CONTROL SYSTEMS ENGINEERING

Course Code	20EC3404	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
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	**Classify** control systems and determine the stability of a system using various models (L2)
CO2	**Apply** standard test signals to a system to determine their characteristics (L3)
CO3	**Make use of** stability concepts to obtain the desired characteristics (L3)
CO4	**Inspect** the characteristics of a linear control system using various time and frequency domain tools (L4)
CO5	**Examine** the system behaviour using various stability analysis techniques (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2							2		2			2	
CO2	1							2		2			2	
CO3	3							2		2			2	
CO4		2						3		3			3	
CO5		2						3		3			3	
Average* (Rounded to nearest integer)	2	2						2		2			2	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Concepts of control systems. Examples of control systems, classification of control systems, Block diagram algebra, Representation by Signal flow graph. Reduction using Mason's gain formula. Feedback Characteristics, Effects of feedback. Mathematical modelling of systems – Electrical, mechanical translational and rotational systems.	CO1,CO3
II	**Time Domain Analysis:** Standard test signals, Time response of first and second order systems with standard input signals, Time domain specifications, steady state error and error constants. Effects of P, PI, PD and PID Controllers.	CO1,CO2, CO3,CO4
III	**Stability Analysis in S-Domain:** Concept of stability, Routh Hurwitz criterion. Construction of Root locus. Effects of adding poles and zeros to open loop transfer function on the root loci.	CO1, CO3,CO4,CO5

IV	**Frequency Response Analysis:** Correlation between time and frequency responses. Determination of frequency domain specifications, Gain margin and Phase margin -Stability Analysis from Bode Plots, Polar plots and Nyquist plots.	CO1, CO3,CO4,CO5
V	**State variable analysis:** State, State variables, State variable representation, State variable form from Transfer function (Diagonal form), transfer function from State variable form, State transition matrix, properties of state transition matrix, Controllability and Observability	CO1, CO5

Learning Resources
Text Books
1. M.Gopal, "Control Systems Engineering" , 3/e , Wiley Eastern Ltd., TMH ,2008 2. Benjamin C.Kuo, "Automatic Control Systems" ,7/e , Prentice Hall of India, 1997.
Reference Books
1. Ogata, "Modern Control Engineering" , 2/e, Prentice Hall of India.,2011 2. R.C. Sukla, "Control Systems", 3/e, Dhanpatrai and Sons,1998 3. Control Systems Engg. , Nise– John wiley , 3rd Edition 2000
e- Resources & other digital material
1. https://nptel.ac.in/courses/108/106/108106098/ 2. https://freevideolectures.com/course/2337/control-engineering