II Year-II Semester		L	T	P	C
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CONTROL SYSTEMS (R1622024)

Preamble: This course introduces the elements of linear control systems and their analysis. Classical methods of design using frequency response are included. The state space approach for modeling and analysis of simple PD, PID controllers.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

Cos	Course Outcomes	POs
1	Ability to derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.	2
2	Capability to determine time response specifications of second order systems and to determine error constants.	2
3	Acquires the skill to analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.	3
4	Capable to analyze the stability of LTI systems using frequency response methods.	3
5	Able to design Lag, Lead, Lag-Lead compensators to improve system performance from Bode diagrams.	4
6	Ability to represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.	2

Syllabus:

UNIT I:

Objective: To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function.

Mathematical Modeling Of Control Systems
Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro, transmitter and receiver - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT II:

Objective: To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers.

Time Response Analysis
Standard test signals - Time response of first and second order systems -Time domain specifications - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT III:

Objective: To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.

Stability and Rootlocus Technique The concept of stability – Routh's stability criterion – limitations of Routh's stability –Root locus concept - construction of root loci (Simple problems)

UNIT IV:

Objective: To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.

Frequency Response Analysis
Introduction to Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion.

UNIT V:

Objective: To discuss basic aspects of design and compensation of linear control systems using Bode plots.

Classical Control Design Techniques

Lag, Lead, Lag-Lead compensators, design of compensators – using Bode plots.

UNIT VI:

Objective: Ability to formulate state models and analyze the systems. To present the concepts of Controllability and Observability.

State Space Analysis of LTI Systems
Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems principles and design, M. Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition

REFERENCE BOOKS:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Control Systems, Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering, I.J.Nagarath and M. Gopal, New age International Publications, 5th Edition.
4. Control Systems Engineering, S.Palani, TataMcGraw Hill Publications.