3/4 B.Tech. FIRST SEMESTER

EE5T6 AUTOMATIC CONTROL SYSTEMS Credits: 4

Lecture: 4 periods/week **Internal assessment: 30 marks**

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

Objective:

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

Learning outcomes :

1. Student mainly understands the basics and principles of control systems in everyday life
2. Mathematical modeling of control systems helps the student in stability analysis in both time domain and frequency domain.
3. And also focuses on advances in control systems and their applications.

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.

UNIT II Mathematical Models

Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

UNIT III Transfer Function Representation

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT IV 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, response of P, PI, and PID controllers

UNIT V 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 (Concept and construction)

UNIT VI Frequency Response Analysis

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

UNIT VII State Space Analysis of Continuous Systems

Concepts of state, state variables and state model, derivation of state models from block diagrams, State Transition Matrix and it's Properties – Concepts of Controllability and Observability

UNIT VIII Advances in Control Systems

Introduction to digital control systems-components and examples of digital control systems. Basic Introduction to Neural Networks and Fuzzy logic control

Learning Resources

Text Books:

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 2nd edition.
2. Digital Control and State Variable Methods by M.Gopal , TMH

Reference Books:

1. Control System Engineering – by Norman S Nise, John Wiley & Sons
2. Control Systems by A.Anand Kumar, PHI Publications,4th edition
3. Control Systems Engineering by S.Palani,Tata Mc Graw Hill Publications
4. Modern Control Engineering, Fifth edition, Kotsuhiko Ogata, Prentice Hall of India
5. B C Kuo, Automatic Control Systems; PHI 2. Norman S Nise, Control System Engineering; John Wiley & Sons, Singapore