

## (EE509) DIGITAL CONTROL SYSTEMS

(ELECTIVE - I)

### **Objective of the Course:**

*The goal of the course is to provide access to the basic design and analysis tools used in practical discrete-time and sampled data control systems as well as to give an exposure to the student to the general area of linear systems theory which appears so very often in all branches of engineering*

### **UNIT - I**

#### **Introduction to Digital Control systems:**

Data conversion and quantisation- Sampling process- Mathematical modeling- Data reconstruction and filtering of sampled signals- Hold devices- z transform and inverse z transform. Relationship between s- plane and z- plane- Difference equation. Solution by recursion and z-transform.

### **UNIT - II**

#### **Analysis of Digital Control Systems:**

Digital control systems- Pulse transfer function. z transform analysis of closed loop open loop systems- Modified z- transfer function-

### **UNIT - III**

Stability of linear digital control systems- Stability tests- Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

Steady- state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and phase margin Case study examples using MATLAB.

### **UNIT - IV**

#### **Classical Design of Digital Control Systems:**

Cascade and feedback compensation by continuous data controllers- Digital controllers-Design using bilinear transformation- Root locus based design- Digital PID controllers- Dead beat control design- Case study examples using MATLAB.

### **UNIT - V**

#### **Advanced Design of Digital Control Systems:**

State variable models- Interrelations between z-transform models and state variable models- Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback . Dynamic output feedback- Effects of finite word length on controllability and closed loop pole placement- Case study examples using MATLAB

### **REFERENCE BOOKS:**

1. B.C Kuo, "Digital Control Systems", 2<sup>nd</sup> ed., Oxford University Press, Inc., New York, 1992.
2. G.F. Franklin, J.D. Powell, and M.L. Workman, "Digital control of Dynamic Systems", Addison-Wesley Longman, Inc., Menlo Park, CA , 1998.
3. M. Gopal, "Digital Control and State Variable Methods", Tata MC Graw Hill Publishing Company, 1997.
4. John F. Walkerly, "Microcomputer architecture and Programs", John Wiley and Sons Inc., New York, 1981.
5. K. Ogata, "Discrete Time Control Systems", Addison-Wesley Longman Pte. Ltd., Indian Branch Delhi, 1995.
6. C. H. Houpis and G.B. Lamont, "Digital Control Systems", MC Graw Hill Book Company, 1985.