

PEE4I102

CONTROL SYSTEM ENGINEERING-I

Module-I

[9 Hours]

University Portion (80%):

Introduction to Control Systems: Basic Concepts of Control Systems, Open loop and closed loop systems, Servo Mechanism/Tracking System. (Text Book-1-Ch1)

Mathematical Models of Physical Systems: Differential Equations of Physical Systems, Transfer functions, Block Diagram Algebra, Signal flow Graphs. (Text Book-1-Ch 2.1, 2.2, 2.4 2.5 2.6)

Feedback characteristics of Control Systems: Feedback and Non-feedback System, Reduction of parameter variation by use of feedback, control over System Dynamics by use of feedback, Control of the Effects of disturbance signals by use of feedback, linearizing effect of feedback, regenerative feedback, Regenerative feedback.(Text Book-1-Ch 3.1 to 3.7)

Module-II

[9 Hours]

University Portion (80%):

Time response Analysis: Standard Test Signals, Time response of first order systems, Time Response of Second order systems, Steady State Errors and Static Error Constants of different types of systems, Effect of adding a zero to a system, Design specification of second order system, Performance indices.

(Text Book-1-Ch- 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.9)

Concepts of Stability: The concept of stability, Necessary conditions for stability, Hurwitz Stability Criterion, Routh Stability Criterion, Relative Stability Analysis, More on Routh Stability Criterion.

(Text Book-1 Ch-6.2, 6.3, 6.4, 6.5, 6.6)

The Root locus Technique: Introduction, Root locus Concepts, Construction of Root locus, Root Contours, Systems with transportation lag. (Text Book-1-Ch- 7.1, 7.2, 7.3, 7.4, 7.5)

Module-III

[9 Hours]

University Portion (80%):

Frequency Response Analysis: Correlation between Time and Frequency Response, Polar plots, Bode plots, All Pass and Minimum- Phase Systems. (Text Book-1-Ch- 8.2, 8.3, 8.4 8.5)

Stability in Frequency Domain: Mathematical Preliminaries, Nyquist Stability Criterion, Assessment of Relative stability using Nyquist Criterion, Closed loop Frequency Response, Sensitivity Analysis in Frequency Domain. (Text Book-1-Ch- 9.2, 9.3, 9.4, 9.5, 9.6)

College/Institute Portion (20%):

Closed loop frequency response: Constant M circles, Constant N-Circles, Nichol's chart. (Text Book-2-Ch-)] Or any related topic as decided by the concerned faculty member teaching the subject.

Module-IV

[8 Hours]

University Portion (80%):

State Variable Analysis: Introduction, Concepts of State, State Variables and State Model, Solution of State Equations, Concepts of Controllability and Observability. (Text Book-1-Ch-12.1, 12.2, 12.4, 12.6, 12.7)

Design Specifications of a control system: Proportional Derivative Error Control (PD Control), Proportional Integral Controller (PI Control), Proportional, Integral and Derivative Controller (PID Control), Derivative Output Control. (Text Book-3-Ch-3.7)

Text Books:

1. *Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010)*
2. *Modern Control Engineering by K. Ogata, 5th edition PHI.*
3. *Automatic Control Systems by Benjamin C. Kuo, 7th Edition, Prentice-Hall India publication (1995)*

Reference Books:

1. *Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press.*
2. *Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.*
3. *Analysis of Linear Control Systems by R.L. Narasimham, I.K. International Publications*
4. *Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu, 1st Edition (2004), S. Chand Co. Ltd.*
5. *Problems and solutions in Control System Engineering by S.N. Sivanandam and S.N. Deepa, Jaico Publishing House.*
6. *Modern Control Systems by Richard C.Dorf and Robert H. Bishop, 11th Ed (2009), Pearson.*

CONTROL SYSTEM LABORATORY

List of Experiments:

1. *Study of a dc motor driven position control system*
2. *Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function*
3. *Obtain the frequency response of a lag and lead compensator*
4. *To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor*
5. *To determine the transfer function of a system (network) using transfer function analyser.*
6. *To study and validate the controllers for a temperature control system*
7. *To study the position control system using Synchroscope.*