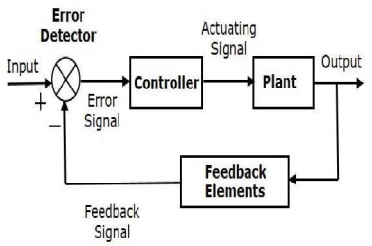
22EC208 CONTROL SYSTEMS



Source- https://www.tutorialspoint.com/control_systems/control_systems_introduction.htm

Hours Per Week :

L	T	P	C
2	2	0	3

PRE-REQUISITE KNOWLEDGE: Basics of circuit theory, differentiation and complex numbers, and Laplace transform.

COURSE DESCRIPTION AND OBJECTIVES:

This course will focus on the, how to obtain mathematical model of any physical system. To be able to do time-domain and frequency-domain analyses of the model to predict the system's behavior. To be able to design control systems that meet design specifications.

MODULE- 2

UNIT-1 **8L+8T+0P=12 Hours**

INTRODUCTION OF CONTROL SYSTEMS:

Motivation, Concept of control systems, classification of control systems, Transfer function and block diagram representation for electrical systems, block diagram algebra, signal flow graph representation.

UNIT-2 **8L+8T+0P=12 Hours**

TIME RESPONSE ANALYSIS AND STABILITY:

Time response analysis for first and second order system. Time domain specifications, Steady state response, Steady state errors, Characteristic equation of feedback control systems and Concept of stability, Routh-Hurwitz test.

PRACTICES:

- Plot various test signals.
- Determine systems that can be modeled by Ordinary Differential Equations (ODEs) and Transfer Function.
- Tell how the input affects the output (or, vice-versa, what inputs should be given to generate a desired output)
- analyze time domain specifications to understand system behavior
- analyze systems obtained as interconnections (e.g., feedback) of two or more other systems.
- analyze the effect of pole zero locations for on system behaviors time

MODULE- 2

UNIT-1 **8L+8T+0P=12 Hours**

PROPERTIES OF FEEDBACK:

Basic idea of feedback control systems. Error analysis. P, PI, PD, PID controllers. Design of controllers: The root-locus technique, steps in obtaining a root-locus. Design of controllers using root-locus.

UNIT-2 **8L+8T+0P=12 Hours**

FREQUENCY DOMAIN ANALYSIS:

Bode plot, Nyquist plot, Nyquist stability criterion, gain and phase margins, robustness. Design of compensator.

SKILLS:

- ✓ *Model any physical system.*
- ✓ *Determine overall transfer function of a system using block diagram reduction technique and SFG method.*
- ✓ *Analyze first and second order systems in time domain.*
- ✓ *Determine design specifications like rise time, settling time, steady state error.*
- ✓ *Determine open loop gain variation in a stable system using root locus method.*
- ✓ *Stability analysis of any system in the time and frequency domain.*

PRACTICES:

- Routh-Hurwitz criterion in terms of stability and root-locus techniques for performance by investigating the effect of parameter variations on the roots of the system characteristic equation.
- analyze the effect of variation of system gain
- Use Bode diagram approach to the design of lead, lag, and lag-lead compensator.
- Use Root Locus approach to the design of lead, lag, and lag-lead compensator.
- Design controller for various systems

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Applying different techniques for calcu-lating transfer function of a linear sys-tems.	Apply	1	1,2,3,4,5,10
2	Analyze the transient and steady state behavior of the open and closed loop systems.	Analyze	1,2	1,2,3,10,12
3	Calculate the stability of linear control system in time and frequency domain.	Evalu-ate	2	1,2,3,4,5 6,10,12
4	Design compensators and controller for a linear system.	Create	1,2	1,2,3,5, 6,10,12

TEXT BOOKS:

1. J. Nagrath and M. Gopal, “Control Systems Engineering”, 7th edition, New Age International (P) Limited, 2021.
2. Katsuhiko Ogata, “Modern Control Engineering”, 5th edition, Prentice Hall of India Private Ltd, New Delhi, 2020.

REFERENCES :

1. M. Gopal, “Control Systems: Principles and Design”, 3rd edition, McGraw Hill, 2008.
2. Benjamin C Kuo and Farid Golnaraghi, “Automatic Control systems”, 9th edition, Prentice Hall of India Private Ltd, New Delhi, 2009.
3. Richerd C. Dorf and Robert H. Bishop, “Modern Control Systems”, 12th edition, Prentice, Hall, 2010.