APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

6252(C)-April 17-2 (pages: 3) Name:

Reg No:

SECOND SEMESTER M.TECH. DEGREE EXAMINATION APRIL 2017

Electrical & Electronics Engineering **Power Electronics**

08EE6252(C): DIGITAL CONTROL SYSTEMS

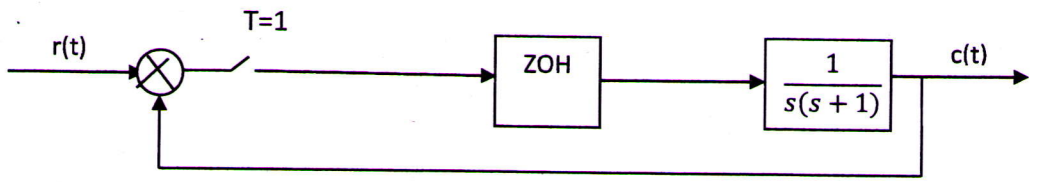
Time:3 hours **Max.marks: 60**

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1.a	Explain series programming technique of discrete time systems	3
	Answer b or c	
b	Realize the pulse transfer function of a digital PID Controller	6
c	Solve the difference equation $x(k+2) - 1.368x(k+1) + 0.368x(k) = 0.368u(k+1) + 0.2642u(k)$ where $x(k) = 0$ for $k \leq 0$. The input function $u(k)$ is given by $u(k) = 0$ for $k < 0$ and $u(0) = 1, u(1) = 0.2142, u(2) = -0.2142, u(k) = 0$ for $k = 3,4,5,\ldots$	6

Q.no.	Module 2	Marks
2.a	Explain stability analysis of a discrete time system using modified Routh stability Criteria.	3
	Answer b or c	
b	Find static error coefficients of a discrete time system with pulse transform function given by $G(z) = \frac{0.5z}{(z-1)(z+0.5)}$	6
c	Determine the pulse transfer function of the system shown in figure	6

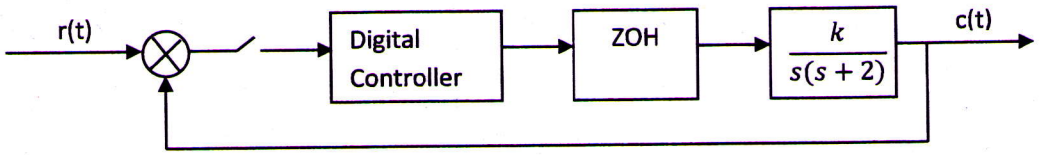


Q.no.	Module 3	Marks
3.a	Explain the effect of sampling period on transient response specifications.	3

Answer b or c

b Design a digital controller for the system shown in figure using root locus method to meet the following specifications — 6

a) Velocity error constant ,k_v = 6; b) peak overshoot to unit step input ≤15% c) Settling Time ($T_s \leq$ 5sec) Assume T=0.2sec



c Explain the design procedure for a lead compensator based on frequency response approach for discrete time system. — 6

Q.no.	Module 4	Marks
4.a	Obtain the transfer function of a discrete time system from state model	3

Answer b or c

b Derive an expression for diagonal canonical form of state space representation of discrete time system — 6

c Obtain two different canonical state space representation of the following system transfer function — 6

$$\frac{Y(z)}{U(z)} = \frac{4z^3 - 12z^2 + 13z - 7}{(z-1)^2(z-2)}$$

Q.no.	Module 5	Marks
5.a	Illustrate the method of obtaining state model in controllable canonical form using transformation matrix	4

Answer b or c

b Obtain the state transition matix for the following system — 8

x(k+1) = G x(k) + H u(k)

ẏ(k) = C x(k)

With $G = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$

c Obtain a discrete time representation of the following continuous time state space equation — 8

$\dot{x}$ = A x + B u

y=Cx

With $A = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}$, $H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$

Q.no.		Marks
	Module 6	
6.a	Explain the concept of controllability and Observability of a linear time invariant discrete time systems	4
	Answer b or c	
b	Consider the system x(k+1) = G x(k) + H u(k) y(k)=Cx(k) With $G = \begin{bmatrix} 0 & -0.16 \\ 1 & -1 \end{bmatrix}$, $H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ Determine observer feedback gain matrix K , such that desired eigen values for the observer matrix are z = 0.5 + j0.5 and z = 0.5- j0.5	8
c	Explain the design of state feedback system using pole placement technique	8