ADVANCED DIGITAL CONTROL SYSTEMS

Course Code : 15EE2204 **L P C**
3 0 3

Pre requisites: Mathematics, Networks, Control Systems.

Course Outcomes:
At the end of the course, the student will be able to

CO1: Solve problems related to State space representation of discrete time systems and determine the stability of discrete time systems using different techniques like Jury stability, bilinear transformation and Liapunov.
CO2: Solve problems related to design of discrete time control system by conventional methods.
CO3: Apply knowledge in designing Controllers and Observers.
CO4: Explain the concepts of kalman filter, Regulators and adaptive control.
CO5: Develop adequate knowledge in the digital simulation concepts and expose to the custom designed chips.

UNIT-I (10-Lectures)

STATE SPACE ANALYSIS:
Introduction to Z-Transforms and inverse Z-Transforms, State space representation of discrete time systems, pulse transfer function matrix, solving discrete time state space equations, state transition matrix and its properties, methods for computation of state transition matrix, discretization of continuous time state-space equations.

STABILITY ANALYSIS:
Stability analysis of closed loop systems in the Z-plane, Jury stability criterion test-Stability analysis by use of the bilinear transformation and routh stability criterion. Stability analysis using lyapunov theorems

UNIT-II (10-Lectures)

DESIGN OF DISCRETE TIME CONTROL SYSTEM BY CONVENTIONAL METHODS:

Design of digital control systems based on Root locus techniques-Design of digital control based on the frequency response methods-Bilinear transformation and design procedure in the w-plane, lead, lag and Lead-lag compensators. Design of digital control through dead beat response methods.

UNIT-III (10-Lectures)

STATE FEEDBACK CONTROLLERS AND OBSERVERS:

Concept of controllability and observability-Design of state feedback controller through pole placement-Necessary and sufficient conditions, Ackerman's formula, State observers-Full order and Reduced Order observer

UNIT-IV (10-Lectures)

LINEAR QUADRATIC REGULATORS:

Min/Max principle, Linear Quadratic Regulators, Kalman Filters, introduction to State Estimation through kalmanfilters, Introduction to adaptive controls

UNIT-V (10-Lectures)

DIGITAL SIMULATION:

Introduction, Digital Simulation- Digital Modeling with Sample and Hold Devices, State Variable Formulation, Numerical Integration, Rectangular Integration, Frequency Domain Characteristics- Frequency Warping, Frequency Prewarping.

MICROPROCESSOR AND DSP CONTROL

Introduction, Microprocessor Control of Control Systems, Single- Board Controllers with Custom-Designed Chips, The Galil DMC-105 Board, Digital Signal Processors- The Texas Instruments TMS320 DSP's, Development Systems and Support Tools. (10 Lectures)

TEXT BOOKS:

1. B.C. Kuo, “Digital Control Systems”, 2nd Edition, Oxford University Press, Feb 2012.
2. K. Ogata, “Discrete-Time Control systems”, 2nd edition.-PHI,2002(Reprint).
3. Mohinder S .Grewal & Angus P.Andrews “ Kalman Filtering theory and practice using MATLAB” 2nd Edition 2014, John Wiley & Sons

REFERENCES:

1. M. Gopal, “Digital control engineering”, New Age International Publications, 2003.
2. M.Gopal, “Digital Control and State Variable Methods”, 3rd edition, TMH, sep-2008.