CONTROL SYSTEMS

Course Code	20EE3501	Year	III	Semester	I
Course Category	Professional Core	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Signals and Systems
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** various models to represent the linear time invariant systems. **(L2)**
CO2	**Apply** the knowledge of engineering fundamentals in control systems, modeling transfer function/state space of the systems and characterize them. **(L3)**
CO3	**Interpret** the LTI system's performance in time and frequency domains. **(L3)**
CO4	**Analyze** the transfer function model of linear control system and stability using various tools **(L4)**
CO5	**Examine** the state of a linear control system using state space representation. **(L4)**
CO6	**Ability** to understand the concepts, investigate various problems of control systems 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												2	1
CO4		3	1	1									2	1
CO5		3		1							1		2	1
CO6			3						3	3		2	2	

Unit No.	Syllabus	Mapped CO's
1	**Mathematical Modelling of Control Systems:** Classification of control systems, Mathematical models – mechanical systems (Translational and Rotational), Concept of transfer function - Finding Transfer functions for electrical networks and mechanical systems. Effects of feedback.	CO1, CO2, CO4, CO6
2	**Transfer function representation:** Transfer function of DC servo motor – AC servo motor. Construction and working of synchro transmitter and receiver. Block diagram algebra - reduction techniques, representation by signal flow graph – reduction using mason's gain formula.	CO1, CO2, CO4, CO6
3	**Time Response Analysis** (descriptive treatment only)**:** Step response of first order, second order systems, time domain specifications, steady state error and static error constants. **Stability Analysis:**	CO1, CO3,

	The concept of stability – Routh's stability criterion –limitations of Routh's stability, Root locus concept – construction of root loci (simple problems).	CO4, CO6
4	**Frequency Response Analysis & Stability:** Introduction, frequency domain specifications (descriptive treatment only). Stability analysis of Bode plots – Phase margin a Gain margin (simple problems).	CO1, CO3, CO4, CO6
5	**State Space Analysis of LTI Systems:** Concepts of state, state variables and state model, Conversion of state variable model to transfer function model and transfer function form to state variable form (controllable canonical form), solution of linear homogenous state equations - state transition matrix (Laplace transform method) and its properties, Kalman's test of controllability and observability.	CO1, CO2, CO5, CO6

Learning Resources

Text Books

1. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited 6th edition, 2009.

Reference Books

1. A. Nagoor Kani, "Control Systems", RBA Publications, 3rd edition, 2017.
2. Farid Golnaraghi and Benjamin C. Kuo, "Automatic Control Systems", John wiley and son's., 9th edition, 2010.
3. S.Palani, "Control Systems Engineering", Tata Mc Graw Hill Publications, 2nd edition, 2009.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108106098
2. https://nptel.ac.in/courses/108107115
3. https://freevideolectures.com/course/2337/control-engineering