Department of Electrical and Electronics Engineering

COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION EVEN SEM
AY 2024-2025

Course Syllabi with CO's

Academic Year: 2024-25

Department: Electrical & Electronics Engineering

Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE602	**Control Systems**	PCC: Professional Core Course	Mathematical Preliminaries – Calculus, Complex Variables, Laplace Transform, Physical System	3	2	-	50

Course objectives:

(1) To analyze and model electrical and mechanical system using analogous systems.
(2) To formulate transfer functions using block diagram and signal flow graphs.
(3) To analyze the transient and steady state time response.
(4) To illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
(5) To discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification.

Topics Covered as per Syllabus

Module-1

Introduction to control systems: Introduction, classification of control systems.
Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains. **(10 Hours)**

Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

Module-2

Block diagram: Elements of Block Diagram, Block diagram of a closed loop system, Block diagram reduction techniques, procedure for block diagram reduction to find transfer function. Numerical.
Signal flow graphs: Construction of signal flow graphs, definition of some important terms, basic properties of signal flow graph, Mason's gain formula, signal flow graph algebra, Numerical **(10 Hours)**

Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing

Module-3

Time Domain Analysis: Introduction**,** Standard test signals, time response of first order systems, time response of second order systems, Time response specifications, steady state errors and error constants, Approximation of higher order systems and step response of second order systems with zero's.
Routh Stability criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis**.** Numerical **(10 Hours)**

Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing

Module-4

Root locus technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus. **Frequency Response analysis**: Co-relation between time and frequency response – 2nd order systems only.
Bode plots: Basic factors G(iw)/H(jw), General procedure for constructing bode plots, computation of gain margin and phase margin**.** **(10 Hours)**

Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing

Module-5

Compensators and Controllers: Introduction, Phase-Lead Compensator, Phase- Lag Compensator, Lead-Lag Compensator. Proportional controller, Derivative controller, Integral controller, PD Controller, PI Controller, PID Controller,
State space model- Concepts of State, State variable and State model, State Model for linear continuous time systems, Transfer Function from State Space Model, State Transition Matrix and its Properties, Solution of state equation **(10 Hours)**

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Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

List of Text Books

- Control Systems by Anand Kumar PHI 2nd Edition, 2014 .

List of Reference Books

	Book Name	Author Name	Publisher	Edition
1	Automatic Control Systems	Farid Golnaraghi, Benjamin C. Kuo	Wiley	9th Edition, 2010
2	Control Systems Engineering	Norman S. Nise	Wiley	4th Edition, 2004
3	Modern Control Systems	Richard C Dorf et al	Pearson	11th Edition, 2008
4	Control Systems, Principles and Design	M.Gopal	McGaw Hill	4th Edition, 2012
5	Control Systems Engineering	S. Salivahanan et al	Pearson	1st Edition, 2015

List of URLs, Text Books, Notes, Multimedia Content, etc

1. http://electrical-engineering-portal.com
2. http://nptel.iitm.ac.in/courses.php

Course Outcomes

Course outcomes:
At the end of the course the student will be able to:
1. Analyze and model electrical and mechanical system using analogous[L4]
2. Formulate transfer functions using block diagram and signal flow graphs[L4]
3. Analyze the stability of control system, ability to determine transient and steady state time response. [L4]
4. Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots. [L4]
5. Discuss controllers, various compensators and State space model [L3]

Internal Assessment Marks: 40 (3 Session Tests are conducted during the semester for 30marks and marks allotted based on average of performances +10 Marks for Assignment).

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code	BEE602	TITLE: **Control Systems**					Faculty Name:		**Dr.Praveen Kumar M**				
	Program Outcomes												
List of Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO-1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO-2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO-3	3	3	2	-	3	2	2	-	-	-	-	3	3	2
CO-4	3	3	2	-	3	2	2	-	-	-	-	3	3	2
CO-5	3	3	2	-	3	2	2	-	-	-	-	3	3	2