ELECTRONICS AND INSTRUMENTATION ENGINEERING

INNOVATION IN TEACHING LEARNING PROCESS

Innovations by the Faculty in teaching and learning shall be summarized as per the following description.
Contributions to teaching and learning are activities that contribute to the improvement of student learning. These activities may include innovations not limited to, use of ICT, instruction delivery, instructional methods, assessment, evaluation and inclusive classrooms that lead to effective, efficient and engaging instruction. Any contributions to teaching and learning should satisfy the following criteria:

- The work must be made available on Institute website
- The work must be available for peer review and critique
- The work must be reproducible and developed further by other scholars

The department/institution may set up appropriate processes for making the contributions available to the public, getting them reviewed and for rewarding. These may typically include statement of clear goals, adequate preparation, use of appropriate methods, significance of results, effective presentation and reflective critique.

Innovation in Teaching and Learning is to deliver the content in an effectiveand an interactive way between the students and faculty members. It is alsoimportant to provide the learning materials for the students and access in any possible locations to understand the subject.

The innovations practiced in teaching learning process are, use of Information and Communication Technology (ICT), Effective delivery methods, Assessment and Evaluation. These practices should satisfy the following conditions

ACTIVITY BASED LEARNING

Activity-Based Learning: Problem-Solving Activity

Introduction to Activity-Based Learning (ABL):

Activity-Based Learning (ABL) is an instructional approach that emphasizes hands-on, practical experiences over passive learning. It is designed to actively engage students by involving them in activities that require critical thinking, creativity, and collaboration. ABL is particularly effective in developing problem-solving skills, as it encourages students to apply knowledge and skills in real-life scenarios, making learning more meaningful and applicable.

Problem-Solving in ABL:

One of the key focuses of ABL is problem-solving. A problem-solving activity provides students with a specific challenge or task that requires them to think critically, analyze information, and come up with a viable solution. This type of activity simulates real-world situations where students must rely on both their prior knowledge and their capacity for innovation to solve problems. In the context of ABL, problem-solving activities are designed to be interactive, collaborative, and often interdisciplinary, helping students to make connections between different areas of knowledge.

Problem Based Learning (PrBL)

Course: U18EII7202 Advanced Control Systems

Course Faculty: Dr. P. S. Mayurappriyan

Course Overview:

• Course Overview • Introduction to Advanced Controls Systems	Course Outcome (CO1): Acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback	Active Learning Methodology: Course Expectation Exercise, You Tube Video Streaming

Active Learning Strategy: Course Expectation Exercise:

- Name of the course (Advanced Control Systems) is written on the blackboard.
- Students are asked to individually write down three expectations they have for the course.
- Then students are put into small groups and to have informed them they must reach consensus regarding their group's top 3-5 expectations.
- Then the groups are allowed to report back to the whole class

You Tube Video Streaming

2. Introduction to State Space Systems

Module 1: State Space Analysis

Active Learning Strategy: Problem Based Learning (PrBL)

CO1: Acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers. (An)

Syllabus: State space analysis of continuous and discrete systems – solution of time invariant autonomous systems, forced system – state transition matrix – relationship between state equations and transfer function – properties of state transition matrix – computation of state transition matrix -

controllability / observability criteria – controller / observer design by state feedback based on pole placement – design of state feedback control systems – full-order and reduced-order observer design.

Learning Objective:

1. Understand the concepts of state space analysis for continuous and discrete systems.

Problem Scenario:

In the bustling city of Coimbatore, the traffic police department is facing a significant challenge in optimizing traffic flow and reducing congestion at a complex intersection known as Lakshmi Mills Junction. Lakshmi Mills Junction connects multiple major highways and local roads, leading to a convergence of diverse traffic patterns and varying traffic volumes throughout the day.

The current traffic control system at Lakshmi Mills Junction relies on outdated signal timings and manual adjustments, resulting in frequent gridlocks and delays for commuters. To address this issue, the city authorities have decided to implement an advanced control system that leverages state-of-the-art technology to improve traffic management efficiency and enhance overall transportation infrastructure.

Your task as a control systems engineer is to design a state-of-the-art traffic control system for Central Junction using state space analysis, state feedback control, pole placement, and observer design techniques. The goal is to create an intelligent system that can dynamically adjust signal timings, lane allocations, and traffic flow patterns in real-time to minimize congestion, reduce travel times, and optimize traffic operations at the intersection.

By developing and implementing this advanced control system, you can revolutionize traffic management in Coimbatore, improve the daily commute experience for residents and visitors, and contribute to the city's efforts towards sustainable urban mobility.

Linked SDGs:

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I	2	STATE SPACE ANALYSIS: State space analysis of continuous and discrete systems – Introduction & Modeling of Physical Systems	CO1	Active Learning Methodology: Problem-Based Learning (PrBL)	*5, 6, e-learning Resources*
I	3	State Space Modeling - Tutorials	CO1	Active Learning Methodology: Problem-Based Learning (PrBL)	*5, 6, e-learning Resources*

Outcome: To develop a State Space model of any physical system

Assessment: Problem Solving Assignment

Project Based Learning

Course: U18EII7202 Advanced Control Systems

Course Faculty: Dr. I.Jeyadaisy

Department of Electronics and Instrumentation Engineering of Kumaraguru College of Technology (KCT) has resolved to make the students' industry ready by conducting Project based activities in classrooms. The III-year EIE students at Kumaraguru College of Technology are assigned a Project-Based Activity as part of the **U18EII5202 Embedded Microcontroller** course. The activity aims to deepen their understanding of the operation,communication and applications of STM microcontrollers, among other concepts. To enrich the learning experience and make it more engaging, several innovative pedagogical methods can be integrated into the course.Here are a few additional points to enhance the activity:

1. **Classroom-based Active Learning**: Interactive lectures with real-time demonstrations of STM microcontroller operations and its applications, allowing students to grasp concepts through practical examples and problem-solving exercises.

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2.Peer Group Learning: Students can collaborate in small groups to work on real-world projects, encouraging mutual learning, sharing of ideas, and development of critical thinking skills. Peer discussions can also help in reinforcing theoretical knowledge and addressing any challenges faced during the project work**.**

3. **Hands-on Programming and Debugging:** Students can write, compile, and debug embedded C code for STM microcontrollers. This will help them understand microcontroller operation, memory management, and peripheral interfacing.

4. **Simulation Tools:** Using simulation tools like Proteus or STM32CubeMX, students can simulate embedded systems before hardware implementation, helping them troubleshoot issues early in the design process.

5. **Case Studies and Research Projects:** Analyzing industry case studies of embedded system applications, like in automotive, healthcare, or robotics, and researching emerging technologies like AI/ML integration in embedded systems, can spark innovative thinking among students

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6. **Industry Expert Interaction:** Inviting industry experts to discuss current trends, challenges, and best practices in embedded systems dev elopment will bridge the gap between theory and practical applications.

7. **Assessment through Prototyping:** Encourage students to develop and present prototypes as part of the final assessment, which could be based on a problem-solving project or real-world application of embedded microcontrollers.

These activities will not only enhance their technical understanding of STM microcontrollers but also develop critical thinking, problem-solving, and industry-ready skills.