PEI6J002 ADVANCED CONTROL SYSTEMS

University level: 80%

Module-I: ***(15Hours)***

Discrete - Time Control Systems: Introduction: Discrete Time Control Systems and Continuous Time Control Systems, SamplingProcess.
Digital Control Systems: Sample and Hold, Analog to digital conversion, Digital to analog conversion.
The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important properties and Theorms of the Z-transform. The inverse Z-transform, Z-Transform method for solving Difference Equations.
Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorem, folding, aliasing. Pulse Transfer function: Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loop systems.

Module -II : (15 Hours)

State Variable Analysis & Design: Introduction: Concepts of State, State Variables and State Model (of continuous time systems): State Model of Linear Systems, State Model for Single-Input-Single-Output Linear Systems, Linearization of the State Equation. State Models for Linear Continuous – Time Systems: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State – space Representation using Canonical Variables, Derivation of Transfer Function for State Model. Solution of State Equations: Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley- Hamilton Theorem. Concepts of Controllability and Observability: Controllability, Observability, Effect of Pole-zero Cancellation in Transfer Function. Pole Placement by State Feedback, Observer Systems. State Variables and LinearDiscrete

Module -III : (12 Hours)

Nonlinear Systems : Introduction : Behaviour of Non linear Systems, Investigation of nonlinear systems.
Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, Multivariable Nonlinearity.
The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus Point, Centre or Vortex Point, Stability of Non Linear Systems: Limit Cycles, Construction of Phase Trajectories: Construction by Analytical Method, Construction by Graphical Methods.
The Describing Function Method: Basic Concepts: Derivation of Describing Functions:

Dead- zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash. Stability Analysis by Describing Function Method: Relay with Dead Zone, Relay with Hysteresis, Stability Analysis by Gain-phase Plots. Jump Resonance.

Text Books:

1. *Discrete-TimeControlSystem,byK.Ogata,2ndedition(2009),PHI.*
2. *Control Systems Engineering, by I.J. Nagrath and M.Gopal., 5th Edition (2007 / 2009), New Age International (P) Ltd.Publishers.*

Reference Books:

1. *Design of Feedback Control Systems by Stefani, Shahian, Savant, Hostetter, Fourth Edition (2009), Oxford UniversityPress.*
2. *Modern Control Systems by K.Ogata, 5^{th}Edition (2010),PHI.*
3. *Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11^{th}Edition (2008), Pearson Education Inc.Publication.*
4. *Control Systems (Principles & Design) by M.Gopal, 3^{rd}Edition (2008), TMH Publishing CompanyLtd.*
5. *ControlSystemsEngineeringbyNormanS.Nise,4^{th}Edition(2008),WileyIndia(P)Ltd.*