

## EC 258:Control System Engineering

CREDITS =6 (L=4,T=0,P=2)

1	<b>Introduction:</b> Systems, interconnections, basic components, classifications, examples of various systems. Review of basic laws governing dynamics of systems. Review of solution of differential equations.	4
2.	<b>Dynamic Models:</b> Two mass systems-suspension model, satellite attitude control model, disk drive model, pendulum model, hanging crane model, loud speaker model, dc motor model, power electronic converter model and linearization. State, state space and state variable models of the systems. Computer simulation exercise.	6
3	<b>Dynamic Response:</b> Review of laplace transform, and convolution. Transfer function. System modeling diagrams. Effect of pole locations, time domain specifications, effect of zeros and additional poles. Stability and R-H criteria, obtaining models from experimental data. Computer simulation exercise.	6
4	<b>Feedback System Properties:</b> Disturbance rejection, Sensitivity of system gain to parameter changes, effect feedback on time response, sensitivity of time response to parameter changes. Three term controller, anti -wind up, steady state tracking and system type, steady state errors. Computer simulation exercise.	8
5	<b>Root locus Method:</b> Root locus of a basic feedback system. Guide line for sketching Root locus, Selected illustrative root-loci with special cases. Dynamic compensation	6
6	<b>Frequency domain Analysis:</b> Frequency response, specifications, Bode plots and stability analysis, Nonminimum phase system, polar plots and Nyquist plots and stability analysis, Nichol's chart.	10

### REFERENCE BOOKS

**Title:** Feedback Control of Dynamic Systems  
**Author:** Gene. F. Franklin, J. David Powell, Emami-Naeini  
**Publisher:** Pearson Education

**Title:** Control System Engineering  
**Author:** Norman S. Nise  
**Publisher:** John Wiley and Sons Inc.

**Title:** Control Systems : Principles and Design  
**Author:** M.Gopal  
**Publisher:** Tata Mc Graw-Hill Publications

## LIST OF PRACTICALS

- 1 Demonstration of systems and its basic components
  - Dc motor Speed control system
  - DC motor Position control system
- 2 Demonstration of systems and its basic components
  - Temperature control system
  - Electronic Systems
- 3 Dynamic Response of the systems: Part I
  - Speed –Torque Characteristics of motors
  - Time constant measurement
  - Separating electrical and mechanical time constant of motor
- 4 Dynamic response of the systems: Part II
  - Repsonse of DC Speed Control
  - Effect of gain and feedback
- 5 Dynamic response of the systems: Part III
  - Response of DC Position Control System
  - Effect of gain and feedback
- 6 Dynamic response of the systems: Part IV
  - Repsonse of Temperature Control System
  - Reponse of Light Intensity Control System
  - Effect of gain and feedabck
- 7 Stepper Motor Control
  - Speed control
  - Position control
  - Direction control
  - Step Response
  - Effect of load on repsonse
- 8 Frequency repsonse of the systems
  - Frequency response of op-amp based systems
  - Obtaining Bode plots and finding Bandwidth
  - Obtaining transfer function of the system
- 9 System Parameter Identification and Transfer Function
  - Oven parameters
  - Motor Parameters
- 10 Simulation and analysis of various systems using computational tools
  - DC Motor system
  - Automotive Suspension Systems
  - Disk drive systems
  - Pendulum Systems
  - Power electronic converter systems

