(This Question paper contains 2 printed pages) Roll No. _____

S.No. of Question Paper : 7979
Unique Paper Code : 2513010028
Name of the Course : B.Sc.(H) Electronics (Core)
Name of the Paper : Digital Control System
Semester : VIII
Duration : 3Hours
Maximum Marks : 90

Instruction for Candidates

1. There are seven questions in all, out of which you have to attempt any five questions
2. All questions carry equal marks
3. Sub-parts can be given
4. First Question is Compulsory.

1	(a)	What is meant by stability in digital control systems?	3
	(b)	What is a Zero Order Hold (ZOH)?	3
	(c)	State Jury's Stability Criteria to check the stability of any digital control system.	3
	(d)	State the angle and magnitude conditions of Root Loci method for discrete-time control system.	3
	(e)	Define state, state variable and state vector model in Discrete time control systems.	3
	(f)	Explain the principle of Deadbeat control design.	3
2	(a)	Define sampling theorem. State the condition to avoid aliasing.	6
	(b)	Derive the pulse transfer function using Zero Order Hold.	6
	(c)	What is the difference between continuous-time and discrete-time systems?	6
3	(a)	Check the stability of the control system having the following characteristic equation using Jury Stability Test: $P(z) = z^4 - 1.2z^3 + 0.07z^2 + 0.3z - 0.08 = 0$	6
	(b)	Explain how the stability of any digital control system is checked using bi-linear transformation method.	6
	(c)	State and explain the various transient response specifications of a digital control system.	6
4	(a)	Derive the general solution of the linear time-invariant discrete-time state-space equation.	6

(b) Explain the concept and fundamental properties of the State Transition Matrix (STM) in discrete-time systems. 6

(c) Find State Transition Matrix of the following state space equation and output equation. 6

$$\mathbf{x}(k+1) = \mathbf{G}\mathbf{x}(k) + \mathbf{H}u(k)$$

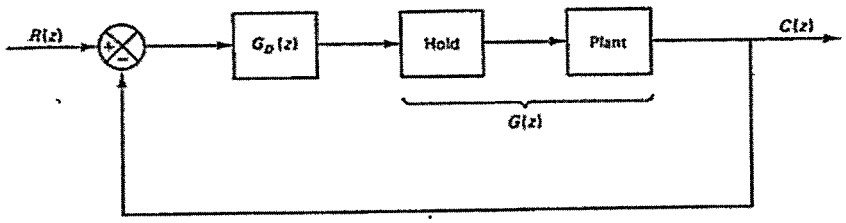
$$y(k) = \mathbf{C}\mathbf{x}(k)$$

where

$$\mathbf{G} = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}, \quad \mathbf{H} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \quad \mathbf{C} = [1 \quad 0]$$

6

5 (a) Explain the design procedure in w plane (bi-linear transformation) for the following digital control system:



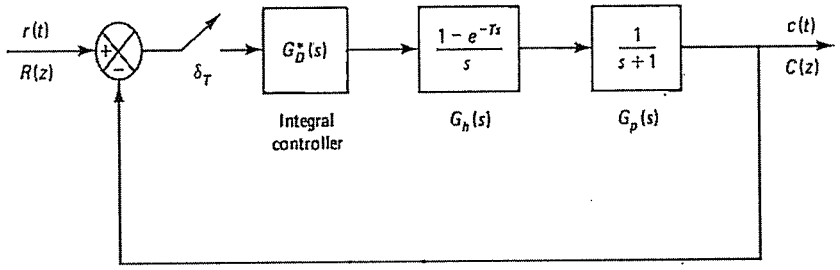
(b) Explain the design steps of a Digital Lead Compensator. 6

(c) How important are digital PID controllers for digital control systems? 6

6 (a) Write the relation between the S- plane and Z-plane. 6

(b) What are the advantages of Bode diagrams to analyse and design control systems? 6

(c) Draw the root locus diagram for the following system for a sampling period of 1 second 6



7. (a) Explain four canonical forms mostly used in State Space representation of Discrete time control system. 9

(b) Discuss the design of a state feedback controller through the pole placement technique and how this method ensures desired closed-loop system stability and performance. 9