3/4 B.Tech SECOND SEMESTER

EE6T6FE3   AUTOMATIC CONTROL SYSTEMS (Free Elective)   Credits :3

Lecture: 3 periods/week   Internal assessment: 30 marks

Tutorial: 1 period /week   Semester end examination: 70 marks

Course Objective:

In this course it is aimed to provide sound knowledge in the basic concepts of linear control theory and giving an exposure to the students on characteristics, stability of linear systems and addresses the analysis of feedback systems

Course Outcomes:

Upon completion of the course, students will be able to:

1. Understand the basic concepts, properties of feedback and applications of control systems in day to day life.
2. Analyze electromechanical systems using mathematical modeling.
3. Determine Transient and Steady State behavior of systems using standard test signals.
4. Perform time domain and frequency domain analysis of control systems required for stability analysis.
5. Present and analyze linear control system using the state space technique.

UNIT I

Introduction

Concepts of Control Systems- Classification of control systems, Different examples of control systems, Open Loop and closed loop control systems, Effects of feedback. Concept of Transfer function- impulse response. Mathematical models – Differential equations, Finding Transfer function for mechanical systems, electrical systems and electrical analogous of mechanical systems

UNIT II

Transfer Function Representation

Transfer Function of DC Servo motor, AC Servo motor, Block diagram algebra-Reduction techniques and Signal flow graph-Overall gain using mason's gain formula.

UNIT III

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 error.

Stability

Concept of stability, Relative stability- Stability analysis using Routh- Hurwitz Criterion.

UNIT IV

Root Locus Technique

Introduction, Root-loci theory- Stability analysis of Control System with root locus.

Frequency Domain Analysis

Introduction, Frequency domain specifications- Polar plots –Nyquist Plots-Stability Analysis

UNIT V

Stability Analysis in Frequency Domain

Bode plots –Gain margin phase margin-Stability Analysis from Bode plots

State Space Analysis
Concepts of state, state variables and state model, TF to SS and SS to TF conversion- Solution of state Equations- State Transition Matrix and it's Properties. Conditions for Controllability and Observability.

Learning Resources

Text Books:
1. Automatic Control Systems– by B. C. Kuo 2003– John wiley and son's., 8th edition
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited 2009, Publishers, 5th edition.
3. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Reference Books:
1. Control Systems Engineering. By NORMAN S.NISE 6th Edition – John Wiley
2. Control systems by A. Nagoorkani –RBA Publications, 2 nd edition.