IFET Autonomous College of Engineering

Permenantly Affiliated to Anna University | Approved by AICTE

Department of Electrical and Electronics Engineering

INNOVATIONS BY THE FACULTY IN TEACHING AND LEARNING

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Important Note to Learners and Educators

A comprehensive collection of course materials has been thoughtfully curated and made accessible through the following Google Drive link: **https://drive.google.com/drive/folders/1d4YyAjSBaAHRQ1Z7mDujffCT31YM4E4R?usp=drive_link.**

To further aid in the understanding of technical concepts, our faculty members have developed informative video modules. These modules have been uploaded to the department's YouTube channel, **IFET EEE 2021**. The YouTube channel can be accessed at:

https://www.youtube.com/@IFETEEE/featured.

These resources are not only intended for IFETCE students but are also accessible to learners and educators from other institutions. It is **open for peer review and critique.** Reviews and critiques can be submitted via the Gmail ID: **ifetceeee98@gmail.com.**

Also, the **content can be reproduced and reused for further development by other scholars.**

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Statement of Clear Goals

The primary goal of these innovative teaching methods is to enhance student learning outcomes by:

1. Engaging students through interactive and visually appealing approaches.
2. Fostering critical thinking, problem-solving, and collaboration.
3. Bridging the gap between theoretical concepts and real-world applications.
4. Catering to diverse learning preferences to ensure holistic understanding and retention.

Use of Appropriate Methods

1. ***Activity-Based Learning:***

   Activity-Based Learning emphasizes student engagement through interactive and experiential techniques. These methods promote deeper understanding, critical thinking, and active participation in the learning process.

   The following are the activity-based innovative learning methodologies adopted:

   - Knowledge Check
   - Hands-on Learning
   - Role-play
   - Quick Thinking Exercise
   - Problem-Solving Activities
   - Collaborative Learning
   - Brainstorming
   - Comparative Chart
   - Mind Mapping

2. ***Visual Learning:***

   Visual Learning enhances comprehension by presenting complex concepts. These tools support better retention and cater effectively to visual learners. The following are the visual-based innovative learning methodologies adopted:

   - Lecture Videos (NPTEL, etc.)

- Animated Videos
- Charts

3. ***Others Methods***

Other Methods such as,

- Flipped Learning
- Blended Learning

promotes self-paced study and integrated learning experiences. These approaches combine traditional and digital techniques to enhance student engagement and flexibility.

Significance of Results

1. Increased student interest and participation through interactive methods.
2. Higher retention rates, deeper understanding, and better application of concepts.
3. Critical thinking, teamwork, and innovation skills fostered through collaborative activities.
4. Flexible learning environments accommodate diverse learning styles and needs.
5. Students gain practical experience and are better equipped for professional challenges.

Effective Presentation

The innovative strategies are communicated effectively by:

1. Providing clear objectives, methodologies, and expected outcomes for each method.
2. Organizing content logically for easy comprehension.
3. Using infographics, charts, and videos to complement explanations.
4. Encouraging discussions to continuously refine methods.

By employing these approaches, faculty create a dynamic and inclusive learning environment that not only enriches knowledge but also equips students with essential skills for academic and professional success.

Samples for each method, based on specific topics, are provided in the table below:

S. No.	Sub Code - Name	Topic of Innovation Teaching	Techniques of Teaching
1.	19UEEPC502 - Control System Engineering	Controllability and Observability	Knowledge Check

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S. No.	Sub Code - Name	Topic of Innovation Teaching	Techniques of Teaching
2.	19UEEPC501 - Power Electronics	Switched Mode Power Supply (SMPS)	Hands-on Learning
3.	19UEEPC304 - Generation, Transmission and Distribution	Nuclear Based Power Generation	Role Play
4.	19UMBHS701 - Professional Ethics	Honesty	Quick Thinking Exercise
5.	23EE3401 - Electronic Devices and Integrated Circuits	Display devices	Problem-Solving Activities
6.	19UEEPC302 – Electromagnetic Theory	Gauss's law and applications	Collaborative Learning
7.	19UEEPC304 - Generation, Transmission and Distribution	Skin, proximity and Ferranti effect	Brainstorming
8.	19UEEPC303 - Electrical Machines I	Brake test	Comparative Chart
9.	19UEEPE611 - Solid State Drives	Converter Selection & characteristics	Mind mapping
10.	19UEEPC302 - Electromagnetic Theory	Strokes Theorem	Lecture Video (NPTEL)
11.	19UEEPC301 - Electric Circuit Analysis	Ohm's Law and Kirchhoff's laws	Animated Video
12.	19UEEPC304 - Generation, Transmission and Distribution	Single line diagram of power system	Chart
13.	19UEEPC501 - Power Electronics	Current source inverter	Flipped Learning
14.	19UEEPC303 - Electrical Machines I	Characteristics of DC Shunt Motor	Blended Learning

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Samples for

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DEPARTMENT OF EEE

INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2023-24**
Course	:	**19UEEPC502 - Control System Engineering**
Topic	:	**Controllability and Observability**
Year/ Sem	:	**III/ V**
Mode	:	**Knowledge Check (Quiz Questions)**

1. Which of the following is a necessary condition for a system to be controllable?

A) The controllability matrix must be singular
B) The controllability matrix must have full rank
C) The observability matrix must be singular
D) The system matrix must be diagonal

Answer: B) The controllability matrix must have full rank

2. The concept of controllability ensures that:

A) The system states can be observed
B) The system states can be driven to any desired state
C) The system has a stable response
D) The system has a minimum-phase response

Answer: B) The system states can be driven to any desired state

3. What is the rank condition for a system to be controllable?

A) The rank of the controllability matrix must be equal to the number of state variables
B) The rank of the observability matrix must be zero
C) The determinant of the system matrix must be zero
D) The system should have more inputs than outputs

Answer: A) The rank of the controllability matrix must be equal to the number of state variables

4. The controllability matrix for a system with state matrix A and input matrix B is given by:

A) [A B]
B) [B AB A^2B ... A^{n-1} B]
C) [A^T B^T]
D) [B $A^{-1}B$ $A^{-2}B$]

Answer: B) [B AB A^2B ... A^{n-1} B]

5. A system is completely observable if:

A) The system matrix is invertible
B) The rank of the observability matrix equals the number of state variables
C) The system poles are all stable
D) The rank of the controllability matrix is less than the number of state variables

Answer: B) The rank of the observability matrix equals the number of state variables

6. The observability matrix for a system with state matrix A and output matrix C is given by:

A) $[C \ CA \ CA^2 \ ... \ CA^{n-1}]^T$
B) $[C \ A^{-1} \ C \ A^{-2}C]$
C) $[A \ C]$
D) $[C^T \ A^T]$

Answer: A) $[C \ CA \ CA^2 \ ... \ CA^{n-1}]^T$

7. If a system is both controllable and observable, it is called:

A) Stable
B) Detectable
C) Completely reachable
D) Completely state controllable and observable

Answer: D) Completely state controllable and observable

8. The Kalman's Controllability Test states that a system is controllable if:

A) The determinant of the observability matrix is zero
B) The rank of the controllability matrix is equal to the number of states
C) The eigenvalues of the system matrix are negative
D) The system has more inputs than outputs

Answer: B) The rank of the controllability matrix is equal to the number of states

9. The Kalman's Observability Test states that a system is observable if:

A) The determinant of the controllability matrix is zero
B) The rank of the observability matrix is equal to the number of states
C) The system has no eigenvalues at zero
D) The system is completely controllable

Answer: B) The rank of the observability matrix is equal to the number of states

10. What does it mean if a system is observable but not controllable?

A) All states can be measured, but not all can be manipulated
B) The system is stable
C) The system is uncontrollable and cannot be used for control purposes
D) The system is completely defined by its input-output relationship

Answer: A) All states can be measured, but not all can be manipulated

11. Which of the following systems is always controllable and observable?

A) First-order linear time-invariant (LTI) systems
B) Higher-order nonlinear systems
C) Linear time-varying systems
D) None of the above

Answer: A) First-order linear time-invariant (LTI) systems

12. What is the significance of unobservable modes in a system?

A) They contribute to the controllability matrix
B) They make some states unmeasurable
C) They improve system stability
D) They do not affect the system performance

Answer: B) They make some states unmeasurable

13. What happens if a system has an uncontrollable state?

A) That state cannot be driven by the control input
B) The system remains fully observable
C) The system is always stable
D) The system becomes fully controllable after feedback

Answer: A) That state cannot be driven by the control input

14. If a system is uncontrollable, which of the following might be a practical solution?

A) Ignore the uncontrollable states
B) Redesign the system or add extra actuators
C) Change the system's initial conditions
D) Reduce the order of the system

Answer: B) Redesign the system or add extra actuators

15. Why is observability important in control system design?

A) It ensures that all system states can be estimated from outputs
B) It guarantees system controllability
C) It helps in minimizing energy consumption
D) It prevents system instability

Answer: A) It ensures that all system states can be estimated from outputs

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DEPARTMENT OF EEE

INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2023-24**
Course	:	**19UEEPC502 - Control System Engineering**
Topic	:	**Controllability and Observability**
Year/ Sem	:	**III/ V**
Mode	:	**Knowledge Check**

Objective:

To reinforce conceptual understanding of Controllability and Observability through a student-led quiz competition using peer learning and collaborative preparation.

Activity Overview:

Four teams were formed in the class, each comprising 6 to 7 students. Two batches of quiz competitions were conducted to evaluate the understanding of the topic in an engaging and interactive format.

Team leaders were nominated for each group and were responsible for preparing quiz questions. They were encouraged to gather questions from any relevant source like books, lecture materials, or online resources. The team leaders discussed the content and framed meaningful and effective questions, which were reviewed by the course handler prior to the competition.

Quiz Batch Results:

Batch 1:

Teams: Baskar's Team vs. Hariharan's Team

Total Questions: 7

Results:

Baskar's Team: 5 correct answers

Hariharan's Team: 2 correct answers

Winner: Baskar's Team

Batch 2:

Teams: Srinivas's Team vs. Eraianbu's Team

Total Questions: 7

Results:

Srinivas's Team: 3 correct answers

Eraianbu's Team: 4 correct answers

Winner: Eraianbu's Team

Final Outcome:

Based on their performance, Baskar's Team and Eraianbu's Team were announced as the winners of the Knowledge Check Quiz activity.

The quiz-based activity provided an interactive and student-centered approach to assessing knowledge on Controllability and Observability. It encouraged teamwork, critical thinking, and self-directed learning, contributing to a deeper understanding of core control system concepts.

TEAM DETAILS

S. No.	Register Number	Name of the Student	Name of the Team
1	421121103001	Arun E	Baskar And Team
2	421121103002	Arun H	
3	421121103003	Baskar R	
4	421121103009	Iswarya R G	
5	421121103007	Geethanjali P	
6	421121103006	Dheenadhayalan M	
7	421121103005	Chandru J	
8	421121103004	Chandravignesh R	Hariharan And Team
9	421121103008	Hariharan S	
10	421121103010	Jagashivaraman G	

S. No.	Register Number	Name of the Student	Name of the Team
11	421121103011	Kaviarasu A	
12	421121103012	Kirthik Raj M	
13	421121103013	Naveen Johnson U	
14	421121103014	Ramyasri V	
15	421121103015	Sabarish D	Srinivas And Team
16	421121103016	Sakthimurugan S	
17	421121103017	Sanjeev G	
18	421121103018	Saravana Kumar B	
19	421121103019	Srinivas P	
20	421121103020	Vignesh T	
21	421121103301	Asif Basha M	Eraianbu And Team
22	421121103302	Eraianbu G	
23	421121103303	Naveenkumar N	
24	421121103304	Ram Kumar M	
25	421121103305	Yaseen Ashraf Z	

Knowledge Check

Knowledge check activity

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2024-25**
Course	:	**19UEEPC501 - Power Electronics**
Topic	:	**Switched Mode Power Supply (SMPS)**
Year/ Sem	:	**III/ V**
Mode	:	**Hands-on Learning**

Objective:

To provide experiential learning of switched mode regulator through practical implementation and real-time circuit testing, enabling students to understand the working, design, and efficiency of SMPS.

Description of the Activity:

The session began with a short interactive briefing on:

- Basics of voltage regulation
- Limitations of linear regulators
- Need for switched mode regulators
- Types: Buck, Boost, and Buck-Boost converters
- ***Hands-on Learning***

Handson Session

Hands-on Tasks Performed:

- Hardware kits were provided to implement a basic buck converter using: Inductor, diode, capacitor, MOSFET, and PWM signal generator.
- Students observed switching waveforms on an oscilloscope and compared the input/output voltage levels.
- Real-time analysis of voltage regulation at different load conditions.
- Observation of switching frequency and ripple content.

Tools and Components Used:

- Breadboard, inductor, capacitors, diodes, MOSFETs
- Oscilloscope, function generator, multimeter
- Regulated DC Power Supply

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2022-23**
Course	:	**19UEEPC304 - Generation, Transmission and Distribution**
Topic	:	**Nuclear Based Power Generation**
Year/ Sem	:	**II/ III**
Mode	:	**Role Play**

Objective:

To enhance students understanding of nuclear-based power generation through an interactive role play, simulating the major components and processes involved in a nuclear power plant.

Activity Overview:

A group of students participated in a role play activity by representing the key functional components of a nuclear power plant. Each student took on the role of a specific element to demonstrate the sequence of operations and the interdependence of various subsystems.

Team Representation:

1. Nuclear Reactor Core:

This is the initial and most critical section of a nuclear power plant, responsible for heat generation through nuclear fission.

Fuel Rod – Mr. E. Arun

Represented the source of nuclear fission, where uranium atoms split and release heat energy.

Control Rod – Mr. R. Baskar

Controlled the rate of reaction by absorbing excess neutrons, ensuring the process remains safe and stable.

Moderator – Mr. K. Sakthimurugan

Slowed down fast neutrons, allowing the chain reaction to be sustained efficiently.

Coolant – Mr. E. Iraianbu

Transferred the heat generated in the core to the steam generator, playing a vital role in energy transfer.

2. Turbine & Generator:

These components are responsible for energy conversion from heat to electricity.

Turbine – Mr. H. Arun

Converted steam energy into mechanical energy by rotating blades.

Generator – Mr. K. Krithik Raj

Converted mechanical energy into electrical energy, forming the final usable power output.

3. Cooling System:

Responsible for maintaining optimal temperature and ensuring efficiency.

Cooling System – Mr. R. Chandru

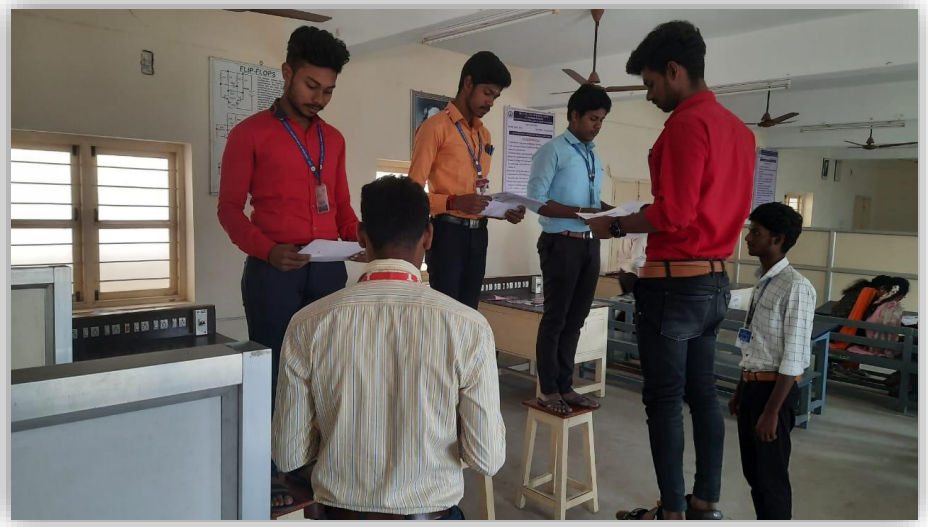
Removed excess heat from the system, condensing steam back into water and ensuring continuous, safe operation of the plant.

Process Demonstrated:

The role plays clearly depicted how nuclear fission in the fuel rods begins the power generation process. The control rods maintain the stability of the chain reaction, and the moderator ensures efficient neutron interaction. Heat is transferred by the coolant to produce steam, which spins the turbine, driving the generator to produce electricity. The cooling system manages the thermal balance of the plant.

Conclusion:

The role play activity on nuclear-based power generation was a successful teaching-learning initiative. It promoted collaborative learning, critical thinking, and reinforced core technical concepts related to the generation of electricity using nuclear energy.



Role play activity

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2022-23**
Course	:	**19UMBHS701 - Professional Ethics**
Topic	:	**Honesty**
Year/ Sem	:	**IV/ VII**
Mode	:	**Quick Thinking Exercise (Questions)**

SCENARIO QUESTIONS

Scenario 1: False Claim on Resume

Situation: You are applying for a job and notice that a small exaggeration in your resume could improve your chances.

Answer: Honesty is crucial in professional ethics. I will present only truthful information, as exaggerating qualifications can lead to loss of trust and potential job termination.

Scenario 2: Billing Extra Hours

Situation: You are a freelancer, and the client does not track your working hours. You worked for 5 hours but could easily bill for 7.

Answer: Overcharging is dishonest. I will bill only for the actual hours worked to maintain integrity and trust with my client.

Scenario 3: Witnessing Workplace Theft

Situation: You see a colleague taking office supplies home for personal use. Answer: I would report or address the issue professionally, as using company resources for personal gain without permission is unethical.

Scenario 4: Covering Up a Friend's Mistake

Situation: A friend at work makes a major mistake that could cost the company money. He asks you to cover it up.

Answer: Honesty requires transparency. I will encourage my friend to admit the mistake and help find a solution rather than hiding it.

Scenario 5: Finding Confidential Data

Situation: You accidentally receive an email containing confidential client data that you are not authorized to see.

Answer: I will not open or use the data and will immediately inform the sender of the mistake, ensuring confidentiality and integrity.

Scenario 6: Plagiarizing a Report

Situation: You are short on time and tempted to copy content from the internet for your report without crediting the source.
Answer: Plagiarism is dishonest. I will either properly cite sources or create my own original work, even if it takes more time.

Scenario 7: Selling a Faulty Product

Situation: You are a salesperson and realize the product you are selling has a minor defect that customers may not notice.

Answer: I will inform the customer about the defect honestly and provide options rather than misleading them.

Scenario 8: Misrepresenting Financial Reports

Situation: Your boss asks you to adjust financial reports to make the company look more profitable.
Answer: I will refuse to manipulate data, as financial dishonesty can have legal consequences and damage company reputation.

Scenario 9: Cheating in an Online Exam

Situation: You have an open-book online test, and a friend offers you the answers in advance.
Answer: I will reject the offer and complete the test honestly, as cheating compromises my integrity and learning.

Scenario 10: Handling a Customer's Overpayment

Situation: A customer accidentally pays you extra for a product/service and does not realize it.
Answer: I will immediately inform the customer and return the excess amount, as keeping it would be unethical.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2021-22**
Course	:	**19UMBHS701 - Professional Ethics**
Topic	:	**Honesty**
Year/ Sem	:	**IV/ VII**
Mode	:	**Quick Thinking Exercise**

Objective:

To encourage students to recognize and respond to ethical challenges promptly, fostering the importance of honesty in real-world professional settings through critical thinking and decision-making.

Activity Overview:

Quick-Thinking Exercise was conducted focusing on the value of honesty. This activity involved presenting students with five real-life professional scenarios that posed ethical dilemmas.

Students were required to:

- Analyze each scenario quickly.
- Make an ethical judgment.
- Justify their response with honesty as the guiding principle.

This rapid-response format was designed to simulate real-time decision-making in professional environments, emphasizing the role of integrity in career and workplace situations.

Questions:

Scenario I

Situation: You are applying for a job and notice that a small exaggeration in your resume could improve your chances.

Answered by Dharshan Sethuram R

Honesty is crucial in professional ethics. I will present only truthful information, as exaggerating qualifications can lead to loss of trust and potential job termination.

Scenario II

Situation: You see a colleague taking office supplies home for personal use. Answer: I would report or address the issue professionally, as using company resources for personal gain without permission is unethical.

Answered by Logesh V

If I see a colleague taking office things home for personal use, I'll talk to them politely first. Maybe they didn't realise it's not okay. If it continues, I'll have to inform the manager because using office stuff for personal work without permission isn't right.

Scenario III

A friend at work makes a major mistake that could cost the company money. He asks you to cover it up.

Answered by Gowtham P

Honesty requires transparency. I will encourage my friend to admit the mistake and help find a solution rather than hiding it.

Scenario IV

Situation: Your boss asks you to adjust financial reports to make the company look more profitable.

Answered by Muthuraman D

I will refuse to manipulate data, as financial dishonesty can have legal consequences and damage company reputation.

Quick Thinking Exercise

Scenario V

Situation: You have an open-book online test, and a friend offers you the answers in advance.

Answered by Gayathri N

I would politely decline the offer. Even though it's tempting, I believe real success comes from my own effort. Cheating might get me marks today, but it takes away the chance to actually

learn and grow. I would rather be proud of what I have earned honestly than carry the weight of a shortcut.

The answer given by Dharshan Sethuraman R for the first scenario is highly valuable and impressive.

Conclusion:

The Quick-Thinking Exercise on Honesty proved to be an engaging and effective method to instill ethical professionalism among students. It helped bridge the gap between theoretical ethics and practical workplace behavior, preparing students for real-world challenges in their future careers.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2024-25**
Course	:	**23EE3401 - Electronic Devices and Integrated Circuits**
Topic	:	**Display devices**
Year/ Sem	:	**II/ III**
Mode	:	**Problem-Solving Activities**

Objective:

To develop students' understanding of various display devices and enhance their analytical and problem-solving skills through applied learning activities related to real-world electronic applications.

Activity Overview:

A problem-solving session was conducted focusing on the topic of display devices. The activity was designed to help students:

- Understand the working principles of different types of display devices (e.g., LCD, LED, etc.,)
- Analyze the applications and limitations of each type.

Students were divided into groups and given scenario-based problems related to Display driving techniques using ICs, Troubleshooting display circuits, etc.,

Students were discussed with the real time scenario, identifying possible solutions, and presenting their approach.

Activity Questions

Activity 1:

Problem Statement:

A company is designing different electronic products and needs suitable display technologies. Match each product with the most appropriate display type and justify your choice.

Products:

1. A budget-friendly feature phone.
2. A curved high-end TV for immersive viewing.
3. A digital billboard placed outdoors.
4. A VR headset for gaming and simulations.
5. A smartwatch with an always-on display and low power consumption.

The problem statement was effectively addressed by Ms. Jayaasri S., who demonstrated a clear understanding of the topic and presented her insights on display devices. She discussed the following key points:

- The classification of display devices based on technology (LED, LCD, OLED, CRT, etc.)
- The working principle and internal construction of LED and LCD displays
- Power consumption and efficiency comparison among different display types
- The interfacing methods of display devices with microcontrollers and ICs
- Real-time applications of each type of display in electronic systems
- Troubleshooting tips and common issues faced with display circuits

Activity 2:

Problem Statement:

A technician is troubleshooting different screens with issues. Identify the display type based on the given symptoms and suggest possible fixes.

Issues:

1. Screen has ghosting (previous images faintly visible) after switching content.
2. Colors appear washed out when viewed from an angle.
3. The screen is flickering at a low refresh rate and straining the eyes.
4. There are "burn-in" marks of previous content, especially in static images.
5. The display turns black but still emits some light when powered on.

Solution:

The problem statement on diagnosing various display issues was effectively addressed by Mr. Mithunkumar G K. He analyzed each symptom to identify the most probable display type and suggested practical solutions for each issue. The summary of his analysis is as follows:

Issue	Likely Display Type	Possible Fix
Ghosting effect	LCD (TN panel)	Increase refresh rate, use a better panel like IPS or OLED.
Washed-out colors from an angle	LCD (TN panel)	Use an IPS panel for better viewing angles.
Flickering screen	CRT or low-refresh LCD	Increase refresh rate or replace the display.
Burn-in effect	OLED or Plasma	Use screen savers, pixel-shifting technology, or reduce static images.

Black screen with backlight on	LCD	Check the display driver, backlight, or power supply.

His explanation was concise, technically accurate, and demonstrated clear problem-solving ability. The structured tabular format enhanced the clarity of his response, making it easier for peers to understand and learn from the diagnosis and suggested solutions.

Activity 3:

Problem Statement:

Your university is setting up a new multimedia classroom and needs to choose a display. Compare the following display types based on resolution, energy consumption, lifespan, and suitability for classroom use. Rank them from best to worst.

Display Options:

- LCD (IPS)
- OLED
- Projector
- LED panel

Solution:

The problem statement regarding the selection of the most suitable display technology for a multimedia classroom was effectively addressed by Ms. Archana A. She compared the given display options—LCD (IPS), OLED, Projector, and LED Panel—based on critical parameters such as resolution, energy consumption, lifespan, and suitability for classroom use. Her well-reasoned analysis is summarized below:

Display Type	Resolution	Energy Use	Lifespan	Classroom Suitability	Rank
LCD (IPS)	High	Medium	Long	Good for standard use	2
OLED	Very High	Low	Medium	Excellent, but expensive	3
Projector	Medium	High	Shorter	Best for large audiences	1
LED Panel	High	Low	Long	Bright and efficient	4

Best Choice: Projector for large classrooms, LED panel for modern smart classrooms.

Activity 4: Design a Future Display Device

Problem Statement:

You are an engineer tasked with designing a next-generation display. Your display should solve at least three current problems seen in today's technology. Propose a name, key features, and benefits of your design.

Ans:

The innovative design challenge was creatively addressed by Mr. Ganesh Kumar S, who proposed a futuristic display solution named "UltraFlex-LED." His idea was aimed at solving common limitations found in current display technologies, such as fragility, dead pixels, and high energy consumption. Below is a summary of his solution:

Problem Statement: As an engineer, design a next-generation display that solves at least three problems seen in today's display technology.

Proposed Solution: UltraFlex-LED

Key Features:

Flexible OLED Material – Enables rollable and foldable screens, allowing for compact and portable display formats.

Self-Repairing Pixels – Integrates nano-circuit healing to automatically detect and repair dead or stuck pixels in real time.

Solar-Powered Display – Incorporates a thin-film solar layer to harness ambient light, significantly reducing dependence on external power sources.

Benefits:

Highly Portable – Can be folded like paper for easy storage and transport.

Eco-Friendly – Lowers energy usage through solar integration and efficient OLED backlighting.

Durable & Long-Lasting – Eliminates common issues like burn-in and pixel degradation over time.

Ganesh Kumar S's concept showcases innovation, sustainability, and practicality. His solution not only enhances user convenience but also contributes toward green technology by reducing environmental impact. This visionary idea aligns with future trends in wearable tech, foldable devices, and smart environments.

Problem Solving Activity

Activity 5:

Problem Statement:

Your team is given a broken smartphone display and must figure out how it works by reverse engineering. Identify at least four key components and their functions.

Solution:

The problem statement involving reverse engineering a broken smartphone display was thoughtfully addressed by Ms. Harini I. Her solution effectively identified and explained the core components that make up modern smartphone display technology. This demonstrates both technical understanding and practical application of electronic device analysis.

Key Components and Their Roles:

Liquid Crystal Layer (LCD) / OLED Panel

– This is the main visual layer of the display. It forms the images seen on the screen.

– In LCDs, it controls the passage of light using liquid crystals, while OLEDs emit light directly.

Backlight (for LCDs)

– Necessary in LCDs, the backlight illuminates the screen, as liquid crystals themselves do not emit light.

– It is typically composed of white LEDs and a light guide plate.

Thin-Film Transistor (TFT) Layer

– This layer is responsible for activating each pixel individually, enabling high-resolution and faster refresh rates.

– It acts like a matrix that switches pixels on or off.

Touchscreen Digitizer

– A transparent sensing layer placed on top of the display.

– It detects touch inputs (finger or stylus), converting them into electrical signals to be processed by the phone's controller.

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Department of Electrical and Electronics Engineering

INNOVATIVE TEACHING METHODOLOGY

Academic Year : **2022-23**

Course : **19UEEPC302 – Electromagnetic Theory**

Topic : **Gauss's law and applications**

Year/ Sem : **II/ III**

Mode : **Collaborative Learning**

Objective:

To deepen students conceptual understanding of Gauss's Law and its application in different electric field scenarios by encouraging collaborative discussions and group-based problem solving.

Activity Overview:

Collaborative Learning session was conducted on the topic Gauss's Law and Applications. The objective of the session was to promote teamwork and analytical thinking among students through the application of theoretical concepts in practical problem-solving environments.

Three teams were formed:

- Team A: 9 members
- Team B: 9 members
- Team C: 7 members

S. No.	Team	Register Number	Name of the Student
1	Team A	421121103001	Arun E
2		421121103002	Arun H
3		421121103003	Baskar R
4		421121103004	Chandravignesh R
5		421121103005	Chandru J
6		421121103006	Dheenadhayalan M
7		421121103007	Geethanjali P
8		421121103008	Hariharan S
9		421121103009	Iswarya R G

S. No.	Team	Register Number	Name of the Student
10	Team B	421121103010	Jagashivaraman G
11		421121103011	Kaviarasu A
12		421121103012	Kirthik Raj M
13		421121103013	Naveen Johnson U
14		421121103014	Ramyasri V
15		421121103015	Sabarish D
16		421121103016	Sakthimurugan S
17		421121103017	Sanjeev G
18		421121103018	Saravana Kumar B
19	Team C	421121103019	Srinivas P
20		421121103020	Vignesh T
21		421121103301	Asif Basha M
22		421121103302	Eraianbu G
23		421121103303	Naveenkumar N
24		421121103304	Ram Kumar M
25		421121103305	Yaseen Ashraf Z

Collaborative Learning

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Department of Electrical and Electronics Engineering

INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2024-25**
Course	:	**19UEEPC304 - Generation, Transmission and Distribution**
Topic	:	**Skin, proximity and Ferranti effect**
Year/ Sem	:	**II/ III**
Mode	:	**Brainstorming**

Objective:

To encourage critical thinking and enhance the conceptual understanding of Skin Effect, Proximity Effect, and Ferranti Effect through a structured brainstorming activity based on real-world transmission line scenarios.

Activity Overview:

A brainstorming session was conducted for students to explore the high-frequency phenomena affecting power transmission lines. The session aimed at promoting active learning by engaging students with a practical scenario-based question.

- A scenario/question related to the behavior of transmission lines under AC conditions was posed.
- Students were asked to individually brainstorm, discuss key concepts with peers, and then submit written responses explaining the effects.

The brainstorming focused on:

- **Skin Effect**: Concentration of current near the surface of a conductor at high frequencies.
- **Proximity Effect**: Redistribution of current in conductors due to the magnetic fields of nearby conductors.
- **Ferranti Effect**: Voltage rise at the receiving end of a lightly loaded or open-circuited long transmission line.

Section 1: Skin Effect

Question 1: Why does the skin effect increase with frequency?

The skin effect increases with frequency because alternating current (AC) induces eddy currents within the conductor, causing the current to flow more on the surface. As frequency

rises, these eddy currents become stronger and further push the main current toward the outer layers.

Question 2: How does the skin effect impact power transmission lines?

The skin effect increases the effective resistance of conductors at higher frequencies, leading to greater power losses and reduced efficiency in transmission lines.

Question 3: How can engineers reduce the skin effect in conductors?

Engineers can reduce the skin effect by:

- Using conductors with larger surface areas (e.g., hollow or stranded conductors),
- Employing Litz wire (individually insulated strands),
- Using materials with high conductivity like copper or silver.

Section 2: Proximity Effect

Question 4: What is the proximity effect in electrical conductors?

The proximity effect is the tendency of current to concentrate in particular regions of a conductor due to the magnetic field of nearby conductors, distorting the current distribution and increasing resistance.

Question 5: How is the proximity effect different from the skin effect?

While the skin effect is caused by the conductor's own magnetic field pushing current to the surface, the proximity effect is due to external magnetic fields from nearby conductors concentrating current in specific regions.

Question 6: What methods are used to minimize the proximity effect?

To minimize the proximity effect, engineers can:

- Increase spacing between conductors,
- Use twisted pair cables or transposed lines,
- Apply proper conductor bundling or orientation in transmission lines.

Section 3: Ferranti Effect

Question 7: What is the Ferranti Effect, and when does it occur?

The Ferranti Effect is the phenomenon where the receiving-end voltage of a long, lightly loaded or open-ended transmission line becomes higher than the sending-end voltage. It typically occurs under light load or no-load conditions.

Question 8: Why does the Ferranti Effect happen more in high-voltage AC systems?

It is more pronounced in high-voltage AC systems because the line capacitance is higher, and the charging current produces a voltage drop across the line inductance in a direction that adds to the receiving-end voltage.

Question 9: How can the Ferranti Effect be reduced in power systems?

The Ferranti Effect can be reduced by:

- Using shunt reactors to absorb excess charging current,
- Reducing line length where possible,
- Maintaining sufficient load on long transmission lines.

Question 10: A 200 km transmission line operates at extra-high voltage (EHV) and carries almost no load at night. What will happen to the receiving-end voltage, and why?

The receiving-end voltage will rise above the sending-end voltage due to the Ferranti Effect. This occurs because the line's capacitance charges up and induces a reactive current that, when interacting with the line's inductance, causes a voltage increase at the receiving end.

Brainstorming Activity

Conclusion:

The brainstorming activity provided students with a platform to critically engage with advanced transmission line concepts. The scenario-based question challenged them to think beyond textbooks, resulting in meaningful discussions and improved clarity of the Skin Effect, Proximity Effect, and Ferranti Effect. The activity was effective in building both conceptual knowledge and technical articulation skills.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2023-24**
Course	:	**19UEEPC303 - Electrical Machines I**
Topic	:	**Brake test**
Year/ Sem	:	**II/ III**
Mode	:	**Comparative Chart**

Objective:

To enable students to understand the Brake Test method for determining the performance of DC machines and to compare it with other testing methods through a comparative chart, enhancing conceptual clarity and analytical thinking.

Activity Overview:

As part of the practical learning under the topic Brake Test, students were engaged in a Comparative Chart Activity where they:

- Studied the Brake Test method conducted on DC motors.
- Analyzed various parameters such as input power, output power, torque, efficiency, and losses.
- Compared Brake Test with other methods like Swinburne's Test, Hopkinson's Test, and Regenerative Test.

Each group presented their charts and discussed:

- Advantages and limitations of the Brake Test
- Suitability of test methods based on machine size and availability
- Importance of direct vs indirect loading

This activity helps in:

- Understanding the principle and execution of the Brake Test.
- Analyzing and comparing different machine testing methods.
- Improves ability to organize technical data through comparative charts.
- Enhances team collaboration and presentation skills.
- Gains insights into selecting appropriate test methods for various machines.

Comparative chart : Brake Test in DC Machines

The brake test is a direct method used to determine the performance of DC machines, particularly for measuring output power, efficiency, and losses. Below is a comparative of test in DC machines.

Parameter	Prony Brake Test	Rope Brake Test.
principle	Measures torque using a wooden block pressing against the pulley.	Measures torque using a rope wound around the pulley with added weights.
Method of load Application	Friction force between a wooden block and the rotating shaft.	Friction between the rope and the rotating pulley.
Torque measurement	Calculated using the force applied by the spring balance and arm length of the lever.	Determined by the difference between weight applied and tension in the rope.
power Calculation	power = Torque x Angular Speed.	power = Torque x Angular Speed
Equipment Required	brake brake (wooden block, lever arm, Spring balance).	Rope, dead weights, and Spring balance
Accuracy	Moderate; depends on the smoothness of the wooden block and contact pressure.	Higher accuracy due to direct measurment of applied weight
Heat Dissipation	Generates significant heat due to friction : cooling is required for long-duration tests	Heat is generated, but lesser compared to the prony brake
Common Application	Used in laboratories for small DC motors and basic performance testing.	Suitable for larger DC motors and practical applications
limitations	- Friction variation affects accuracy.	

Comparative chart

Team Details

S. No.	Register No.	Name of the Student	Team
1	421122103001	Abinesh D	A
2	421122103004	Afzal M J	
3	421122103005	Antony Shajan J	

S. No.	Register No.	Name of the Student	Team
4	421122103006	Ashwathi V	B
5	421122103011	Deepa S	
6	421122103014	Gomathi M	
7	421122103020	Jayashree G	C
8	421122103026	Kirutika K.S	
9	421122103023	Kalaiarasi A	
10	421122103032	Padmasri S	
11	421122103035	Priyadharshini G	
12	421122103036	Priyadharshini K	D
13	421122103037	Priyadharshini R	
14	421122103041	Sujitha K	
15	421122103042	Swetha M	
16	421122103043	Thrisha A	
17	421122103304	Karan S	E
18	421122103002	Abinesh G	
19	421122103003	Abinesh P	
20	421122103010	Buvanraj	
21	421122103013	Dhayanithi N S	
22	421122103007	Balamurugan S	F
23	421122103008	Barath Gowsik C	
24	421122103009	Bharathi S	
25	421122103012	Deepan M	
26	421122103015	Gunasegaran K	
27	421122103016	Hari Srinivas P	G
28	421122103017	Jagatheesh K	
29	421122103018	Janakiraman R	
30	421122103019	Janarthanan S	
31	421122103021	Jayasuriya J	
32	421122103022	Jefrin Infant E	H
33	421122103024	Kalyana Sundar R	
34	421122103025	Karthikeyan K	
35	421122103027	Madesh R	
36	421122103028	Manikandan S	
37	421122103029	Mohamed Imran F	I
38	421122103030	Mohan N	
39	421122103031	Octavius Antony Raj Y	

S. No.	Register No.	Name of the Student	Team
40	421122103033	Pragathishwaran T	
41	421122103034	Prasanth P	
42	421122103038	Rahothaman P	J
43	421122103039	Ravichandran S	
44	421122103040	Sriram K	
45	421122103044	Thulasidharan D	
46	421122103045	Udhayakrishnan M	
47	421122103046	Vasanth P	K
48	421122103048	Vikram V	
49	421122103049	Yakash M	
50	421122103301	Gopalan D	
51	421122103302	Guruprassaath V.S	
52	421122103303	Hariharan M	L
53	421122103305	Karthikeyan K	
54	421122103306	Ragunathan V	
55	421122103307	Rajagopal E	
56	421122103308	Sanjai P	M
57	421122103309	Soban Babu P	
58	421122103310	Surendran R	
59	421122103311	Vanavendhan K	

Conclusion:

The Comparative Chart Activity on the Brake Test effectively reinforced theoretical knowledge through visual learning. Students showcased critical thinking in comparing test methods, and the activity served as a strong foundation for understanding machine performance evaluation techniques.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2022-23**
Course	:	**19UEEPE611 - Solid State Drives**
Topic	:	**Converter Selection & characteristics**
Year/ Sem	:	**III/ VI**
Mode	:	**Mind mapping**

Objective:

To help students visually organize and connect the key concepts related to various types of power converters used in Solid State Drives and understand their characteristics, suitability, and application areas.

Activity Overview:

Students were grouped as 5 to 6 in a team and asked to create detailed mind maps linking:

- Types of converters (AC-DC, DC-DC, DC-AC, AC-AC)
- Key characteristics (voltage regulation, frequency control, efficiency, ripple content, cost, size)
- Selection criteria (load type, voltage/current ratings, control strategy, application)
- Applications in SSDs (electric drives, motor speed control, energy conversion in automation)

Each group prepared a mind map starting with the central idea of “Converter Selection”, branching out to:

- Converter types
- Technical features
- Advantages & limitations
- Industrial and practical use-cases

Finally each and every batch will be discussing with the map, they have mapped to all other batches.

This activity will give out:

- Improved conceptual clarity of converter types and their roles in SSDs.
- Developed skills in visual representation of technical content.

- Understood comparative aspects of converters for selection in specific drive applications.
- Enhanced collaborative learning and critical thinking through group activity.
- Learned to connect theory with real-world application effectively.

Mind mapping activity

Conclusion:

The Mind Mapping activity on Converter Selection & Characteristics provided an interactive and engaging way to learn core concepts. Students actively explored and organized information, promoting deeper understanding and retention of technical details critical for modern power electronic systems.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2021-22**
Course	:	**19UEEPC302 - Electromagnetic Theory**
Topic	:	**Strokes Theorem**
Year/ Sem	:	**II/ III**
Mode	:	**Lecture Video (NPTEL)**

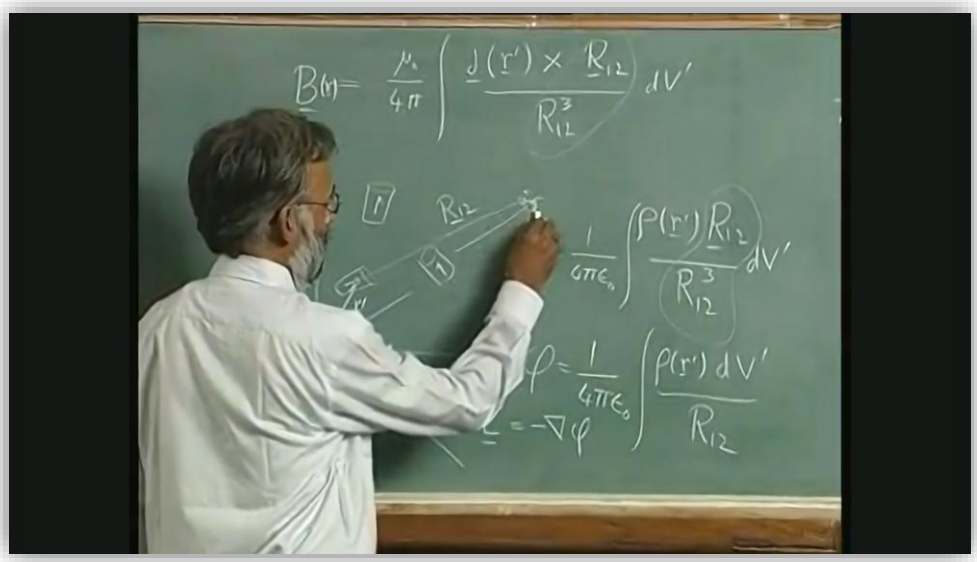
Objective:

To enhance conceptual understanding of Stokes' Theorem and its applications in electromagnetic theory using high-quality video content from NPTEL, promoting visual learning and comprehension of vector calculus.

Activity Overview:

A learning session was conducted using a lecture video from the NPTEL platform delivered by Prof. Dr. Harishankar Ramachandran. The video content focused on the fundamental concepts and mathematical formulation of Stokes' Theorem, and its importance in electromagnetic field theory. The session involved:

- Step-by-step derivation and visualization of the relationship between line integrals and surface integrals.
- Real-life examples showcasing how Stokes' Theorem is applied in solving problems related to Maxwell's equations.



NPTEL Lecture Video

Lecture Link: https://www.youtube.com/watch?v=Zr3lHeqzquI&t=67s

Conclusion:

The use of the NPTEL lecture video as a method of innovation effectively supported the theoretical learning of Stokes' Theorem by providing clarity on abstract mathematical concepts through visual explanation and expert narration. The session contributed to deeper understanding and better retention, demonstrating the value of multimedia learning resources in engineering education.

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INNOVATIVE TEACHING METHODOLOGY

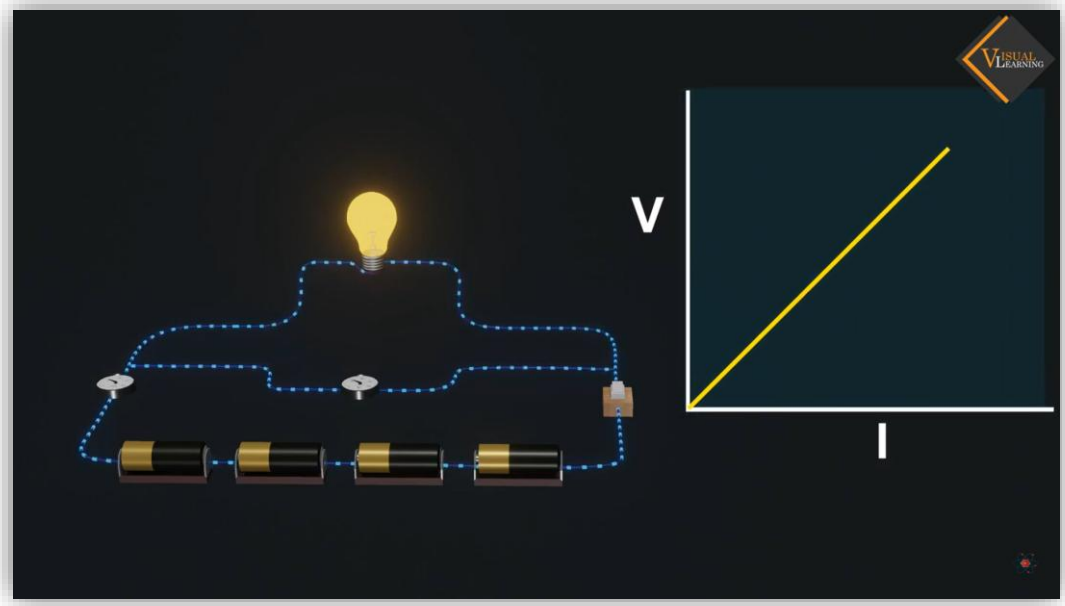
Academic Year	:	**2022-23**
Course	:	**19UEEPC301 - Electric Circuit Analysis**
Topic	:	**Ohm's Law and Kirchhoff's laws**
Year/ Sem	:	**II/ III**
Mode	:	**Animated Video**

Objective:

To enhance student understanding of fundamental electrical principles, Ohm's Law and Kirchhoff's Laws using animated videos that visually represent circuit behavior and current/voltage flow in electrical networks.

Activity Overview:

An animated video session was conducted to teach the basic laws governing electrical circuits. The animation provided a clear, engaging, and interactive approach to understanding how current and voltage behave in circuits governed by Ohm's Law, Kirchhoff's Current Law (KCL), and Kirchhoff's Voltage Law (KVL).



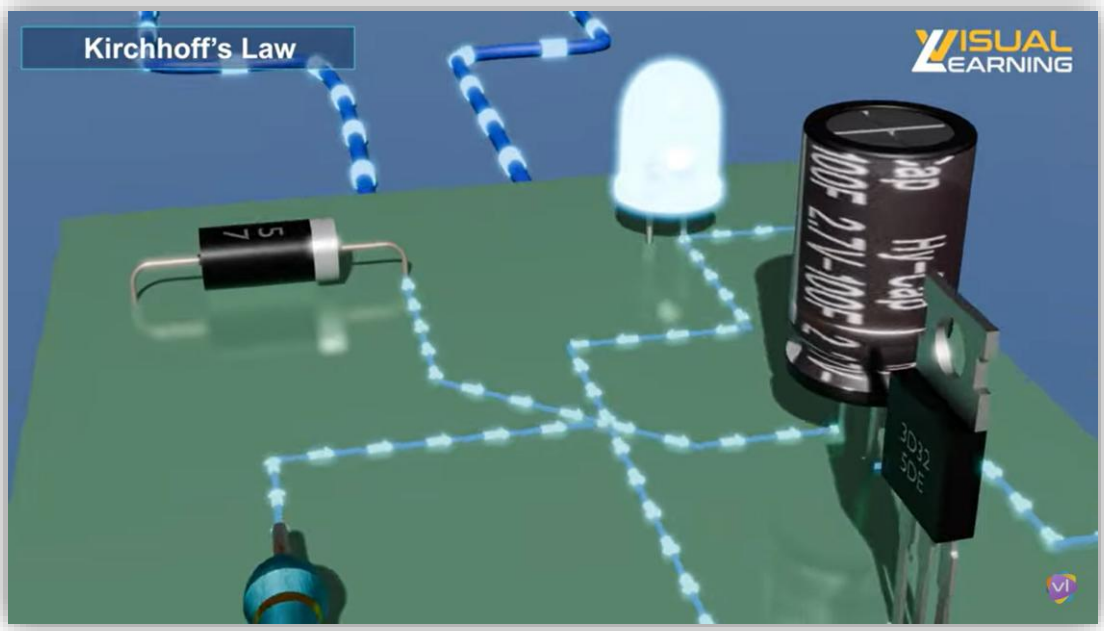
Animated Video – Ohms Law

Video Link: https://www.youtube.com/watch?v=WQjGeCGuC1o

The session included:

- Visual explanation of resistance, current, and voltage relationships (Ohm's Law).

- Animation of current splitting and combining at junctions (KCL).
- Animation of voltage distribution and loop analysis (KVL).
- Discussion based on video scenarios to reinforce understanding.



Animated Video – Kirchoff's Law

Video Link: https://www.youtube.com/watch?v=FHJWkx5yehE

Conclusion:

The use of animated video content significantly boosted students' interest and understanding of Ohm's Law and Kirchhoff's Laws. The visual and interactive nature of the session made the theoretical content more relatable and easier to grasp. It proved to be an effective innovative teaching method, especially for foundational topics in electrical circuit analysis.

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INNOVATIVE TEACHING METHODOLOGY

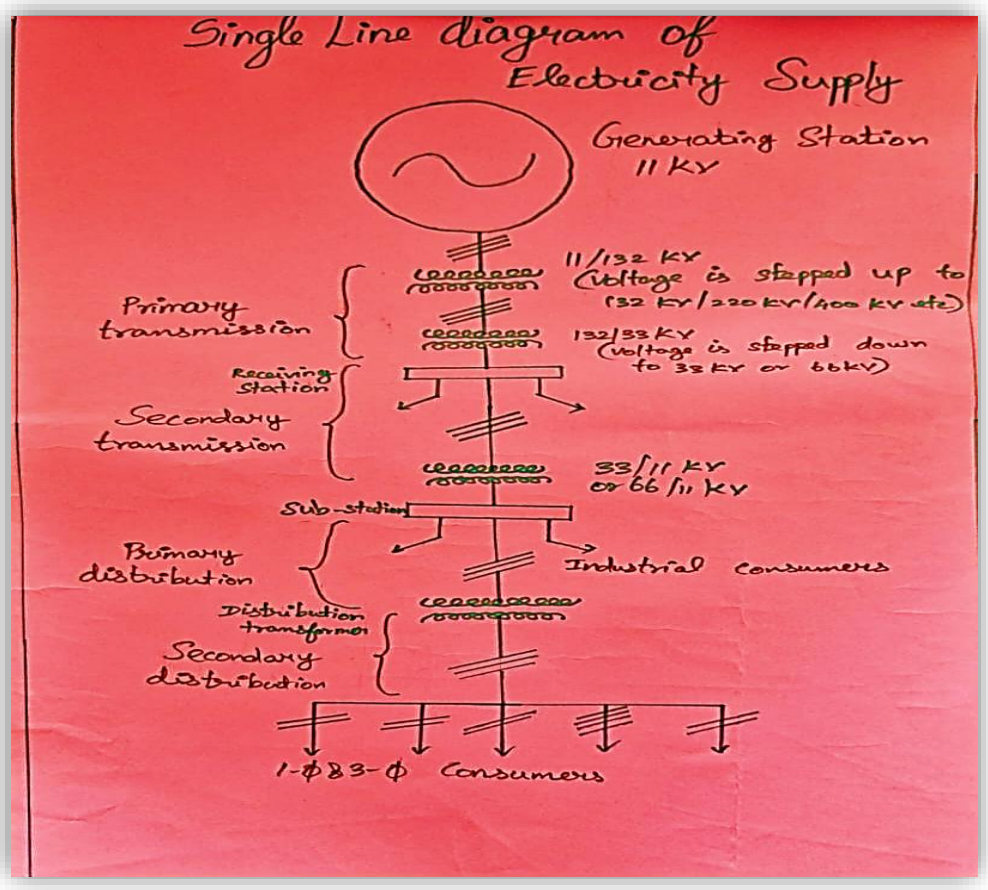
Academic Year	:	**2022-23**
Course	:	**19UEEPC304 - Generation, Transmission and Distribution**
Topic	:	**Single line diagram of power system**
Year/ Sem	:	**II/ III**
Mode	:	**Chart**

Objective:

To enhance student understanding of the structure and components of electrical power systems using visual learning tools like single line diagram charts.

Activity Overview:

A chart-based activity was conducted to help students understand the layout and elements of a typical power system using single line diagrams. The visual representation was aimed at simplifying complex connections and improving retention.



Chart

The activity included:

- Introduction to symbols and components used in single line diagrams (e.g., generators, transformers, bus bars, circuit breakers, loads, etc.).
- Display of a comprehensive chart showing generation, transmission, and distribution layout.
- Students were asked to analyze the chart and identify key sections and flow of electrical energy.
- Discussions were held where students explained each block and its function.

Conclusion:

The chart-based activity on the Single Line Diagram of a Power System proved to be an effective instructional strategy. It helped bridge the gap between theoretical knowledge and practical system layout understanding. The activity promoted visual and collaborative learning, allowing students to confidently read and interpret power system diagrams.

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INNOVATIVE TEACHING METHODOLOGY

Academic Year	:	**2024-25**
Course	:	**19UEEPC501 - Power Electronics**
Topic	:	**Current source inverter**
Year/ Sem	:	**III/ V**
Mode	:	**Flipped Learning**

Objective:

To enhance conceptual understanding and promote active student engagement on the topic of Current Source Inverters through the flipped classroom approach.

Activity Overview:

As part of the Power Electronics curriculum, a flipped learning strategy was implemented for the topic current source inverter.

In-class activity

The aim was to shift passive learning into active, in-class discussions and applications by assigning learning materials before class.

The flipped learning activity involved the following steps:

Pre-class Preparation:

Mr. Bharathi S is provided with curated learning materials including videos, lecture notes, and reading references on current source inverter principles, operation, waveforms, and applications.

In-class Activity:

Instead of traditional lectures, the class time was utilized for discussions. He explains, draw waveform diagrams, and analyze the operation of current source inverters under various conditions**.**

Faculty Facilitation:

The faculty facilitated deeper learning by asking probing questions, providing immediate feedback, and guiding students through design and analysis tasks.

Faculty Facilitation

Conclusion:

The flipped learning approach for the topic Current Source Inverter was highly effective in fostering active engagement and deep understanding. Students responded positively to the change in format, showing increased participation and enthusiasm. The method proved beneficial in reinforcing theoretical concepts through application-based learning.

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INNOVATIVE TEACHING METHODOLOGY

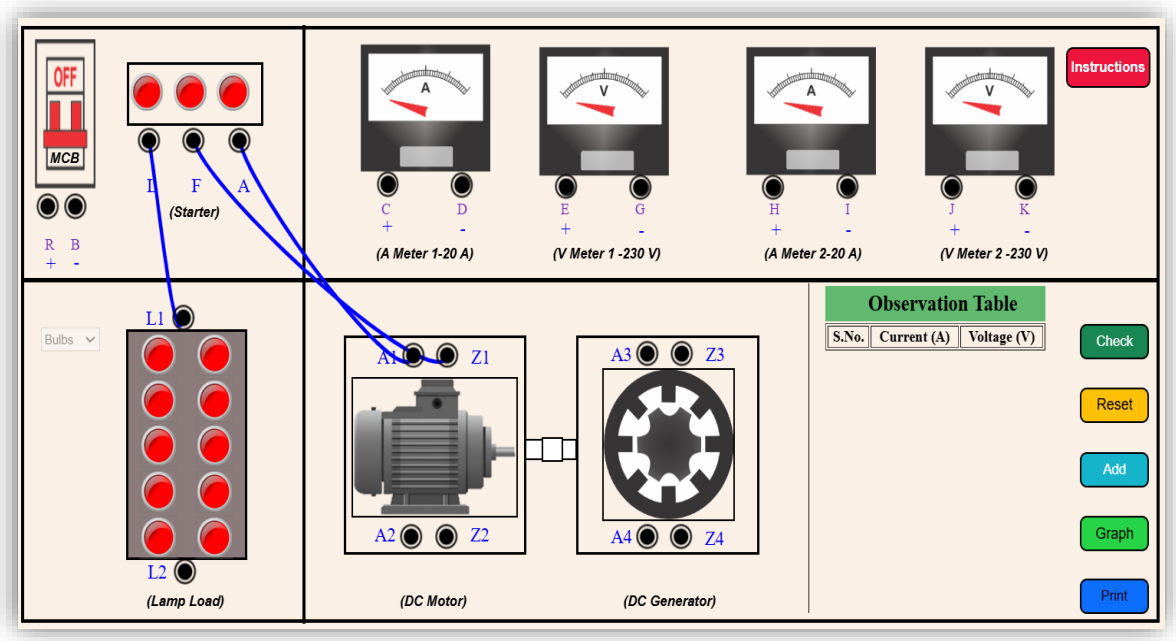
Academic Year	:	**2023-24**
Course	:	**19UEEPC303 - Electrical Machines I**
Topic	:	**Characteristics of DC Shunt Motor**
Year/ Sem	:	**II/ III**
Mode	:	**Blended Learning**

Objective:

To provide students with a comprehensive understanding of the characteristics of a DC Shunt Motor by integrating theoretical concepts with virtual lab-based experimentation.

Activity Overview:

A Blended Learning session was conducted focusing on the performance characteristics of the DC Shunt Motor. The session integrated both classroom instruction and virtual laboratory simulations to offer a holistic learning experience.



Virtual tool

Structure of the Activity:

Students were introduced to the basic working principles and types of characteristics of DC shunt motors (Torque-Speed, Speed-Armature Current, Torque-Armature Current).

Students were explored with the virtual lab platform to simulate and observe the behavior of a DC Shunt Motor under varying load conditions. The platform allows to:

- Adjust parameters such as voltage and load.
- Record and plot characteristic curves.
- Analyze motor performance in real-time scenarios.

Exploration of the concept using the virtual lab

Link for the virtual tool: https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

Conclusion:

The Blended Learning session combining classroom teaching and virtual lab experimentation proved to be highly effective. It enabled students to visualize the performance characteristics of DC Shunt Motors and understand the operational principles in a simulated environment. This approach successfully bridged the gap between theory and practical application, fostering deeper engagement and comprehension.