

**Control System**

**IT705B**

**Contracts: 3L**

**Credits- 3**

**Module - I:**

**a) 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 - Translational and Rotational mechanical systems [4L]

**b) TRANSFER FUNCTION REPRESENTATION**

Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra - Representation by Signal flow graph - Reduction using mason's gain formula. [4L]

**Module - II:**

**a) 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. [4L]

**b) STABILITY ANALYSIS IN S-DOMAIN**

The concept of stability - Routh's stability criterion - 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. [5L]

**Module - III:**

**a) 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. [5L]

**b) : STABILITY ANALYSIS IN FREQUENCY DOMAIN**

Polar Plots, Nyquist Plots Stability Analysis. [4L]

**Module - IV :**

**a) CLASSICAL CONTROL DESIGN TECHNIQUES**

Compensation techniques - Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]

**b) 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 [5L]

**TEXT BOOKS:**

1. Automatic Control Systems 8th edition - by B. C. Kuo 2003 - John Wiley and son's.,
2. Control Systems Engineering - by I. J. Nagrath and M. Gopal, New Age International

**REFERENCE BOOKS:**

1. Modern Control Engineering - by Katsuhiko Ogata - Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems Engg. by NISE 3rd Edition - John Wiley