CONTROL SYSTEMS

Course Objectives:

Objective
1. To understand the basic concepts of open loop and closed loop control systems.
2. To analyse the given system in time domain.
3. To understand the concept of frequency domain analysis.
4. To understand the concept of stability of system.
5. To design the compensator for different control systems.

Programme Outcomes (POs):

Programme Outcome
PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PSO1 Design, analyze and evaluate the performance of Electrical & Electronics systems using contemporary tools to provide effective solutions for real-world problems.
PSO2 Apply technology to make a significant contribution in terms of Electrical Engineering Innovations and ethically supporting the sustainable development of the society.

Course Outcomes (COs):

Course Outcome
CO1 Develop a mathematical model of a physical system and compute the transfer function using Block diagram reduction technique and Signal flow graph.
CO2 Analyze the performance of first and second order system and compute the steady state error for different test signals.
CO3 Analyze the frequency response of a given system.
CO4 Examine the stability of a given system using various methods.
CO5 Design a lag lead and lag lead compensator for open loop system and examine a system using state variable techniques.

Articulation Matrix:

CO.No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3										
2	1	2	3	3		2								
3	2	3	3	3	3									
4	1	4	3	3	3									
5	2	1	3	3	1		2							

Units:

UNIT I MATHEMATICAL MODEL OF PHYSICAL SYSTEMS (10 Hours):

Introduction- Basic Elements of control Systems-Open loop and closed loop system - Elements of Control system - Transfer function of mechanical translational and rotational system electrical system - Electrical analogy of mechanical system - Block diagram reduction technique - Signal flow graph.

UNIT II TIME DOMAIN ANALYSIS (8 Hours):

Standard test signals - Time response of first order and second order systems for unit step test signals - Time domain Specifications-Steady state response - Static error constants - steady state error - Effects of proportional derivative proportional integral systems.

UNIT III FREQUENCY DOMAIN ANALYSIS (9 Hours):

Frequency response of systems - Frequency domain specifications - Correlation between frequency domain and time domain specifications - Bode plot Polar plot

UNIT IV STABILITY ANALYSIS OF CONTROL SYSTEM (9 Hours):

Concepts of stability - Necessary conditions for Stability-Characteristics equation - Location of roots in S plane for stability - Routh Hurwitz criterion-Nyquist stability criterion- Root Locus technique- Relative Stability

UNIT V COMPENSATOR DESIGN (9 Hours):

Compensators Design of Lag compensator - Lead compensator - Lag-lead compensator (using Bode plot) - Concept of state variable state model Controllability and observability