GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720728
Semester – II
Subject Name: Digital control and its applications

Type of course: Professional elective (Electrical)

Prerequisite: Thorough knowledge of Control system engineering at UG level

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to discrete-time systems** Data conversion and quantisation - Sampling process- mathematical modelling- 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- Discretisation Methods	**09**
2	**Frequency domain approach** – Analysis and discretization, Design in the Z plane using root locus diagram, phase lead lag controller, digital P, PI, PD, PID controller, Pole zero cancellation, Time domain approach, analysis and discretization, State space formulation for discretized systems	**10**
3	**Engineering aspects of computer controlled systems -** Roll for digital computer system in process control. Introduction to distributed instrumentation and control system. General purpose digital data acquisition and control hardware.	**04**
4	**Sampled data systems, Control of Sampled data systems -** Digital control of continuous time system and sampled data control system, Discrete-time system and Z-Transformation implementation for control, State space description of dynamic system, Discrete time observer and controller, related examples	**05**
5	**Concept of differential sampling, Closed loop analysis of differentially sampled Systems, Control design based on differential sampling -** 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 – Servo Design- State feedback with Integral Control-Deadbeat Control by state feedback and deadbeat observers- Dynamic output Feedback- Effects of finite word length on controllability and closed loop pole placement- Case study examples using MATLAB.	**10**

6	**Recent applications of Digital Control**	**04**
	Application of digital control aspects related to power electronics i.e. drives, FACTs etc.	

Reference Books:

1. K. Ogata, "Discrete-time Control Systems', Ed. 2, Prentice-Hall, 1995.
2. Benjamin C. Kuo, "Digital Control Systems", Ed. 2, Oxford Uiversity Press, 1999
3. M. Gopal, Digital control and state variable methods, New Age International Publication
4. B. C Kuo, Digital Control Systems (second Edition), Oxford University Press, Inc., New York,1992.
5. C. H. Houpis and G.B. Lamont, Digital Control Systems, McGraw Hill Book Company, 1985.
6. G. F. Franklin, J.D. Powell, and M.L. Workman, Digital control of Dynamic Systems, Addison-Wesley Longman, Inc., Menlo Park, CA, 1998.

Course Outcomes:

After learning the course the students should be able to

Sr. No.	CO statement	Marks % weightage
CO-1	model digital filters and systems.	15
CO-2	analyse thoroughly digital systems in time domain and frequency domain.	35
CO-3	model and analyse digital systems in state space representation.	25
CO-4	design controllers for digital systems in state space representation.	25

List of Experiments:

- Laboratory work will consist of minimum experiments based on the above syllabus.

Major Equipment:

- **Computers**

List of Open Source Software/learning website:

- MATLAB Software.
- CONTROL SYSTEM TUTORIALS by University of Michigan
- Digital control tutorials from NPTEL videos