Innovations by the Faculty in Teaching and Learning

In the present competitive world, technology is changing very rapidly. Engineering graduates must adapt to these changes to grab the opportunities globally. This can be achieved through effective content delivery. Students with diverse locations, backgrounds, and aspirations have varied learning styles. Irrespective of the learning style of the student, the content must be delivered effectively through innovative practices in Teaching & Learning to make them globally acceptable in line with the Department Vision and Mission.

- Department of EEE follows a systematic framework for implementation of innovative teaching learning strategies effectively in regular course work along with traditional classroom teaching. The implementation of teaching learning practices is as shown in the flow chart given below:

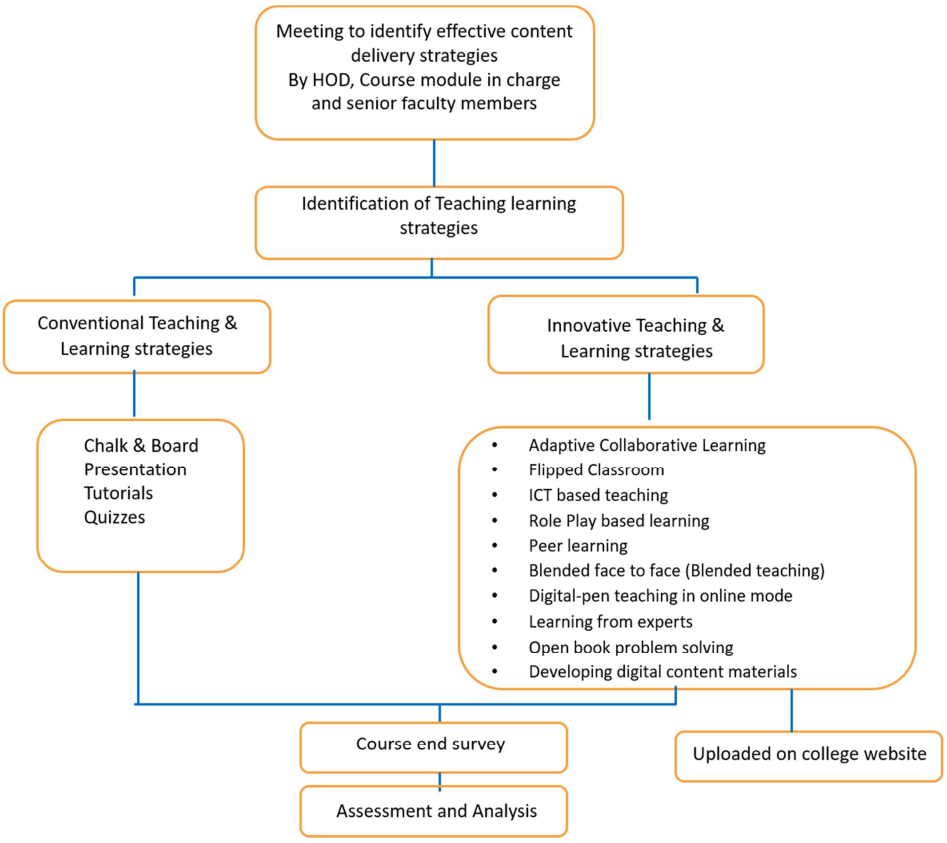


Figure: Flowchart for the implementation of Innovative Teaching Learning & Conventional Teaching Learning Strategies

The innovative teaching learning strategies provide opportunities for students to work in teams, learn from peers, and learn from themselves. Also, the students have the opportunity to engage in sophisticated and complex levels of cognitive activity–define, analyze, evaluate, reflect, assess, and solve real-world problems. The evaluation suggests that implementation of these methodologies in the engineering courses improve the higher-level skills of the students as well as integrated theory, design, and practice.

Innovative Teaching Methodologies:

To improve the quality of teaching learning and to make students actively participate in the class environment, the following are the appropriate methods. The appropriate innovations in teaching learning followed by the faculty in our department are:

1. Adaptive Collaborative Learning (Collaborative learning)
2. Flipped Classroom
3. ICT based teaching
4. Role Play based learning
5. Peer learning
6. Blended face to face (Blended teaching)
7. Digital-pen teaching in online mode
8. Learning from experts
9. Open book problem solving
10. Developing digital content materials

1. Adaptive Collaborative Learning

In the department we have developed a unique way of teaching the students in the classroom through adaptive collaborative learning. Adaptive collaborative classroom teaching has been introduced for the first time in pedagogical initiatives by our faculty.

Adaptive Collaborative Learning starts with the identification of group of slow, medium and fast learners in a particular class room through open book problem solving exercises. Followed by formation of heterogeneous clusters of students by taking amalgamation of slow, medium and fast learners and allow them to discuss among themselves about the given topic or problem.

Finally, any student is asked from any group to deliver the lecture on the board on the same topic and again another problem is given to solve individually, to check the impact of learning by adapting to this methodology.

Benefits of the Adaptive Collaborative classroom:

- Development of skills to find the solution independently
- Enhanced ability to comprehend what is there in the provided material,
- Versatility for students to learn in time and speed.
- Induce research temperament through search
- Interaction among slow, medium and fast learners (peers' interaction)
- Appropriate use of resources
- More participation of students.
- Communication skills

Objectives of the activity:

- Inspire students to find the solution independently.
- Learning from peers through discussion, inquiry and search

Execution Plan:

- A problem is given by the faculty to solve individually.
- Students are provided with the concerned subject text book and they are asked to find the solution within a stipulated time frame (depending upon the problem, generally 15 min)
- With in that stipulated time those who completed the task are considered as fast learner, those who complted more than 50%, they are considered medium learner and those who completed less than 50 % are considered as slow learner.
- Three groups are formed for fast, medium and slow learners.
- Based on the number candidates in each group, heterogenous clusters of students is formed by taking amalgamation of slow, medium and fast learners.
- Each cluster of students are asked to discuss on the same topic, so that the medium and the slow learner get benefitted from the fast learner of that concept. They are again provided with stipulated time for discussion. (15 min)

- After the stipulated time of discussion, any student from any cluster is asked to explain the solution thoroughly.
- In order to evaluate the students through this exercise, another problem is given to the students of same topic to solve independently without book.
- The scripts are collected in chronological order (roll number) after 15 minutes.

Plan of action:

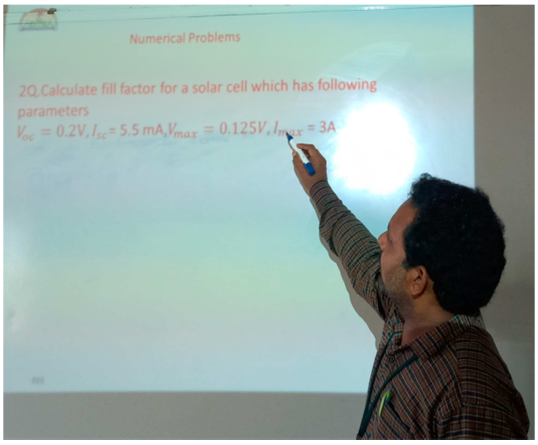
- Inculcate the students to think and absorb the knowledge from any resource
- Creating environment to think

Expected Outcomes:

- Development of skills to find the solution independently
- Dissemination of knowledge among peers

Adaptive Collaborative Classroom Activities carried out by Mr.M.P SubbaRaju for Renewable Energy sources course

1. Problems provided by faculty.



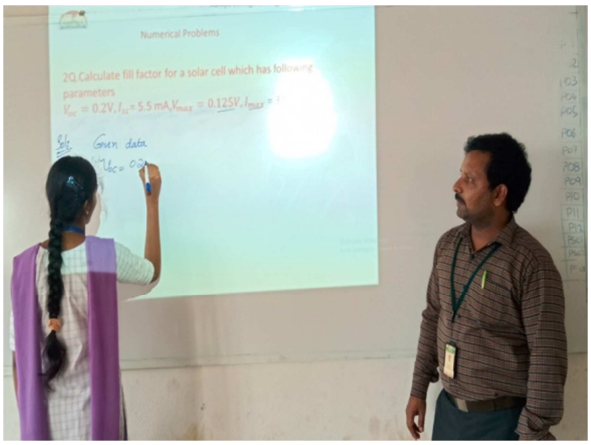
2. Open book problem solving for 15 minutes.

3. **Formation of groups based on grades:**
    - Those who completed, considered as fast learner; **Grade A**
    - Those who completed > 50%, considered medium learner; **Grade B**
    - Those who completed < 50 % are considered as slow learner; **Grade C**

4. **Formation of heterogenous clusters by mixing slow, medium and fast learners.**

5. **Discussion**

6. Explanation and demonstration



7. Evaluation

S. No	Name of the Faculty	Course	Topic	No of Students participated	Relevance to POs & PSOs	Activity Outcome
1.		Renewable Energy Sources	Performance characteristics of PV cell	38	PO1, PO2, PO3,PO7,PO12 PSO1	Developed the thinking and participating ability

Sl. No.	Student Roll No.	Grade achieved before activity	Grade achieved after activity	Improvement (Yes/No)
1.	18P31A0201	A	A	YES
2.	18P31A0206	B	B	NO
3.	18P31A0211	B	A	YES
4.	**19P35A0202**	B	A	YES
5.	**19P35A0203**	B	A	YES

6.	**19P35A0204**	B	A	YES
7.	**19P35A0206**	B	A	YES
8.	**19P35A0209**	C	B	YES
9.	**19P35A0210**	B	A	YES
10.	**19P35A0211**	B	A	YES
11.	**19P35A0212**	B	A	YES
12.	**19P35A0213**	B	A	YES
13.	**19P35A0214**	B	A	YES
14.	**19P35A0215**	B	A	YES
15.	**19P35A0216**	B	A	YES
16.	**19P35A0217**	B	A	YES
17.	**19P35A0218**	B	A	YES
18.	**19P35A0219**	B	A	YES
19.	**19P35A0220**	B	A	YES
20.	**19P35A0221**	C	B	YES
21.	**19P35A0226**	C	B	YES
22.	**19P35A0227**	C	B	YES
23.	**19P35A0228**	B	A	YES
24.	**19P35A0229**	A	A	YES
25.	**19P35A0230**	B	A	YES
26.	**19P35A0231**	A	A	YES
27.	**19P35A0235**	A	A	YES
28.	**19P35A0240**	C	B	YES
29.	**19P35A0241**	B	B	NO
30.	**19P35A0243**	B	A	YES
31.	**19P35A0244**	C	A	YES
32.	**19P35A0241**	B	B	NO
33.	**19P35A0246**	C	B	YES
34.	**19P35A0249**	B	A	YES
35.	**19P35A0253**	**A**	A	YES
36.	**19P35A0255**	**A**	A	YES
37.	**19P35A0272**	C	B	YES
38.	**19P35A0290**	C	C	NO

Faculty Signature

2. Flipped Classroom

A **flipped classroom** is an instructional strategy focused on student engagement and active learning, giving the instructor a better opportunity to deal with mixed levels, student difficulties, and differentiated learning preferences during the in-class time.

Benefits of the Flipped classroom:

- More participation of students.
- Versatility for students to learn in time and speed.
- Interaction instructor-student.
- Appropriate use of resources by the teacher for constructive learning methods.

Objectives of the activity:

- Inspire students to learn the concepts thoroughly.
- A student discovers the ideas of videos, may use them for discussions and assignments in the classroom to motivate the students to learn the concepts thoroughly.

Execution Plan:

- Orientation session: 20 minutes.
- Students are provided with the learning material (Video Link, textbook page numbers) of the topic to be covered and a time of 4 days to prepare for the activity.
- On the day of activity, topics are given as per their position in the classroom (the students are observed writing different topics at the same desk) and 20 minutes are given to think and write about the topic.
- The scripts are collected in chronological order (roll number) after 20 minutes.

Plan of action:

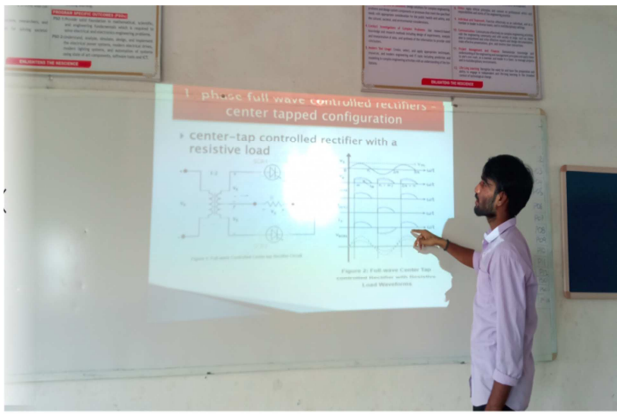
- Students are asked to go through the learning materials, and 2 days of training time will be given. Each individual will be given a different question or numeric as per higher bloom level and a time of 15 minutes will be given to complete the task.

Expected Outcomes:

- Demonstrate points from a video than from a lecture note.
- Build awareness and understanding of the course field.
- Explain the concepts especially the most basic and important aspects of the course.

Evaluation:

S. No	Name of the Topic	Number of students	Relevance to POs, PSOs	Benefits	Activity Outcome
1	Single Phase center tapped converter	45	PO1, PO2, PO3, PO9, PO10,PSO1 ,PSO2	More participation of students. • Versatility for students to learn in time and speed. • Interaction instructor-student.	Identify the bright students& slow learners



Students are actively participated in the Flipped classroom activity carried out by Mr.Venkateswara Rao for Power Electronic course

ADITYA COLLEGE OF ENGINEERING & TECHNOLOGY
Surampalem, Andhra Pradesh
Department of Electrical and Electronics Engineering

S.No	Student Reg. Number	Grade Achieved before activity	Grade achieved after activity	Improvement in performance (Y/N)
1	19P31A0201	B	C	NO
2	19P31A0202	C	B	YES
3	19P31A0203	B	A	YES
4	19P31A0204	C	B	YES
5	19P31A0205	A	A	YES
6	20P35A0201	A	A	YES
7	20P35A0202	A	A	YES
8	20P35A0203	A	A	YES
9	20P35A0204	A	A	YES
10	20P35A0205	A	A	YES
11	20P35A0206	B	A	YES
12	20P35A0207	B	A	YES
13	20P35A0208	B	A	YES
14	20P35A0209	C	B	YES
15	20P35A0210	B	A	YES
16	20P35A0211	C	B	YES
17	20P35A0212	C	B	YES
18	20P35A0213	C	B	YES
19	20P35A0214	A	A	YES
20	20P35A0215	C	C	NO
21	20P35A0216	B	B	NO
22	20P35A0217	C	B	YES
23	20P35A0218	B	A	YES
24	20P35A0219	C	B	YES
25	20P35A0220	C	C	NO

26	20P35A0221	B	A	YES
27	20P35A0222	B	B	NO
28	20P35A0223	C	B	YES
29	20P35A0224	C	C	NO
30	20P35A0225	A	A	YES
31	20P35A0226	A	A	YES
32	20P35A0227	A	A	YES
33	20P35A0228	C	B	YES
34	20P35A0229	A	A	YES
35	20P35A0230	A	A	YES
36	20P35A0231	B	C	NO
37	20P35A0233	A	A	YES
38	20P35A0234	A	A	YES
39	20P35A0235	B	C	YES
40	20P35A0236	B	A	YES
41	20P35A0237	B	A	YES
42	20P35A0238	B	A	YES
43	20P35A0239	B	A	YES
44	20P35A0240	C	B	YES
45	20P35A0241	C	A	YES

3. ICT based teaching:

Information and Communication Technologies (ICT) is fundamental in the promotion and development of growth in Education. Inventions and innovation have led to the increase in tools that are available as educational tools. The tools come in handy in collection of relevant material, storage and dissemination of educational material and improvement of quality of delivery and learning. Didactic teaching is a teacher centered method of teaching, whereby the teacher acts as the main source of knowledge. The student is a passive learner or a listener. The teacher is seen as an authority in the subject in question. ICT comes in handy in the interaction between the teacher and student hence improving the didactic method of teaching. It improves the quality of discussions, analysis of the learning material and synthesis of the knowledge.

Goals of the ICT Learning Process:

- ICT allows students to monitor and manage their own learning.
- ICT provides students from remote areas access to expert teachers and learning resources.
- ICT allows students think critically and creatively, solve simulated real-world problems.

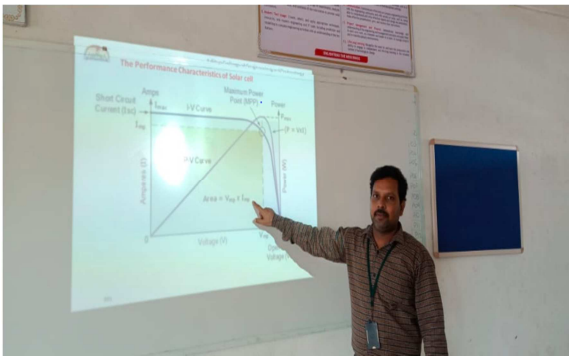
Outcomes:

- Understanding the progress of information and communication technologies (ICT) and their role in modern World.
- ICT has made the students enable to get various professional courses and skills for their development according to their convenience.
- Information and Communication Technology tools helps a student to come in contact with other students, teachers experts of the subjects for better learning

Execution plan

The plan of execution of ICT learning process is as follows:

- Discussing about the types of ICT learning in the class room and students are encouraged to participate in learning process.
- Presentation of the topics by using Virtual Learning Environment (VLE) & Computer Supported Collaborative Learning (CSCL).
- The corresponding faculty member has to discuss with students about the given topic in learning process.
- These ICT students have to explain the concept and should discuss among their group.
- Each person in the class will then learn the concept effectively and efficiently.
- Later all the students can also involve in the discussion to better understanding of the doubts and can also present their own conclusions about the concept.

Mr.M.P.Subba raju Conducting an ICT learning method in the classroom

Activity Outcomes to PO Mapping:

Activity Outcomes	Mapping to PO'S
Understanding the progress of information and communication technologies (ICT) and their role in modern World.	PO1, PO2, PO5,PO10,PSO1
ICT has made the students enable to get various professional courses and skills for their development according to their convenience	PO1,PO2, PO3, PO5,PO10,PSO1
Information and Communication Technology tools helps a student to come in contact with other students, teachers experts of the subjects for better learning	PO1,PO3,PO4,PO5,PO10,PSO1

Impact Analysis

- The interactive and multimedia features within software can be used to help students grapple with concepts and ideas.
- ICT has transformed teaching and learning processes from being highly teacher-dominated to student- cantered, and that this transformation will result in increased learning gains for students.
- This allows teachers to consider providing a range of activities to assist students to become critical thinkers, designers and problem solvers.
- It has a positive effect on behaviour, motivation, communication and process skills of students and teachers.

4. Role Play based learning:

The role play-based learning exercises give students the opportunity to assume the role of a person or act out a given situation. These roles can be performed by individual students, in pairs, or in groups which can play out a more complex scenario. They may be given specific instructions on how to act or what to say. Through this method, students have opportunities to express their ideas of reality and be confronted with the consequences of their actions. It means by using role play-based learning the students prefer to develop knowledge through doing rather than sitting and listening.

Execution Plan:

The following steps are needed to implement role play-based learning.

- Selection of a topic suitable for role-play teaching-learning method.
- The teacher will select a group of students as per the complexity of the scenario.
- Instruct students that the purpose of the role play. Every selected student has to play one role in the selected scenario.
- Allow time for students to practice the role play.
- Students will perform the role play.
- While the students are implementing the role-play method in the class, explain its purpose and answer questions to students so they are able to understand the concept properly.

Expected Outcomes/ Impact Analysis:

Role-playing can be effectively used in the classroom to:

- Motivate and engage students
- Enhance current teaching strategies
- Provide real-world scenarios to help students learn
- Learn skills used in real-world situations (negotiation, debate, teamwork, cooperation, persuasion)
- Provide opportunities for critical observation of peers

Dr Mayur Barman conducting a Role Playbased learning method in the classroom

5. Peer Learning Process

Peer learning is a strategy where a group of students were trained first by the faculty and then the students are guided to explain the trained topic to his/her co-students in the group. This technique requires students to discuss the topic explained by their peer and should be able to solve the related topics. Discussing responses with peers serves to maximize participation, direct attention, and engage students in reading comprehension. At the end of the peer leaning process, both student-tutee and student-tutor will be benefited even for the complex topic.

Goals of the Peer Learning Process:

- To activate peer student's prior knowledge
- To Enhance oral communication skills of the peer student
- To make students active learners with brief discussion

Outcomes:

- Classify the different technologies involved in learning a concept
- Outline the selected concepts to the other students in group
- Demonstrate the findings effectively with other peers and criticize the others conclusions.

Execution plan

The plan of execution of peer learning process is as follows:

- Discussing about the peer learning in the class room and students are encouraged to participate as peers in the learning process.
- Selecting a group of students as peers to each and every group.
- The corresponding faculty member has to train the peer students about the given topic to discuss in learning process.
- These peer students has to explain the concept and should discuss among their group.
- Each person in the group will then learn the concept effectively and efficiently
- Later all the students can also involve in the discussion to better understanding of the doubts and can also present their own conclusions about the concept.

Mrs K.Vara Lakshmi conducting a peer learning activity to the students in classroom

Activity Outcomes to PO Mapping:

Activity Outcomes	Mapping to PO'S
Classify the different technologies involved in learning a concept	PO1, PO2, PO9,PSO1
Outline the selected concepts to the other students in group	PO1,PO2, PO3,PO9,PSO1
Demonstrate the findings effectively with other peers and criticize the others conclusions	PO1,PO3,PO4,PO9,PSO1

Impact Analysis

- The impact of peer learning process is helpful to enrich the knowledge potentials of the students to explore their skill in presentation of the learned topic from the corresponding faculty.
- Communication skills and team work abilities of the students are improved.
- Technical knowledge and self thinking to understand the concept helps the student to enhance their abilities.

6. Blended Learning:

The evolution of the digital learning platforms has a huge impact in educational institutions and has eventually put the traditional methods in the back seat. However, there are demands for both technology and traditional learning methods. As a result of this, the art of combining digital learning tools with more traditional classroom face to face teaching gave birth to the term "Blended Learning".

Given the emergence of digital technologies and the emerging importance of leveraging technology for teaching-learning at all levels from school to higher education, the NEP 2020 recommends for use of blended models of learning. The NEP-2020 states that while promoting digital learning and education, the importance of face-to-face in-person learning is fully

recognized. Accordingly, different effective models of blended learning will be identified for appropriate replication for different subjects.

The important features of Blended Learning environment are:

- Increased student engagement in learning.
- Enhanced teacher and student interaction.
- Responsibility for learning.
- Time management and flexibility
- Improved student learning outcomes
- More flexible teaching and learning environment

Key benefits:

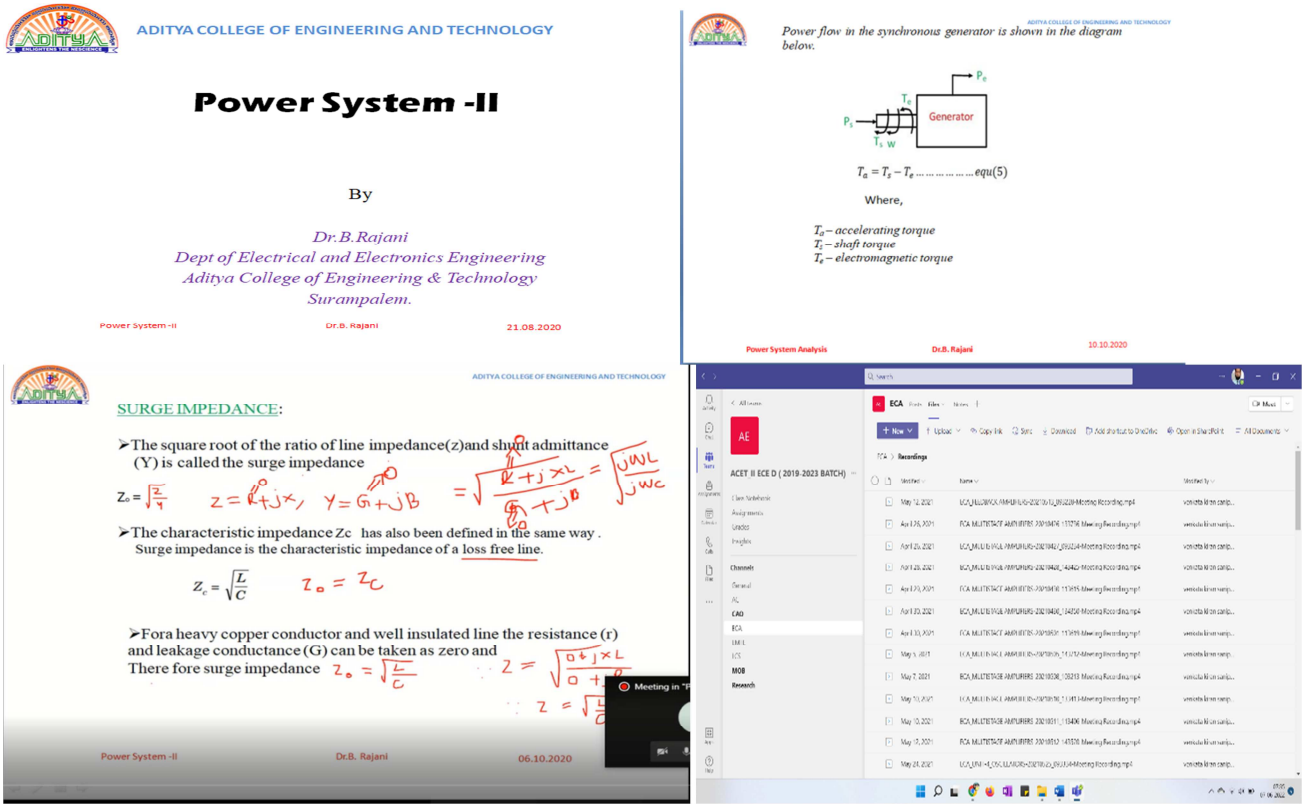
- Opportunity for collaboration at a distance: Individual students work together virtually in an intellectual endeavour as a learning practice.
- Increased flexibility: Technology-enabled learning allows for learning anytime and anywhere, letting students learn without the barriers of time and location but with the possible support of in-person engagement. (Any speed, any mode, any language)
- Increased interaction: BL offers a platform to facilitate greater interactivity between students, as well as between students and teachers.
- Blended learning provides making learning resources and experiences repeatable, reliable and reproducible.

Prepares students for the future: BL offers a multitude of real-world skills, that directly translate into life skills, from:

- Research skills
- Self-learning
- Self-engagement
- Helps to develop a ‘self-driving force’
- Better decision making
- Offers a larger sense of responsibility
- Computer literacy

Blended face-to-face class: Also, sometimes called the “face-to-face driver model,” the blended face-to-face class model is based in the classroom, although a significant amount of classroom time has been replaced by online activities. While online activities are used to supplement the in-person classes; readings, quizzes or other assessments are done online. This model allows students and faculty to share more high-value instructional time because class time is used for higher-order learning activities such as discussions and group projects. The glimpse of online classes and list of the recorded classes is shown in the figure below. This is combined with the face to face classroom learning, hence nurturing a blended face to face environment.

Blended learning activities carried by Mrs S.Vani



Blended learning activities carried by Dr B.Rajani

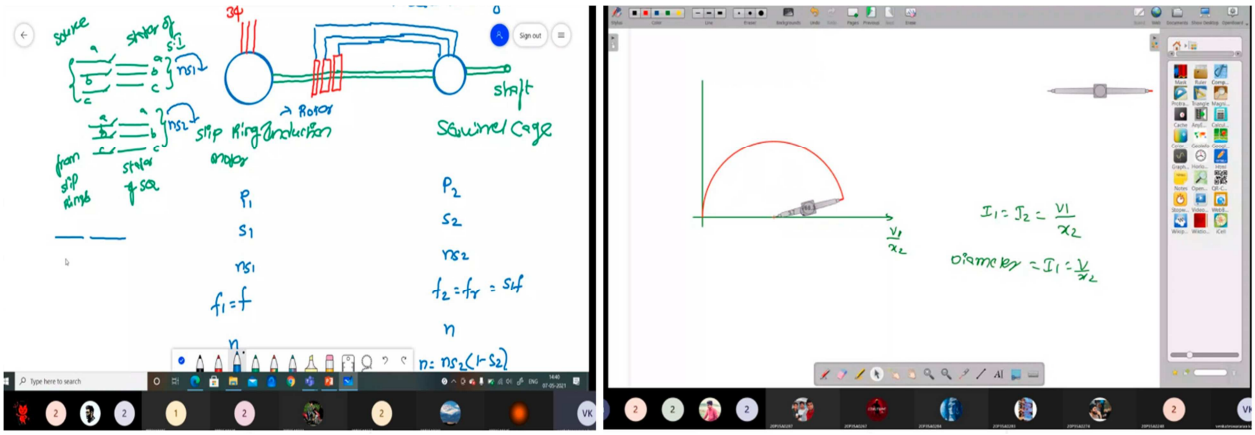
7. Digital-pen teaching in online mode

It has been observed that some of the analytical courses require rigorous analysis of problems by the faculty. In online mode merely using PPT does not provide that feel to the students of analysis. Therefore, use of digital-pen to explain the concepts provide solution that problem. In this methodology, faculty are able to explain in a traditional way by using the modern tool.

Advantages:

- Student satisfaction by explaining in traditional way online
- Ability to comprehend the approach to solve a problem
- Lecture notes easily shared after class

The application of digital-pen by our faculty using WACOM board is shown in the figure below for LCS Subject:



Digital pen is used by Mr K.Venkateswa Rao for teaching to solve problems

8. Learning from Experts:

The identified gaps are communicated to the University forconsideration during the revision of curriculum. Beyond this, the department takes necessary measures to fill the gaps by imparting knowledge to the concepts through content beyond syllabus.

- Seminars are arranged by experts frequently.
- Guest lectures are arranged by industry experts to overcome the gap between industry and academica.
- Practical Hands-on workshops are arranged to get exposure to modern tools.
- Students are sent for industrial visits to various industries.
- Aptitude tests, value added courses, mini projects, employability enhancement programs etc. are regularly conducted to enhance their skills.
- Students are encouraged to undertake in-plant training in the industries during their semester holidays.

Guest lectures by visiting faculty Mr.Mahesh Babu, Mr. B. Praneeth and N Sai Krishna

9. Open book problem solving

An "Open Book Problem solving" is that in which students are allowed to refer to class notes and summaries, textbooks, or other approved material while answering questions. Open book class test creates an enriched environment, offering the opportunity to better understanding.

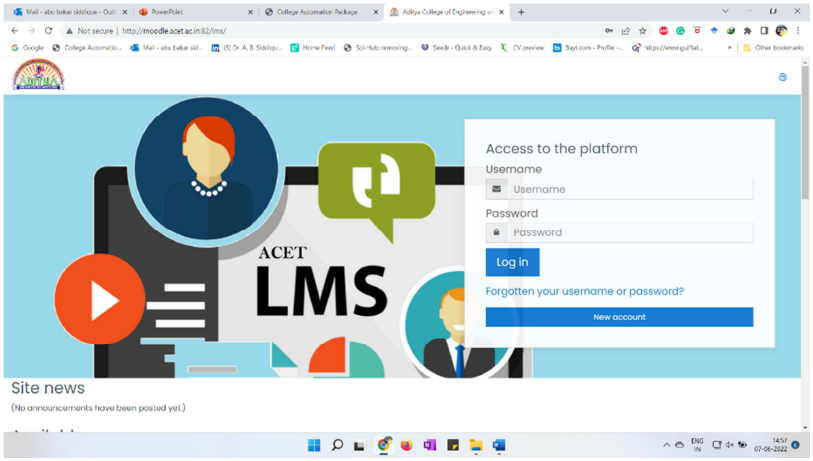
Open book problem solving carried out by Mr.S.Reddy Ramesh

10. Developing digital content materials

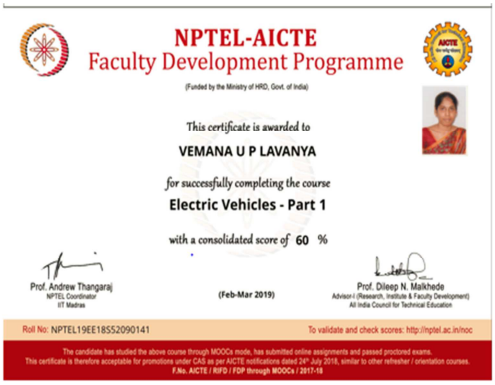
Digital media has slowly peered its way into classrooms and it is reshaping education. Our growing reliance on technology is redefining education. Technology makes education efficient, engaging, and easily accessible. There are many advantages to digital media and its effect on students learning. Technology makes learning efficient. The main benefit of digital media in education is that it can increase student engagement. In addition, it helps students work through difficult concepts with multiple resources. Digital instruction helps show difficult topics that are often hard to understand.

Learning Management Tools

- http://moodle.acet.ac.in:82/lms/



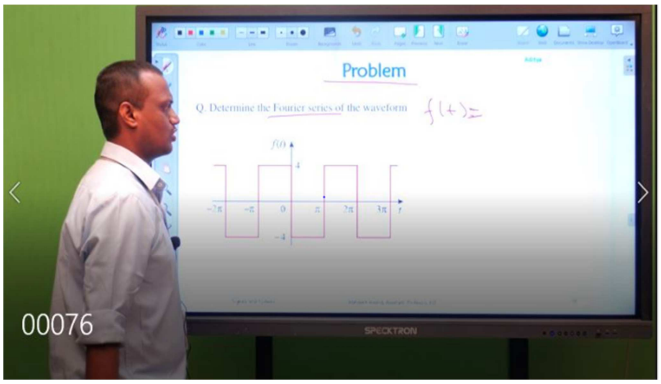
- A massive open online course (MOOC) course aims at providing high quality study materials to the student/faculty community worldwide. The MOOC courses offered by Cours- era, edX, NPTEL are of high standards. The students are clustered in a group based on their MOOC course interest and the provider. Students are encouraged to complete a MOOC certification to acquire in depth knowledge.

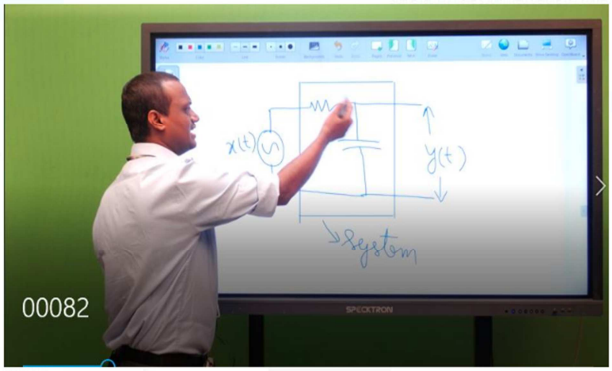


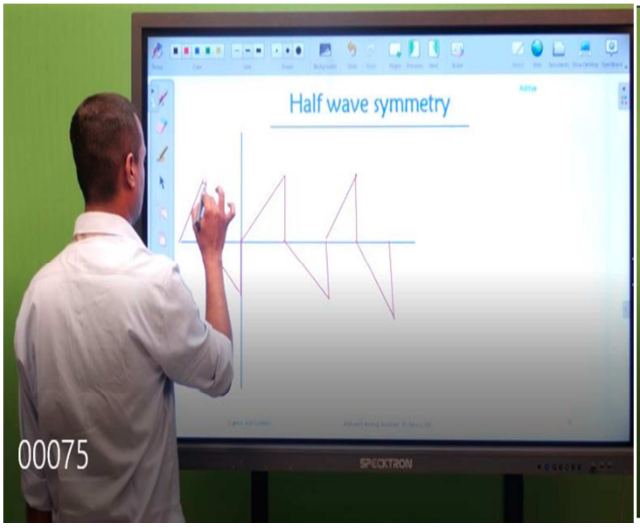
- The department of EEE uses LMS tools such as Moodles., to make the students submit their assignments, learn online and implement the experiments to gain knowledge about the concepts learned in the class. Recently, Micro soft Team App been utilized by the faculty to teach the courses

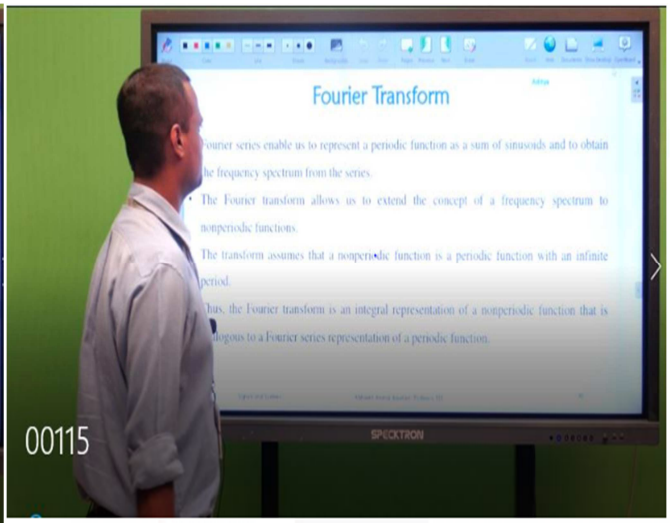
- **Developing Video Lectures**

Mr.Abhisekh Anand , recording digital content videos for Signala and systems:


Problem
Q. Determine the Fourier series of the waveform
f(t)=
00076


x(t)
y(t)
System
00082


Half wave symmetry
00075


Fourier Transform
Fourier series enable us to represent a periodic function as a sum of sinusoids and to obtain the frequency spectrum from the series.
The Fourier transform allows us to extend the concept of a frequency spectrum to nonperiodic functions.
The transform assumes that a nonperiodic function is a periodic function with an infinite period.
Thus, the Fourier transform is an integral representation of a nonperiodic function that is analogous to a Fourier series representation of a periodic function.
00115