

CONTROL SYSTEMS

Course Code	23EE3403	Year	II	Semester(s)	II
Course Category	Professional Core	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Linear algebra & Calculus, Differential equations and Vector Calculus, Electrical Circuit Analysis-II
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to	
CO1	Understand different representations of the linear time invariant systems. (L2)
CO2	Apply the basic principles of engineering in modeling of control systems and learn about feedback characteristics, effects of controllers, stability and state space representation. (L3)
CO3	Examine the time response and realization of compensators (L3)
CO4	Analyze the transfer function representation and performance of LTI systems in time domain and frequency domain (L4)
CO5	Illustrate the status of LTI systems in state space model (L4)
CO6	Ability to understand the principles, analyse various control system problems, and submit a report.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3					1							2	1
CO3	3												1	1
CO4		3	1	1									2	1
CO5		3		1							1		2	1
CO6			3						3	3		2	2	1

SYLLABUS

Unit No.	Contents	Mapped CO
I	Mathematical Modelling of Control Systems Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems - Transfer function of Armature controlled DC servo motor.	CO1, CO2, CO4, CO6
II	Transfer Function Representation Block diagram algebra – representation by signal flow graph – reduction using Mason’s gain formula.	CO1, CO3, CO4, CO6

	Time Response Analysis Standard test signals – step response of first and second order systems – time domain specifications - steady state errors and error constants	
III	Stability And Root Locus Technique The concept of stability – Routh’s stability criterion – limitations of Routh’s stability, root locus concept – construction of root loci (simple problems). Effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) controllers	CO1, CO2, CO4, CO6
IV	Frequency Response Analysis Introduction to frequency domain specifications –Polar plots, Nyquist stability criterion, Bode plots- stability analysis (phase margin and gain margin). Classical Control Techniques Lag, lead, lag-lead compensators - physical realization	CO1, CO3, CO4, CO6
V	State Space Analysis of LTI Systems Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - solving the time invariant state equations - State Transition Matrix by Laplace transform and its properties- concepts of Kalman’s controllability and observability.	CO1, CO2, CO5, CO6

Learning Resources

Text Books

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 2010.
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition
3. Control Systems by Manik Dhanesh N, Cengage publications.
4. Control Systems Engineering by I.J.Nagarath and M.Gopal, New age International Publications, 5th Edition.
5. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/107/106/107106081/>
2. <https://archive.nptel.ac.in/courses/108/106/108106098/>
3. <https://nptelvideos.com/video.php?id=1423&c=14>