



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

CONTROL SYSTEMS LABORATORY								
IV Semester: EEE								
Course Code	Category	Hours/Week			Credits	MaximumMarks		
AEEE15	Core	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil		Tutorial Classes: Nil		Practical Classes: 36			Total Classes: 36	
Prerequisite: Electrical Circuits								

I. COURSE OVERVIEW:

The Control Systems laboratory course is indeed to train the students practically on the modeling, analysis and design of linear feedback control systems. This course deals with modeling of dynamical systems, and the control components and designing the compensator. The hands on training in the laboratory enable students to apply and modeling control principles in various areas of industrial applications.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The estimation of stability of dynamical systems using Digital simulation
- II. The various techniques of modeling and analyzing system's performance
- III. Design the time and frequency response of system by both classical and modern techniques.

III. COURSEOUTCOMES:

At the end of the course students should be able to:

- CO1 Make use of the knowledge of digital simulation tool for system analysis with different standard Inputs.
- CO2 Model the dynamic systems in transfer function using digital simulation tool and validate the Performance characteristics of motors.
- CO3 Analyze and select various electronics devices for improving system performance along with tuning mechanism in virtual environment
- CO4 Estimate voltage and current swings in salient pole alternator for determination of direct and quadrature axis reactance.
- CO5 Apply programmable logic controllers for limiting the starting current of poly-phase induction motors.
- CO6 Analyze the system's stability in time and frequency domain by computing gain and phase margin.

IV. COURSE CONTENT:

EXERCISE-1: TIME RESPONSE OF SECOND ORDER SYSTEM

Determine response of first order and second order systems for step input for several of constant 'K' using linear simulator unit and compare theoretical and practical results.

EXERCISE -2: TRANSFER FUNCTION OF DC MOTOR

Determine Transfer function of armature-controlled dc motor

EXERCISE -3: TRANSFER FUNCTION OF AC SERVO MOTOR

Determine the transfer Function of AC Servo Motor using MATLAB.

EXERCISE -4: EFFECT OF VARIOUS CONTROLLERS ON SECOND ORDER SYSTEM

Analyze the effects of various controllers on a second-order system using the control system toolbox.

EXERCISE -5: COMPENSATOR

Study the performance of lead and lag compensators

EXERCISE -6: TEMPERATURE CONTROLLER

Study the performance of PID controller used to control the temperature of an oven.

EXERCISE -7: DESIGN AND VERIFICATION OF OP-AMP BASED PID CONTROLLER

Implementing the design and verification of an op-amp based PID controller involves a combination of analog circuit design and simulation using tools like MATLAB.

EXERCISE -8: STABILITY ANALYSIS USING DIGITAL SIMULATION

Stability analysis of a linear time-invariant system using root locus, Bode plot, polar plot, and Nyquist criterion through digital simulation. MATLAB

EXERCISE -9: STATE SPACE MODEL USING DIGITAL SIMULATION

Verification of state space model from transfer function and transfer function from state space model using digital simulation

EXERCISE -10: LADDER DIAGRAMS USING PLC

Input output connection, simple programming, ladder diagrams, uploading, running the program and debugging in programmable logic controller

EXERCISE -11: TRUTH TABLES USING PLC

Study and verification of truth tables of logic gates, simple Boolean expressions and application to speed control of DC motor using programmable logic controller.

EXERCISE -12: IMPLEMENTATION OF COUNTER

Implementation of counting number of objects and acting using PLC.

EXERCISE -13: BLINKING LIGHTS USING PLC

Implementation of blinking lights with programmable logic controller.

EXERCISE -14: WATER LEVEL CONTROL

Control of maximum and minimum level of water in a tank using PLC

V. TEXTBOOKS:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

VI. REFERENCEBOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

VII. ELECTRONICSRESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_ee90 <https://nptel.ac.in/courses/115108104>

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lab Manual