22EE504	CONTROL SYSTEMS	3	1	0	4

Course Objectives

- To understand the basic concepts of open loop and closed loop control systems.
- To analyse the given system in time domain.
- To understand the concept of frequency domain analysis
- To understand the concept of stability of system
- To design the compensator for different control systems

Programme Outcomes (POs)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Programme-Specific Outcomes (PSOs)

PSO1	Design, analyze, and evaluate the performance of Electrical & Electronics systems using contemporary tools to provide effective solutions for real-world problems
PSO2	Apply technology to make a significant contribution in terms of Electrical Engineering Innovations and ethically supporting the sustainable development of the society

Course Outcomes (COs)

CO1	Develop a mathematical model of a physical system and compute the transfer function usingBlock diagram reduction technique and Signal flow graph.
CO2	Analyze the performance of first and second order system and compute the steady state error fordifferent test signals.
CO3	Analyze the frequency response of a given system.
CO4	Examine the stability of a given system using various methods.
CO5	Design a lag, lead and lag lead compensator for open loop system and examine a system usingstate variable techniques.

Articulation Matrix

CO .No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
9	3	3	1	3	-	-	-	-	-	-	-	-	2	1
10	3	3	-	2	-	-	-	-	-	-	-	-	2	2
11	3	3	-	3	-	-	-	-	-	-	-	-	1	2
12	3	3	-	3	-	-	-	-	-	-	-	-	2	1
13	3	3	1	3	-	-	-	-	-	-	-	-	2	2

	UNIT I MATHEMATICAL MODEL OF PHYSICAL SYSTEMS	10hours

Introduction- Basic Elements of control Systems-Open loop and closed loop system - Elements of Control
system - Transfer function of mechanical translational and rotational system, electrical system - Electrical
analogy of mechanical system - Block diagram reduction technique - Signal flow graph.

	UNIT II TIME DOMAIN ANALYSIS	8hours

Standard test signals - Time response of first order and second order systems for unit step test signals - Time
domain Specifications-Steady state response - Static error constants - steady state error - Effects of proportional
derivative, proportional integral systems.

	UNIT III FREQUENCY DOMAIN ANALYSIS	9hours

Frequency response of systems - Frequency domain specifications - Correlation between frequency domain and
time domain specifications - Bode plot, Polar plot

	UNIT IV STABILITY ANALYSIS OF CONTROL SYSTEM	9hours

Concepts of stability - Necessary conditions for Stability-Characteristics equation - Location of roots inS plane
for stability - Routh Hurwitz criterion-Nyquist stability criterion- Root Locus technique- Relative Stability

	UNIT V COMPENSATOR DESIGN	9hours

Compensators, Deign of Lag compensator - Lead compensator - Lag-lead compensator (using Bode plot) -
Concept of state, state variable, state model, Controllability and observability

	Tutorial	15

	Total Hours	010hours8hours9 hours9hours9hou rs15

References

- 1. I.J.Nagrath and M.Gopal, Control System Engineering, NewAge International Publisher,2018
  2. M.Gopal, Control System Principles and Design, TataMcGraw-Hill,2012.
  3. K.Ogatta, Modern Control Engineering, Pearson Education, NewDelhi, 2015
  4. BenjaminC. Kuo, Automatic Control Systems, Prentice-Hall of India Pvt. Ltd.2014
  5. M.N.Bandyopadhyay, Control Engineering Theory and Practice, 9 th Edition, John Wiley &amp
- Sons, 2006.
  6. https://archive.nptel.ac.in/courses/107/106/107106081/