APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

08EE6252C-2-April18 **(pages: 3)** **Name:**

Reg No:

SECOND SEMESTER M.TECH. DEGREE EXAMINATION MAY 2018

08EE6252 (C) **DIGITAL CONTROL SYSTEMS**

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

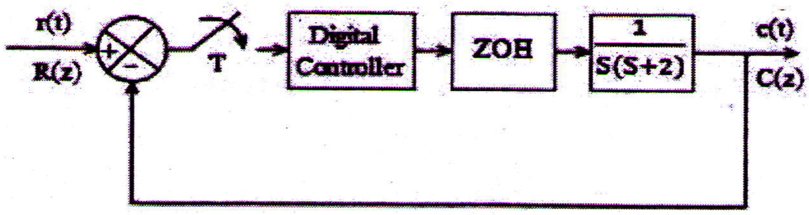
Answer all six questions. Part 'a' of each question is compulsory.

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

Q.no.	Module 1	Marks
1.a	Draw the block diagram representation of a digital control system.	3
	Answer b or c	
b	Consider the digital filter designed by $G(z)=\frac{4(z-1)(z^2+1.2z+1)}{(z+0.1)(z^2-0.3z+.8)}$. Draw a series and parallel realization diagram.	6
c	Obtain the inverse of $X(z)=\frac{z^2+z+2}{(z-1)(z^2-z+1)}$ using partial fraction expansion method.	6

Q.no.	Module 2	Marks
2.a	State and explain Jury's stability criterion.	3
	Answer b or c	
b	Find the range of K for which the system is stable using Jury's stability test $\frac{K(0.368z+0.264)}{(z-1)(z-0.368)}$	6
c	Obtain the pulse transfer function of the system where G(s) is given by $\frac{1-e^{-Ts}}{s}\frac{1}{s(s+1)}$	6

Q.no.	Module 3	Marks
3.a	Write a short note on the effect of sampling time on the stability of a discrete system.	3
	Answer b or c	
b	Explain the design procedure for lead and lag compensators for discrete systems.	6
	c. Design a digital controller for the system shown in figure using root locus ethod tt to meet the following specifications. a). Kv= 2.5, b). ζ=0.5, c) Ts ≤ 2 sec.	6



Q.no.	Module 4	Marks
4.a	What are the Canonical form representations of Discrete Time systems.	3
	Answer b or c	
b	Obtain the state variable model for the difference equation y(k+3)+5y(k+2)+ 7y(k+1) +3y(k)=r(k+1)+2r(k)	6
c	Obtain the state representation of the following transfer function. $\frac{Y(z)}{U(z)}=\frac{5}{(z+2)^2(z+1)}$. Also obtain the initial values of state variables in terms of y(0), y(1) and y(2). Also draw a block diagram for the same.	6

Q.no.	Module 5	Marks
5.a	What is state transition matrix .Obtain its formulae in z domain.	4

Answer b or c

b Obtain the discrete time state and output equation and the pulse transfer function (when the sampling period T = 1) of the following **8**

$$G(S) = \frac{Y(S)}{U(S)} = \frac{1}{S(S+2)}$$

c Obtain the Controllable Canonical Form (CCF) of the given state space model by using transformation matrix. **8**

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 5 & 3 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 5 & 4 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix}$$

Q.no.	Module 6	Marks
6.a	Define Controllability and Observability for a linear time invariant discrete time control system?	4

Answer b or c

b Consider the system $x(k+1) = \begin{bmatrix} 1 & 0 \\ 0 & .5 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$, **8**

$$y(k) = [1 \;\; 1] \; x(k)$$

Determine the Observability of the system

c Consider the system $x(k+1) = Gx(k) + Hu(k)$ $\quad y(k) = Cx(k)$Where **8**

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

Design a full order state observer, the desired eigen values of the observer matrix are $z = 0.5 + j0.5$, $z = 0.5 - j0.5$