

## Criteria 5.5

### Sample course on Innovative Practices

Sl. No.	Course Code & Title	Course Instructor	Assessment Year
01.	EE8391 - Electromagnetic Theory	Dr. K. Karthikeyan	CAY (2019 – 2020)

#### **1. Clear goals and adequate preparation:**

The goals of innovative practices in the teaching-learning process are to make the students get insight knowledge, skill sets and, in the course, and obtain good grades in University examinations. To achieve this faculty members are consistently taking the following measures:

- Attending Faculty Development Programme
- Delivering lectures in Value Added Courses
- Undergoing industrial training and Implant training
- Undergoing Advanced Training Programme
- Self-equipping through Institute – Industry Interaction
- Pursuing online courses

This enables the faculty members to get adequate preparation with subject knowledge to achieve the goal in the teaching-learning process.

#### **2. Appropriate Methods, Effective Presentation, Reflective Critiques**

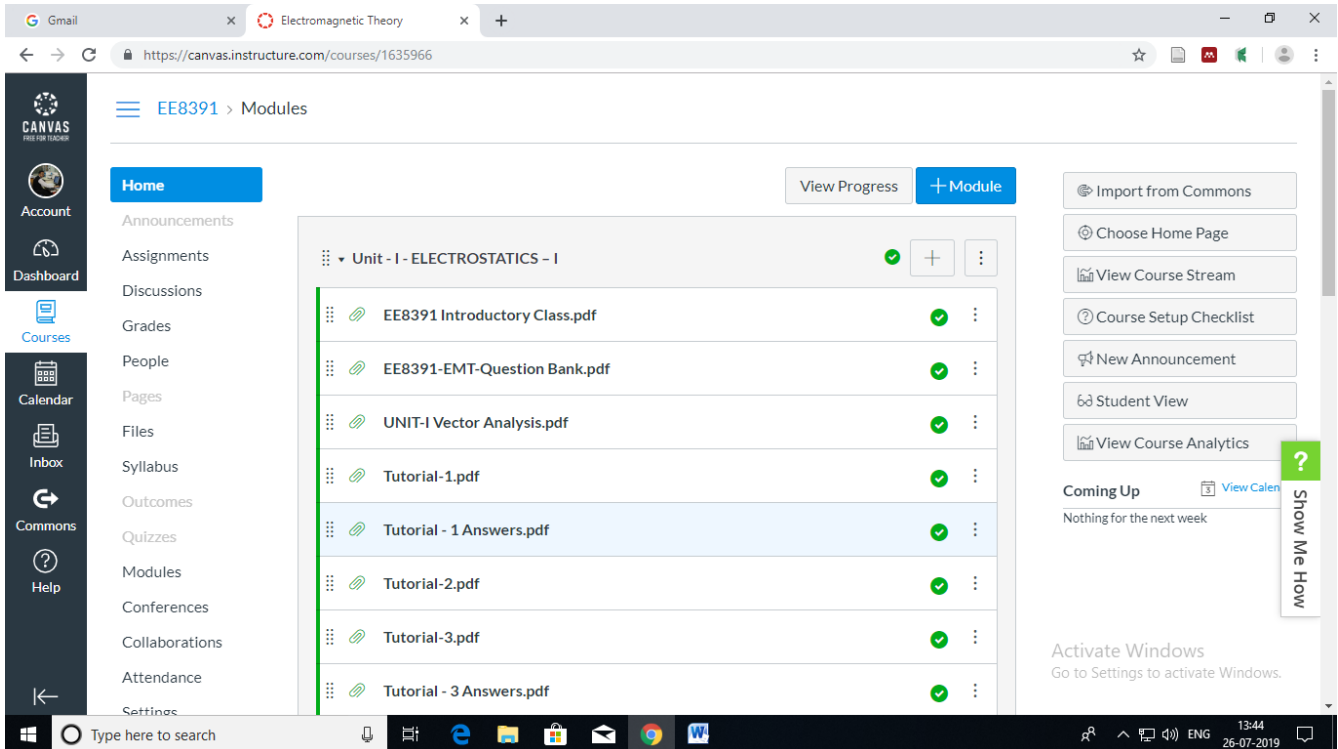
EE8391 - Electromagnetic Theory is a core paper offered to the students of Electrical and Electronics Engineering in Anna University regulation 2017. The subject is very much essential for the electrical students to visualize most of their core concepts like Electrical Machines, Measurements and Instrumentation, Electronic devices and circuits, Power system analysis, Power system operation and control and Power Electronics. The importance of this subject can be easily understood by looking at any of the question papers of competitive exams like TANCET, GATE, and IES.

Many students will find it difficult to understand the concepts of this subject because of the nature of the subject. It requires the students to visualize the each and every topic in three dimensional. The students also find it difficult to do calculations involved in the subject since most of the quantities are vector. Hence to create interest among students and to make the subject comfortable for them to learn, various innovative practices were adopted in the teaching-learning process. The list of innovative practices followed in teaching-learning processes is listed below:

Sl. No.	Type of Innovative Practices in Teaching-Learning Process	Topic Chosen
1.	Usage of Learning Management System (Canvas)	-
2.	Usage of Rubrics	-
<b>Active Learning Methods</b>		
3.	Think-Pair-Share (TPS)	Application of Gauss's law
		Electrostatic boundary conditions
4.	Visible Quiz or Clickers	Classification and types of magnetic materials
		Magnetic Force on a Current-Carrying Conductor and Torque on a Current Loop: Rectangular and General
5.	One-minute paper	Maxwell's equations
6.	Three-step interviews	Magnetic Force on a Current-Carrying Conductor and Torque on a Current Loop: Rectangular and General
7.	Poll Question	Electrostatic boundary conditions
<b>Lowman's 2 D Model of Effective Teaching</b>		
8.	Intellectual Excitement	Maxwell's equations
9.	Interpersonal Rapport	Electromagnetic waves in different medium
<b>ARCS model of motivational design</b>		
10.	Attention, Relevance, Confidence and Satisfaction model	Electrostatic boundary conditions
<b>Collaborative learning method</b>		
11.	Students Teams Achievement Division (STAD)	Electromagnetic wave propagation in various media
12.	Flipped Classroom (FC) activity	Magnetic Force on a Current-Carrying Conductor and Torque on a Current Loop: Rectangular and General
<b>Harnessing the power of technology</b>		
13.	Virtual laboratory for theory concept explanation: Laboratory manual developed for chosen topic	Point charge, Electric field, Electric flux, Electric field intensity calculations, Electric potential & Equipotential surfaces
14.	YouTube video preparation	Magnetic Potential

## 2.1 Learning Management System (LMS):

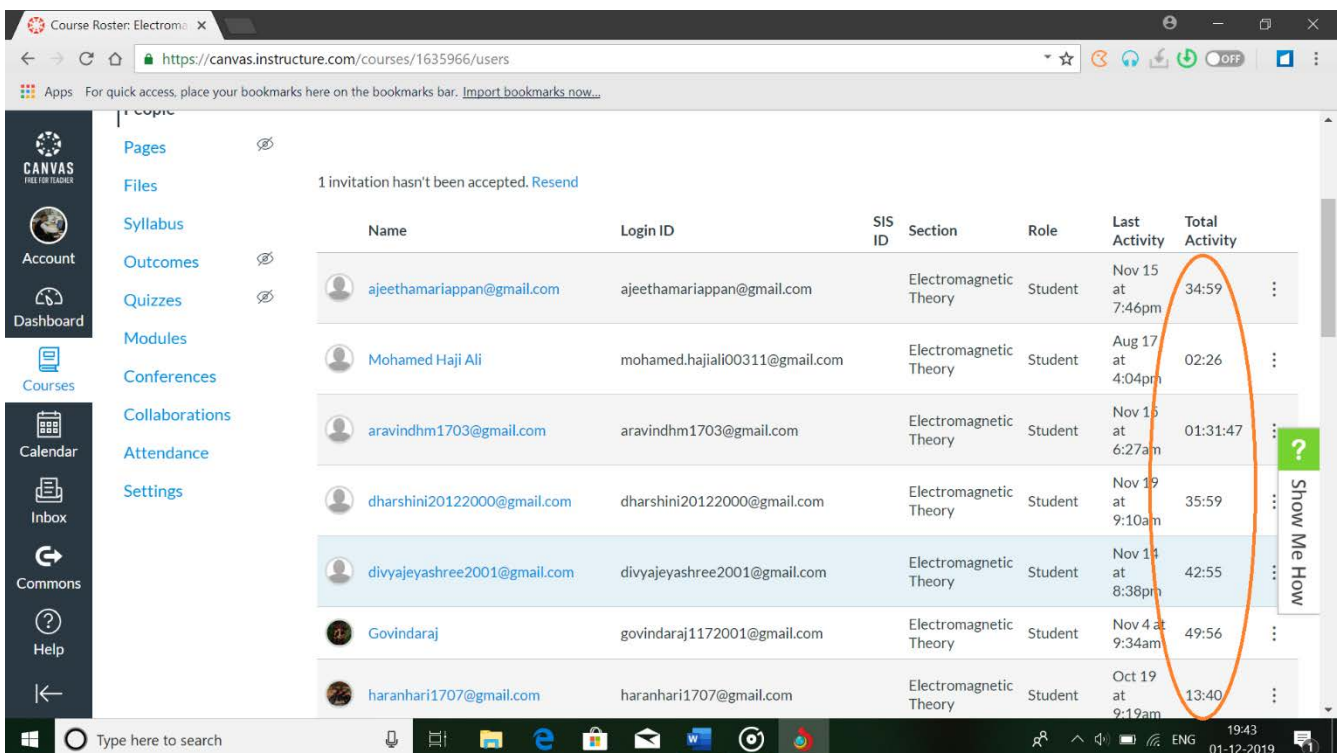
Usage of LMS will help the current Z-generation students to learn beyond classroom environment. Canvas LMS is used for this course through which study materials including notes of the lesson, question bank, and syllabus are shared. This helps the students to get accessed to those materials round the clock.



The screenshot shows the Canvas LMS interface for course EE8391. The main content area displays a list of modules under the heading "Unit - I - ELECTROSTATICS - I". Each module includes a PDF file name and a green checkmark indicating completion. The modules listed are:

- EE8391 Introductory Class.pdf
- EE8391-EMT-Question Bank.pdf
- UNIT-I Vector Analysis.pdf
- Tutorial-1.pdf
- Tutorial - 1 Answers.pdf
- Tutorial-2.pdf
- Tutorial-3.pdf
- Tutorial - 3 Answers.pdf

The right sidebar contains various course management options such as "Import from Commons", "Choose Home Page", "View Course Stream", "Course Setup Checklist", "New Announcement", "Student View", and "View Course Analytics". A "Coming Up" section indicates "Nothing for the next week".

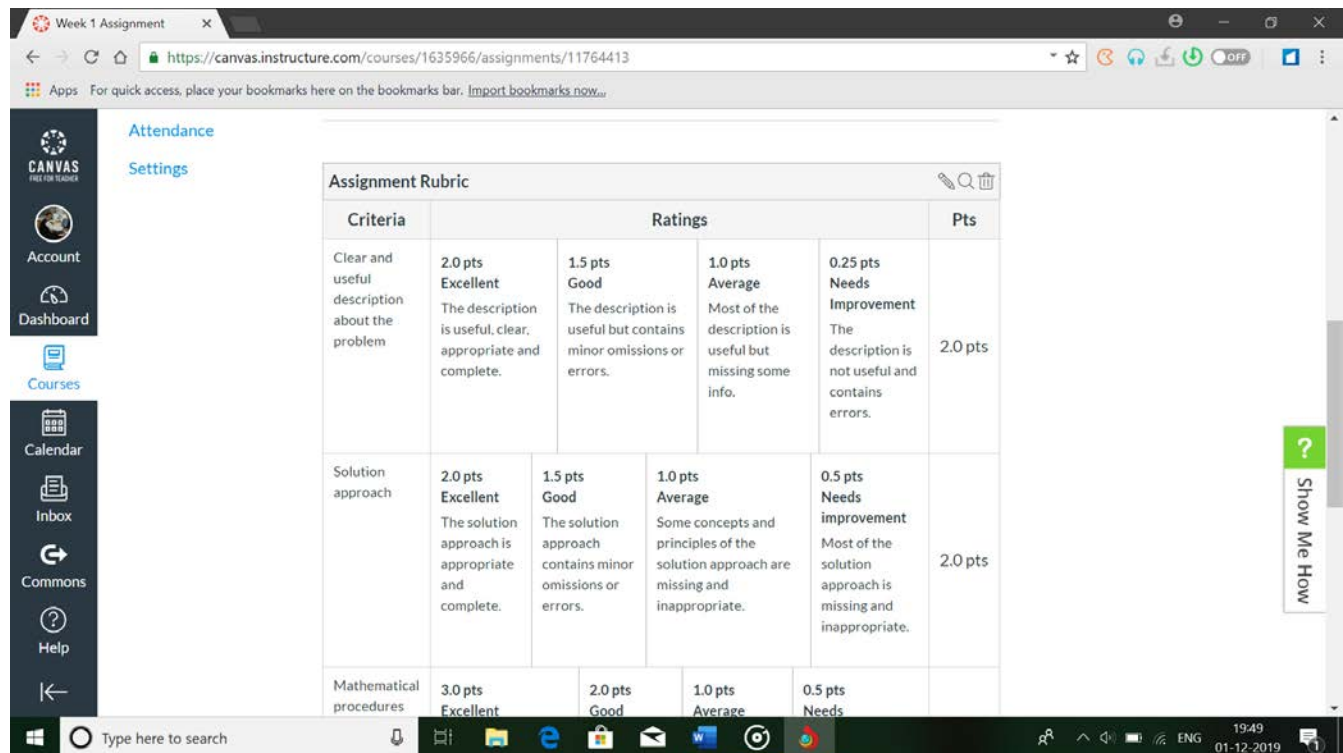


The screenshot shows the "Users" page in the Canvas LMS interface. A table lists the enrolled students with their details. A red circle highlights the "Total Activity" column for several students.

Name	Login ID	SIS ID	Section	Role	Last Activity	Total Activity
ajeethamariappan@gmail.com	ajeethamariappan@gmail.com		Electromagnetic Theory	Student	Nov 15 at 7:46pm	34:59
Mohamed Haji Ali	mohamed.hajiali00311@gmail.com		Electromagnetic Theory	Student	Aug 17 at 4:04pm	02:26
aravindh1703@gmail.com	aravindh1703@gmail.com		Electromagnetic Theory	Student	Nov 15 at 6:27am	01:31:47
dharshini20122000@gmail.com	dharshini20122000@gmail.com		Electromagnetic Theory	Student	Nov 19 at 9:10am	35:59
divyajayashree2001@gmail.com	divyajayashree2001@gmail.com		Electromagnetic Theory	Student	Nov 14 at 8:38pm	42:55
Govindaraj	govindaraj1172001@gmail.com		Electromagnetic Theory	Student	Nov 4 at 9:34am	49:56
haranhari1707@gmail.com	haranhari1707@gmail.com		Electromagnetic Theory	Student	Oct 19 at 9:19am	13:40

## 2.2 Usage of Rubrics

To ensure fair and transparent assessment in an assignment, quiz, active learning, and collaborative learning activity, Rubrics were framed and used. The template used for grading the student's assignments is shown below. With the usage of rubrics, the students were able to understand what is required from them for the concerned assignment and it helped them to effectively do the assignments.



The screenshot shows a web browser window displaying a Canvas LMS page for 'Week 1 Assignment'. The URL is <https://canvas.instructure.com/courses/1635966/assignments/11764413>. The page features a sidebar with navigation options like Attendance, Settings, Account, Dashboard, Courses, Calendar, Inbox, Commons, and Help. The main content area displays an 'Assignment Rubric' table with three criteria and five rating levels.

Criteria	Ratings					Pts
Clear and useful description about the problem	2.0 pts Excellent The description is useful, clear, appropriate and complete.	1.5 pts Good The description is useful but contains minor omissions or errors.	1.0 pts Average Most of the description is useful but missing some info.	0.25 pts Needs Improvement The description is not useful and contains errors.		2.0 pts
Solution approach	2.0 pts Excellent The solution approach is appropriate and complete.	1.5 pts Good The solution approach contains minor omissions or errors.	1.0 pts Average Some concepts and principles of the solution approach are missing and inappropriate.	0.5 pts Needs improvement Most of the solution approach is missing and inappropriate.		2.0 pts
Mathematical procedures	3.0 pts Excellent	2.0 pts Good	1.0 pts Average	0.5 pts Needs		

## 2.3 Active Learning Methods

Active learning is anything course-related that all students in a class room are called upon to do other than simply watching, listening and taking notes. Active learning is an instructional approach that engages students in the material they are learning through activities viz., Think-Pair-Share (TPS), Visible Quiz or Clickers, One-minute paper, Three-step interviews, Poll Question, group discussion, reflection activities, and any other task that promotes critical thinking about the subject.

Active learning requires that students *do something that develops their skills*, as opposed to passive learning where information is merely transmitted to students. Handling classes through chalk and talk approach for mathematical derivations with repeated steps will make the students get bored. But if the same content is delivered through active learning method, the students will find it easier to grasp the mathematical concepts. Hence, above mentioned various active learning methods have been incorporated in this subject.



**Students are doing active learning activity – Think-Pair-Share**

#### **2.4 Lowman's 2 D Model of Effective Teaching**

Lowman's two-dimensional model that categorizes teachers on the basis of their levels of intellectual excitement and interpersonal rapport. Intellectual Excitement (IE), consists of two components. The first component focuses on the ability of an instructor to clearly present the subject material, while the second component considers the instructors stimulating and emotional impact on the student. Interpersonal Rapport (IR) is comprised of the dimensions that deal with the emotional connections within a college class that connects to the teacher's role, student types, and the patterns within the class. This model emphasis on the necessity of the faculty member to not only focus on the effective content delivery but also, they should take care of the student's emotional behavior. The model has been implemented for the mathematical concepts which involves more critical thinking.

#### **2.5 Attention, Relevance, Confidence and Satisfaction model**

Today challenge before most of the faculty members is gaining attention of the students during content delivery. The students are not showing interest in learning because of various factors. The predominant factor is lack of motivation. There are numerous instructional design models out of which the ARCS model of Motivational Design is the most effective model to overcome the challenges faced by the faculty members.

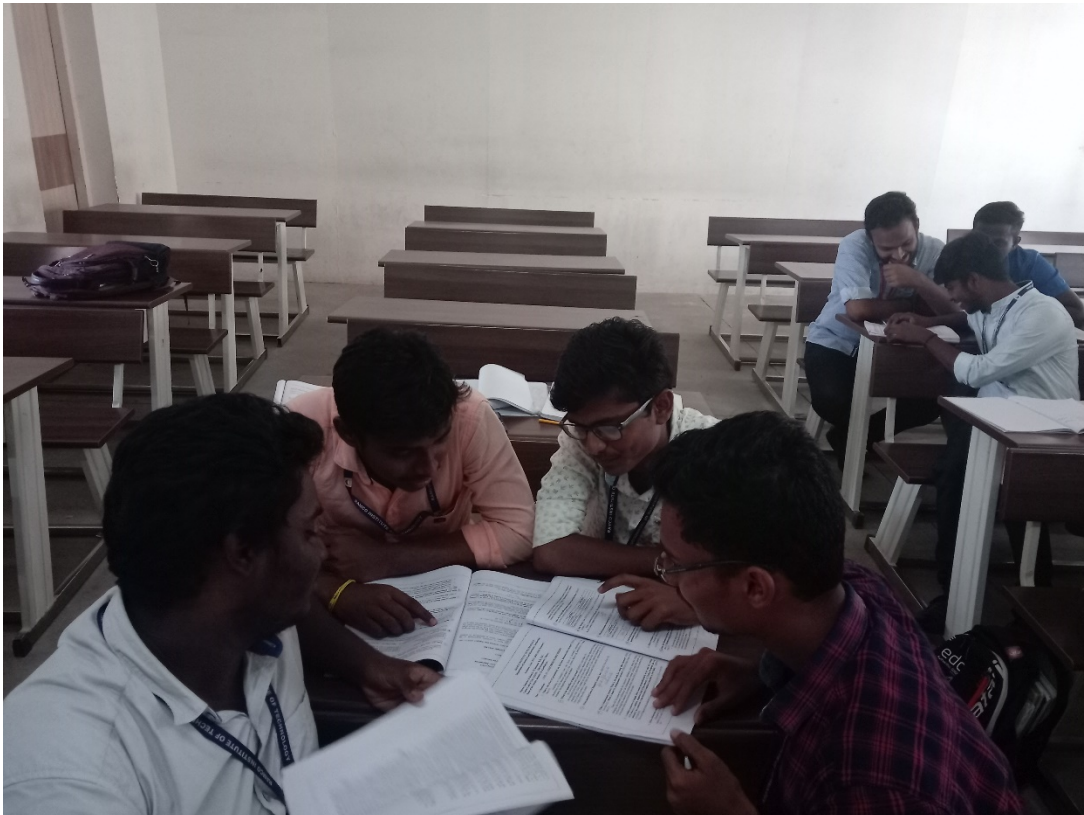
ARCS is an instructional model developed by John Keller, and focuses on motivation. It is important to motivate the learners, and ensure the continuity of the motivation during the instruction.

There are four components of ARCS model, and stands for Attention, Relevance, Confidence, and Satisfaction. The goal of the many instructional design theories that have been developed is providing an effective and efficient instruction, whereas the ARCS model takes motivation also as an essence of learning. The ARCS model has been implemented in the subject for effective content delivery.

### **2.6 Students Teams Achievement Division (STAD)**

The collaborative learning helps the students to develop higher level thinking capabilities, improves the oral communication and inculcates the leadership skills. The collaborative activity like Students Teams Achievement Division (STAD) will enable the peer tutoring naturally which can be harvested for enhancing the problem skills of the students. It improves the social interaction and interpersonal skills among the students.

In this subject, the topic which involves derivations and problems have been chosen for STAD activity and it is done mainly to revise the topics. In class activity has been planned like a team play which triggered the student's active participation.



**Students are doing in class activity of STAD**

### **2.7 Flipped Classroom (FC) activity**

The flipped classroom is one of the collaborative learning activities which helps in inculcating the self-learning habit in students which paves a way for attaining PO12 Life-Long Learning. The

abundance availability of online resources has made the teaching-learning process as a more joyful one. With available online videos and animation videos, it is easy for a faculty to conduct such flipped classroom activity.

Unlike traditional lectures, the flipped classroom provided the students to learn the concepts at their own pace and enough time to do collaborative learning inside the classroom. Since the students are applying their knowledge in the presence of a teacher in FC activity, it provided them a better understanding of the concepts. Most of the students expressed that this is a new kind of experience, where they are made to actively participate in learning.

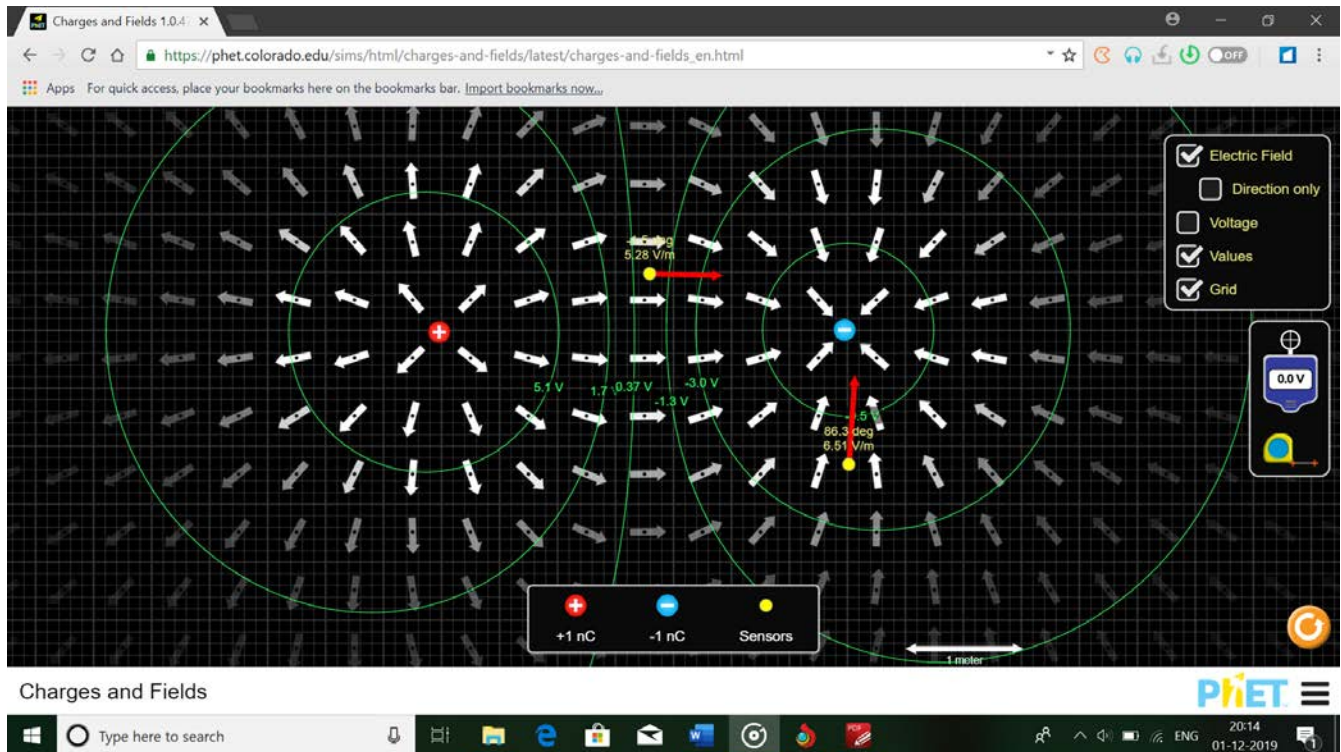


**Faculty explaining the Flipped classroom activity to the students**

## **2.8 Virtual laboratory (Online Simulation) for theory concept explanation:**

The interactive online simulation tool has been developed and used for explaining the properties of electric flux lines, calculation of electric field intensity and draws the equipotential lines and surfaces. The laboratory manual has been developed along with important key points and given to the students.

The students have really enjoyed the hands-on experience in learning the fundamental concepts which they learned only through theory-based lectures. The simulation has really helped the students to understand the concepts better and certainly improved their level of understanding. Many of the students have felt that they understood the concepts in different angles/manner which is not possible with the conventional teaching method.



## 2.9 YouTube video preparation

The Z-generation students are very much interested in watching videos related to the topics. The 21<sup>st</sup>-century students always have a passion for learning the contents through high-quality video presentations. The subject “Electromagnetic Theory” involves so much derivations and problems, most of my students not interested in reading the materials. To harness the power of the technology, a video presentation has been made and uploaded in the YouTube channel.

The students can watch the videos at any time, anywhere at their own pace of learning. The link for the video is <https://www.youtube.com/watch?v=bgTZA0yIEcc>.



### 3. Significance of results – EE8391 – Electromagnetic Theory:

#### Impact of Innovative Practices:

Dr.K.Karthikeyan handled the course EE8391 – Electromagnetic Theory in the academic year 2019–20 Odd Semester. The details of the topic, type of innovative practice and questions are tabulated below.

Sl. No.	Type of Innovative Practices	Topic	Question Number
1.	Attention, Relevance, Confidence and Satisfaction model	Electrostatic boundary conditions	IAT – II 7b (i)
2.	Students Teams Achievement Division (STAD)	Electromagnetic wave propagation in various media	IAT – III 14a
3.	Lowman's 2 D Model of Effective Teaching	Maxwell's equation	IAT – III 12a

The following questions were asked in the Internal Assessment Test II and III:

7b. (i) Derive electrostatic boundary conditions at the interface of two different dielectric media. (8)

12a. Starting from the basic principle obtain Maxwell's equations in point and integral form. [CO4, L3] (13 Marks)

14a. Derive the expression for an intrinsic impedance, propagation constant and velocity of a plane Electromagnetic wave when propagated in (i) a perfect dielectric medium (ii) conducting medium (13 marks)

The 60% of the students have answered the above questions very well and scored good marks. Almost 90% of the students have attempted and answered the questions. Only 2-3 students have not attempted the questions and not wrote the answers very well.