III Year B.Tech. ECM I - Semester	L	T	P	To	C
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EE319 LINEAR CONTROL SYSTEMS (Elective – I)

Course Description &Objectives:

This course is to explore the modeling of linear dynamic systems via differential equations and transfer functions utilizing input-output representations; analysis of control systems in the time and frequency domains and using transfer function and state-space methods.

Course Outcome:

a. *Able to formulate mathematical models of physical systems and represent them in block diagrams and signal flow graphs.*
b. *Able to analyze the words Transient & Steady State Performance of a system.*
c. *Able to understand the stability of an Electrical, Electronics and other physical systems.*
d. *Able to Design controllers, compensators and control systems.*

UNIT I - Introduction & Mathematical Models of Physical Systems :

Introduction: Concepts of Control Systems - Open Loop and closed loop control systems and their differences - Different examples of control systems - Clasification of control systems. Mathematical Models of Physical Systems: Differentical equations - transfer functions and block diagram representation of systems considering electrical systems as examples Block diagram algebra -Representation by Signal flow graph - reduction using Mason's gain formula - translational and rotational mechanical systems

UNIT II - Feed-Back Characteristics & Elements of Control Systems :

Feed-Back Characteristics : What is Feedback? Effects of feedback - reduction of parameter variations by use of feedback-Control over system dynamics - by the use of feedback.

Elements of Control Systems : DC Servo motor - AC Servo motor - Synchro transmitter and Receiver.

UNIT III - Time Response Analysis & Concepts of stability :

Time Response Analysis : Standard test signals - Time response of first order systems - Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications - Steady state response - Steady state errors and error constant

Concepts of stability : The concept of stability, Routh stability criterion

UNIT IV - Root Locus Technique & Frequency Response Analysis :

Root Locus Technique: The root locus concept - construction of root loci Frequency Response Analysis: Introduction, Frequency domain specifications - Bode diagrams - Determination of Frequency domain specifications from the Bode Diagram - Phase margin and Gain margin - Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots and Nyquist stability criterion

UNIT V - Design and Compensation Technique & State Space Analysis of Continuous Systems :

Design and Compensation Technique : Introduction and Preliminary design considerations - Lead, Lag, Lead-lag. PID controller. State Space Analysis of Continuous Systems : Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization - Solving the Time Invariant state Equations - State Transition Matrix.

TEXT BOOKS :

1. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, 2nd ed.,New Age International (P) Limited, 2010.
2. Katsuhiko Ogata, “Modern Control Engineering”, 3rd ed.,Prentice Hall of India Pvt. Ltd., 1998.

REFERENCE BOOKS :

1. B. C. Kuo, “Automatic Control Systems”, 8th ed., John wiley and son’s, 2003.
2. John wiley, “Control Systems Engg”., 3rd ed.,NISE, 2000.