CONTROL SYSTEMS

IV Semester: ECE, EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEEB16	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

This course deals with the basic concepts of block diagram reduction technique, time response analysis of first order and second order systems. It deals with various time and frequency domain analysis. It elaborates the concept of stability and its assessment for linear time invariant systems. This course address the various real time issues and how the control strategies are used in automation areas associates with variety of engineering streams.

II. OBJECTIVES:

The course should enable the students to:

I	The mathematical models of dynamic systems using the concepts of basic sciences.
II	The system performance using time domain and frequency domain analysis forstandard inputs.
III	Classification of controllers and compensators as per the desired dynamic responseof the system.
IV	The different ways of system representation such as transfer function and statespace.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** the different physical and mechanical systems into equivalent electrical analogies using the mathematical form ofcomplex physical systems.	Understand
CO 2	**Utilize** various reduction techniques for developing the transfer function and steady state error with the standard input signals.	Apply
CO 3	**Make use of** the time domain analysis to predict transient response specifications for analyzing system's stability	Apply
CO 4	**Infer** the stability of first and second order systems using frequency domain specifications.	Understand
CO 5	**Classify** the types of compensators in time domain and frequency domains specifications for increasing the steady stateaccuracy of the system.	Understand
CO 6	**Interpret** linear system equations in state-variable form for theanalysis of system's dynamic behavior.	Understand

IV. SYLLABUS:

MODULE-I	INTRODUCTION AND MODELING OF PHYSICAL SYSTEMS	Classes: 08
Control systems: Introduction, open loop and closed loop systems, examples, comparison, mathematical modeling and differential equations of physical systems, concept of transfer function, translational and rotational mechanical systems, electrical systems, force, voltage and force, current analogy.		
MODULE-II	BLOCK DIAGRAM REDUCTION AND TIME RESPONSE ANALYSIS	Classes: 10
Block Diagrams: Block diagram representation of various systems, block diagram algebra, characteristics of feedback systems, AC servomotor, signal flow graph, Mason's gain formula; Time response analysis: Standard test signals, shifted unit step, shifting theorem, convolution integral, impulse response, unit step response of first and second order systems, time response specifications, steady state errors and error		

constants, dynamic error coefficients method, effects of proportional, derivative and proportional derivative, proportional integral and PID controllers.		
MODULE-III	**CONCEPT OF STABILITY AND ROOT LOCUS TECHNIQUE**	**Classes: 09**
Concept of stability: Necessary and sufficient conditions for stability, Routh's and Routh Hurwitz stability criterions and limitations. Root locus technique: Introduction, root locus concept, construction of root loci, graphical determination of 'k' for specified damping ratio, relative stability, effect of adding zeros and poles on stability.		
MODULE-IV	**FREQUENCY DOMAIN ANALYSIS**	**Classes: 10**
Frequency domain analysis: Introduction, frequency domain specifications, stability analysis from Bode plot, Nyquist plot, calculation of gain margin and phase margin, determination of transfer function, correlation between time and frequency responses.		
MODULE-V	**STATE SPACE ANALYSIS AND COMPENSATORS**	**Classes: 08**
State Space Analysis: Concept of state, state variables and state model, derivation of state models from block diagrams, diagonalization, solving the time invariant state equations, state transition matrix and properties, concept of controllability and observability; Compensators: Lag, lead, lead - lag networks.		
Text Books:		
1. I J Nagrath, M Gopal, "Control Systems Engineering", New Age International Publications, 3rd Edition, 2007. 2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th Edition, 2003. 3. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.		
Reference Books:		
1. Anand Kumar, "Control Systems", PHI Learning, 1st Edition, 2007. 2. S Palani, "Control Systems Engineering", Tata McGraw-Hill Publications, 1st Edition, 2001. 3. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.		
Web References:		
1. https://www.researchgate.net 2. https://www.aar.faculty.asu.edu/classes 3. https://www.facstaff.bucknell.edu/ 4. https://www.electrical4u.com 5. https://www.iare.ac.in		
E-Text Books:		
1. https://www.jntubook.com/ 2. https://www.freeengineeringbooks.com		