a semester to deliver the practical exposure to the students Industry Visit: https://bitswgl.ac.in/ece/ece
6	Internship	The internship will be conducted during the semester end before the start of next semester Students will be trained on industry-oriented skills some of the students will be sent to the industry/company/organization to conduction the internships Internship: https://bitswgl.ac.in/ece/ece
7	InnovativeMethodsofTeachingAdopted	• **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. https://bitswgl.ac.in/ece/ece
8	Online platform	Faculty members use Google Drive, Google Class rooms, Google forms, and other platforms such as YOUTUBE:

9	Open/Industry Courses/Skill/Enhancement Courses	
		These activities 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 https://bitswgl.ac.in/ece/ec

Innovations by the faculty in teaching and learning are as follows:

1. Project-based Learning

The Department of Electronics and Communication Engineering (ECE) 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.
Problem-Based Learning (PBL) is deeply integrated into the Electronics and Communication Engineering (ECE) curriculum to develop students' critical thinking, analytical skills, and real-world problem-solving abilities. This approach ensures that learning is not just theoretical but application-driven and industry-relevant.

Key Aspects of PBL Integration:

Courses incorporate real-world problem statements, requiring students to explore, analyze, and develop innovative solutions.Subjects like Embedded Systems, VLSI, IoT and Wireless Communication include problem-solving tasks that mimic industry challenges.Internal assessments emphasize problem-solving through mini-projects, case studies, and simulations rather than traditional exams.Students work on open-ended problems, encouraging creativity, research, and a solution-oriented mindset.Problems often require knowledge from multiple domains, integrating electronics, coding, AI, and automation. Promotes collaborative learning, where students work in teams to solve complex, multi-faceted problems.Real-world case studies and problem statements are sourced from industry partners and research institutions.Students engage in live problem-solving scenarios, preparing them for professional challenges in R&D, design, and manufacturing.

Fig: Project-based learning Students Presenting the major project Development in Project lab .

2. Modern Tools Usage (ICT)

Modern tools play a crucial role in enhancing the learning and practical experience of students. Simulation platforms like MATLAB and Simulink enable them to test theories and solve complex problems. Programming tools such as Python, C++, and Java are used for coding in various domains like software development and automation.

Integration of Modern Tools

The integration of modern tools such as LCD projectors, speakers, systems, PowerPoint presentations, laser pointers, slide changers, writing pads, and Wi-Fi-enabled classrooms has revolutionized the teaching and learning process. These tools have transformed traditional classrooms into dynamic, interactive, and student-centric environments, fostering a culture of innovation, collaboration, and excellence.

Benefits of Modern Tools

By leveraging these technologies, faculty members not only enhance the quality of education but also prepare students to face the challenges of a rapidly evolving, technology-driven world. One of the most significant advantages of modern tools is their ability to cater to diverse learning styles. Visual learners benefit from high-quality displays and animations, auditory learners gain from clear and impactful audio delivery, and kinesthetic learners thrive through interactive tools like writing pads and real-time annotations. This inclusivity ensures that every student, regardless of their preferred learning style, can engage deeply with the subject matter and achieve their full potential. Moreover, the use of tools like PowerPoint presentations, laser pointers, and slide changers enables faculty to deliver structured and organized content, making complex topics more accessible.

In addition to enhancing academic learning, modern tools also play a crucial role in developing essential life skills. Collaborative platforms and Wi-Fi-enabled devices encourage teamwork, communication, and project management, which are critical for success in both academic and professional settings. The impact of these modern tools extends beyond the classroom, creating a future-ready generation of learners who are capable of driving innovation and progress. By embracing technology, educational institutions are not only enhancing the quality of education but also contributing to societal development. The integration of modern tools in education has ushered in a new era of learning, characterized by interactivity, inclusivity, and innovation. By leveraging these technologies, faculty members are creating engaging and effective learning environments that empower students to achieve their academic and professional goals. As we move forward, it is essential to continue embracing and advancing these tools, ensuring that education remains a powerful force for positive change in society.

Fig-Smart Classrooms & Digital Infrastructure

Advanced Tools:

- Advanced versions of Software like MATLAB, Xilinx are taught to students every semester
- Simulation-based learning for theoretical concepts and use of the latest tools. The students are encouraged to simulation-based learning for a better understanding of the subject.

Simulation lab

3. Innovative Learning practices

The Department of Electronics and Communication Engineering (ECE) 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.

Education is constantly evolving, with new methods emerging to make learning more engaging, student-centered, and effective. Traditional lecture-based learning is gradually being replaced by innovative approaches that in corporate technology, hands-on experiences, and interactive learning strategies. These methods help students develop critical thinking, creativity, and problem-solving skills, preparing them for real-world challenges.

Fig: Students Presenting Group Seminar as a Part of Innovative Learning practices.

Technology-Enhanced Learning

One of the most significant advancements in education is technology-enhanced learning. The flipped classroom model replaces traditional lectures with pre-recorded videos, allowing students to engage in discussions and problem-solving activities in class. This method fosters active learning and deeper understanding.

Similarly, virtual reality (VR) and augmented reality (AR) create immersive learning experiences, enabling students to explore historical sites, conduct virtual science experiments, or even practice medical procedures. Artificial intelligence (AI) in learning is also transforming education, with AI-powered chat bots and adaptive learning platforms personalizing lessons based on student performance, making education more efficient and tailored to individual needs. Student-centered learning shifts the focus from passive absorption of information to active participation. Gamification is an effective way to make learning fun and engaging by incorporating game elements such as points, leader boards, and rewards. Platforms like Kahoot! and Duo lingo use this method to increase student motivation.

Fig: Students presenting their Innovative ideas

4. Quality course materials

Lab manuals with sample readings are available in the laboratories for the students' reference. All the lab manuals are revised and updated whenever the syllabus is revised.Experiments in addition to the regular syllabus of the university curriculum are conducted to fill the gap and improve their practical knowledge

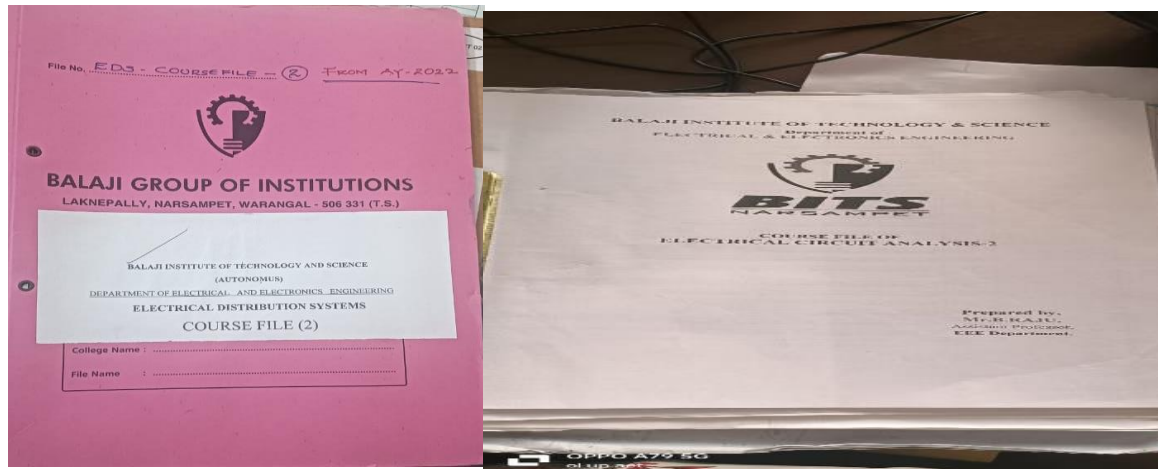Charts and Cut views of important equipment are displayed in each lab for reference.

Fig: Course files and Lab manuals

MOOC courses provide access to global knowledge, allowing students to learn from experts worldwide and stay updated with the latest trends. Mini-project reviews and group seminars foster accountability and peer learning, as students present their work, receive feedback, and refine their ideas collaboratively.

Collaborative learning is perhaps the most impactful, as it mirrors real-world work environments. By working in teams, students develop interpersonal skills, learn to resolve conflicts, and appreciate diverse viewpoints.

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.

NPTEL Courses

NPTEL (National Programme on Technology Enhanced Learning) is a joint initiative of the Indian Institutes of Technology (IITs) and the Indian Institute of Science (IISc) to provide high-quality online courses and resources for engineering and science students.

Benefits

1. Flexibility: Learn at your own pace, anytime, anywhere.

2. Accessibility: Access high-quality educational resources, regardless of geographical location.

3. Career Advancement: Enhance your skills and knowledge to advance your career.

4. Academic Preparation: Prepare for competitive exams, such as GATE, GRE, and more.

Elite

NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)

This certificate is awarded to

LALITHA

for successfully completing the course

Digital Circuits

with a consolidated score of **73** %

Online Assignments	23.94/25	Proctored Exam	49.5/75

Total number of candidates certified in this course: **3425**

Jul-Oct 2024
(12 week course)

Skill India
कौशल भारत - कुशल भारत

TOP TOPPER 5%

Prof. Haimanti Banerji
Coordinator, NPTEL
IIT Kharagpur

Elite

NPTEL ONLINE CERTIFICATION
(Funded by the MoE, Govt. of India)

This certificate is awarded to

PADAKANTI KIRAN KUMAR

for successfully completing the course

Digital Circuits

with a consolidated score of **85** %

Online Assignments	23.91/25	Proctored Exam	61.5/75

Total number of candidates certified in this course: **3425**

Jul-Oct 2024
(12 week course)

Skill India
कौशल भारत - कुशल भारत

TOP TOPPER 1%

Prof. Haimanti Banerji
Coordinator, NPTEL
IIT Kharagpur

5. Industry Visit

Industrial visits are essential for providing practical exposure to students or professionals. They allow individuals to see real-world applications of the concepts learned in classrooms, offering insights into industry practices, technologies, and operations. These visits help bridge the gap between theory and practice, encourage career exploration, and foster networking opportunities with industry professionals. Additionally, they improve problem-solving skills and motivation by showcasing how various industries tackle challenges. Overall, industrial visits enrich learning, making it more comprehensive and aligned with real-world scenarios.

Indian Space Research Organisation (ISRO) is the space agency of India. The organisation is involved in science, engineering and technology to harvest the benefits of outer space for India

and the mankind. ISRO is a major constituent of the Department of Space (DOS), Government of India. The department executes the Indian Space Programme primarily through various Centres or units within ISRO.

ISRO was previously the Indian National Committee for Space Research (INCOSPAR), set up by the Government of India in 1962, as envisioned by Dr.Vikram A Sarabhai. ISRO was formed on August 15, 1969 and superseded INCOSPAR with an expanded role to harness space technology. DOS was set up and ISRO was brought under DOS in 1972.

Fig: Students Visited ISRO as a part of an Industrial Visit

Fig: Students Visited ISRO as a part of an Industrial Visit

6. Internship

Internships are important as they provide practical experience, helping individuals apply classroom knowledge in real-world settings. They develop essential skills, offer networking opportunities, and provide insight into specific industries. Internships enhance employability by making resumes stand out and often lead to full-time job offers. They also help build confidence and clarify career goals by giving interns a firsthand look at their chosen field.

The internship will be conducted during the semester's end before the start of next semester. student will be trained on industry-oriented skills some of the students will be sent to the industry/company/organization to conduct the internships.Industry training, internships, and summer programs are vital for bridging the gap between academic learning and practical

applications. They provide students with hands-on experience, exposure to professional environments, and insights into industry operations.

These programs enhance technical and interpersonal skills, improve employability, and foster innovation. By working on real-world challenges, students develop problem-solving abilities and industry-specific expertise. Such experiences also strengthen industry-academia relationships, ensuring students are better prepared for their careers and aligned with professional standards.

Fig: Internship certificate issued by EduSkills

7. **Innovative Methods of Teaching Adopted**

   Exploring creative Teaching Techniques, to improve student learning and simplify challenging ideas, in the field of Electronics and Communication Engineering (ECE) the department has implemented innovative teaching approaches.

- **Role playing** – Another interactive method that allows students to approach on specific roles relevant to real world engineering scenarios and working together to complete the assigned tasks, like network design and system troubleshooting tasks student may act has a hardware engineer and quality analyst to solve practical problems. This methods enhances leadership, communication problem-solving, teamwork, and decision-making abilities, preparing students for professional challenges.
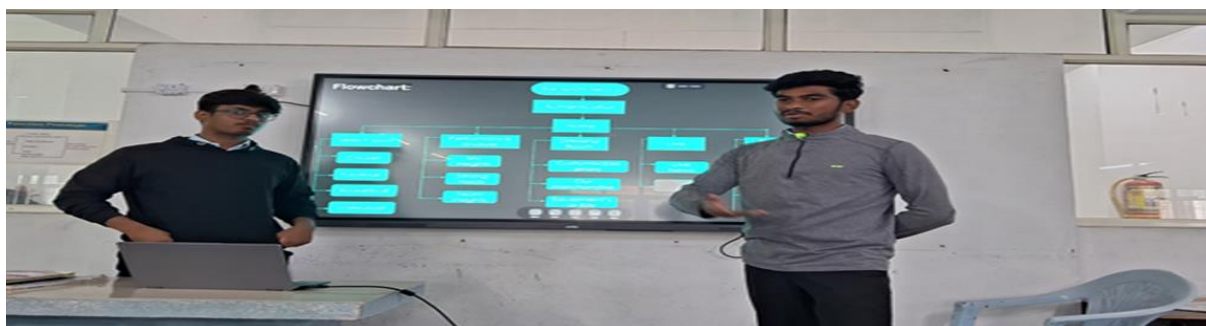
Students participating in role-play activity during their class

- **Seminars –** Plays a crucial role in developing research and communication skills by encouraging students to present on recent advancements, emerging technologies, research papers, or innovative projects. This practice supports learning and boosts self-confidence in public speaking. This process not only helps students to stay updated with the new technology but also enhances their ability to analyze, synthesize and convey technical knowledge proficiently. which also encourages thinking and sharing of knowledge among Peers.

Seminars Presentations

- **THINK – PAIR – SHARE**

The "think-pair-share" method is a cooperative learning strategy commonly used in classrooms to encourage active participation and deeper understanding of a topic.

Students interacting with each other during their classes

- **BRAINSTORMING**

Brainstorming is a group creativity technique used to generate a large number of ideas or solutions to a problem or question within a short period of time.

Students participating in Brain Storming activity to promote creativity

- **HARDWARE SIMULATION & IT WORKSHOP**

Hardware simulation refers to the process of emulating the behaviour, functionality, or characteristics of physical hardware using software-based models or virtual environments**.**

Students participating in Hardware Simulation activity

- **CLASS POLLS**

The class polls teaching method involves using polls or surveys to gather feedback, opinions, or responses from students on various topics, questions, or issues related to the lesson or curriculum**.**
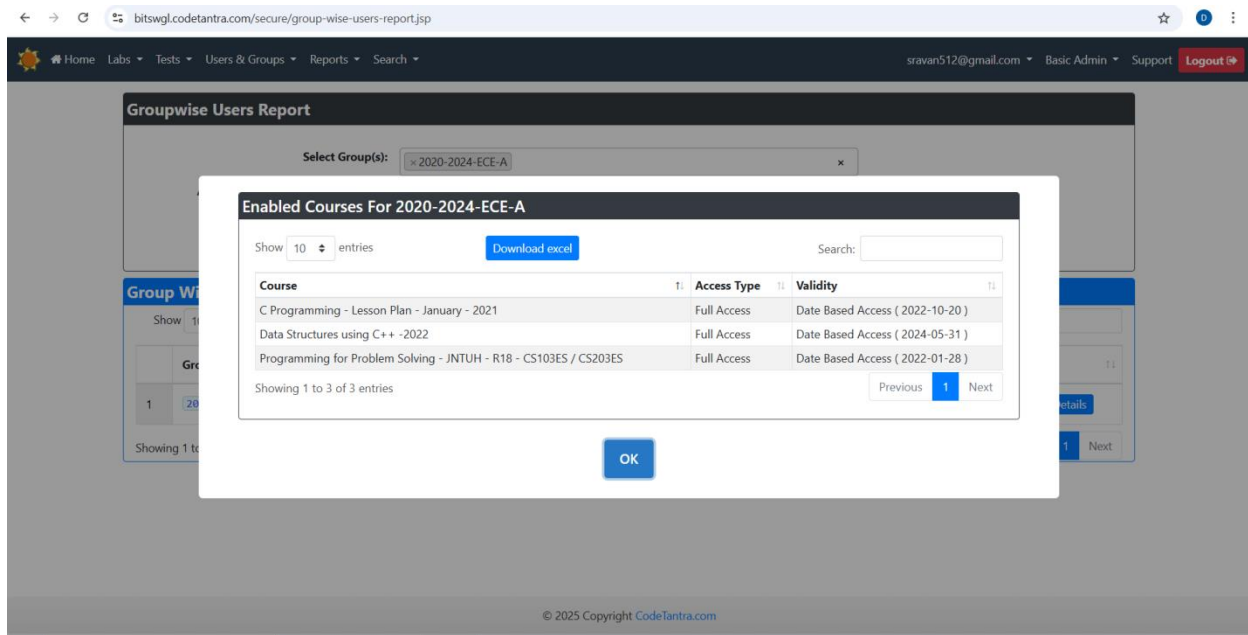
Students participating in Class Polls activity

8. Online platform

Online platforms have revolutionized education by making learning more accessible, flexible, and interactive. They provide unlimited resources through digital libraries, video tutorials, and online courses on platforms like YouTube, Coursera, and Khan Academy, enabling self-paced learning. Virtual classrooms and tools like Google Classroom, Zoom, and Microsoft Teams facilitate remote education, allowing students to learn from anywhere. Online discussion forums and academic networks enhance collaboration, helping learners connect with peers and educators worldwide. These platforms also reduce costs by eliminating the need for physical resources like textbooks and travel. Additionally, AI-driven learning tools personalize education, improving engagement and retention. Overall, online platforms bridge the gap between traditional and modern education, making quality learning available to all.

Faculty members utilize a suite of Google tools, including Google Drive, Google Classroom, and Google Forms, to create a seamless and interactive learning environment. Google Drive serves as a centralized repository for storing and sharing course materials, ensuring easy access for students. Google Classroom streamlines communication, assignment distribution, and grading, fostering collaboration between faculty and students. Google Forms enables the creation of quizzes and surveys, allowing educators to assess student understanding and gather feedback efficiently.
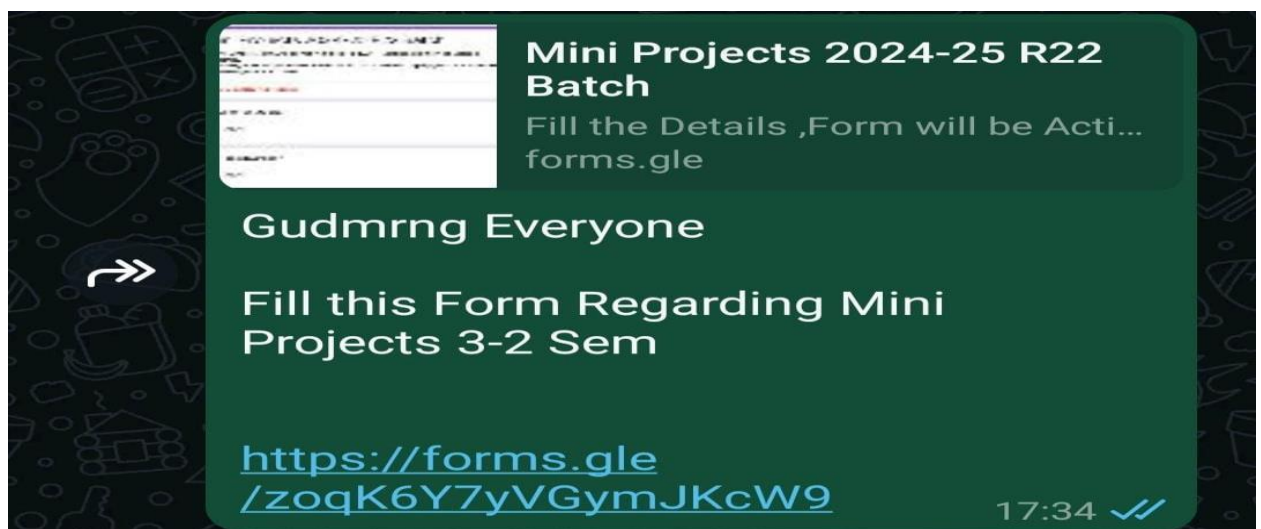
Faculty members use Google Drive, Google class rooms, Google forms and other platforms such as YOUTUBE.

https://forms.gle/zoqK6Y7yVGymJKcW9

Fig: Google forms Used by Students in Accessing the Major/Mini Project and Course Materials

9. Open/Industry Courses/Skill/Enhancement Courses

The Department of Electronics and Communication Engineering (ECE) 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 gain proficiency in VLSI design (Cadence, Xilinx), embedded systems (ARM, Raspberry Pi, Arduino), FPGA programming, signal processing, wireless communication, IoT, robotics, and automation. Additionally, courses on AI, machine learning, cloud computing and data analytics for ECE applications ensure students stay ahead in the evolving technological landscape.
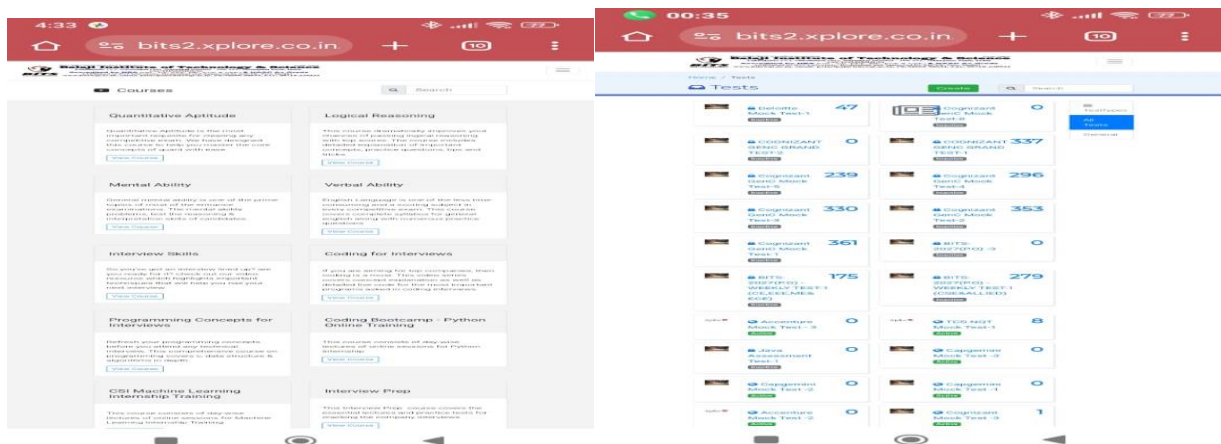

Fig: As Part of Open/Industry Courses/Skill/Enhancement Courses