JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III Year B.Tech. ECE. - I Sem L T/P/D C
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(A50217) CONTROL SYSTEMS ENGINEERING

Objective :

- In this course it is aimed to introduce to the students the principles and applications of control systems in every day life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

UNIT - I:

Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback.
Mathematical models – Differential equations, Impulse Response and transfer functions.

Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT - II:

Time Response Analysis: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT - III:

Stability Analysis in S-Domain: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT - IV:

Frequency Response Analysis: Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-
Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots Stability Analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

UNIT - V:

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems Theory and Applications - S. K. Bhattacharya, Pearson.
2. Control Systems - N. C. Jagan, BS Publications.

REFERENCE BOOKS:

1. Control Systems - A. Ananad Kumar, PHI.
2. Control Systems Engineering - S. Palani, TMH.
3. Control Systems - Dhanesh N. Manik, Cengage Learning.
4. Control Systems Engineering - I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers.
5. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.

Outcome:

After going through this course the student gets a through knowledge on open loop and closed loop control systems, concept of feedback in control systems, mathematical modeling and transfer function derivations of Synchros, AC and DC servo motors, Transfer function representation through block diagram algebra and signal flow graphs, time response analysis of different ordered systems through their characteristic equation and time domain specifications, stability analysis of control systems in S-domain through R-H criteria and root-locus techniques, frequency response analysis through bode diagrams, Nyquist, polar plots and the basics of state space analysis, design of PID controllers, lag, lead, lag-leadcompensators, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.