

PCEI 4303 **CONTROL SYSTEMS** (3-0-0)

Module-I: (12 Hours)

Introduction: definition, automatic control, open loop, close loop, modern control, properties of transfer function, linear approximation of physical systems;

Mathematical Modeling: translational, rotational systems and their electrical analogy, mechanical coupling, liquid level systems, servo motors, sensors, magnetic amplifiers, stepper motor, synchors, block diagram, signal flow graph, gain formula.

Characteristic of Feedback Control: sensitivity of control system, parameter variation and disturbance of signal.

Module-II: (12 Hours)

Time Domain Analysis: typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error constants, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stability criteria.

Root Locus Technique: Basic conditions for root loci, rules for construction, stability and conditional stability on root locus.

Module-III: (12 Hours)

Frequency Response Analysis: Bodes plot, frequency domain behaviour of control, gain margin and phase margin, ω_p and M_p for second order system, stability criteria.

Nyquist Criteria: Stability criteria, conformal mapping, Cauchy's theorem, Nyquist stability criteria, conditionally stable system.

State variable Technique: state variable for continuous system, transfer function to state variable, state variable to transfer function, state transition matrix, time domain solution of single input single output system.

Text Book:

1. D Roy Choudhury, Modern Control Engineering, PHI, 2008. (Selected portions from Chapter 1, 2, 3, 4, 5, 6, 8, 9 and 11)

Reference Books:

1. K Ogata, Modern Control Engineering, PHI, 5th edition
2. I J Nagrath and M Gopal, Control system engineering; New Age International Publisher 2010.
3. R C Dorf and R H Bishop, Modern Control Systems; Pearson Education; 2009
4. R T Stefani, B Shahiana, C J Savant and G H Hostetter, Design of Feedback control System, Oxform University Press
5. B C Kuo, Automatic Control System; PHI; 7th Edition.