APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

08EE6252C-1-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**

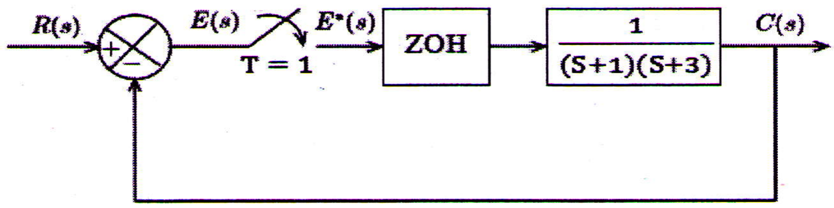
Answer all six questions. Part 'a' of each question is compulsory.

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

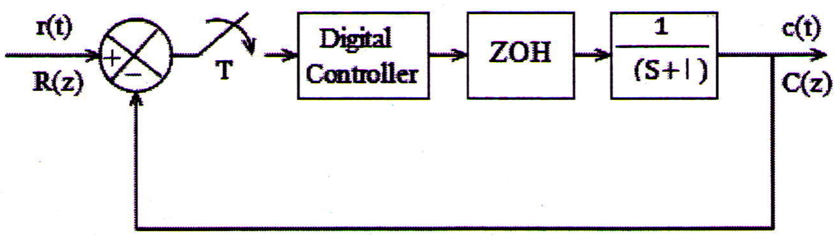
Q.no.	Module 1	Marks
1.a	Differentiate between direct and standard programming methods.	3
	Answer b or c	
b	Consider the equation x(k+2)-1.3679 x(k+1)+0.3679x(k) = 0.3679 u(k+1)+0.2642u(k) where x(k) is the output and x(k) =0 for k ≤ 0 and where u(k) is the input and is given by u(k)=0, k<0; u(0)=1; u(1)=0.2142; u(2)= -0.2142 u(k)=0, k=3,4,5....... Determine the output x(k)	6
c	Obtain the block diagrams for the following pulse transfer function systems by 1) direct programming 2) standard programming $G(z)=\dfrac{2-0.6z^{-1}}{1+0.5z^{-1}}$.	6

Q.no.	Module 2	Marks
2.a	Explain the method of stability analysis using bilinear transformation and Routh criteria.	3
	Answer b or c	
b	Check the stability of the following system by using Routh Hurwitz criterion $P(z) = z^3 - 1.3z^2 - 0.08z + 0.24 = 0$	6

c	Calculate the steady state errors of unit step and unit ramp inputs for the system shown in Figure.	6

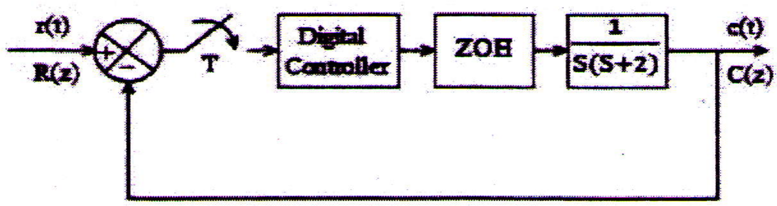


Q.no.	Module 3	Marks
3.a	Write a short note on Lag and Lead compensator..	3
	Answer b or c	
b	Consider the digital control system shown in figure in the Z plane, design a digital controller such that the dominant closed loop poles have a damping ratio of 0.5 and a settling time of 2 sec. The sampling period is assumed to be 0.2 sec or T = 0.2. Obtain the response of the designed digital control system to a unit step. Also obtain the static velocity error constant Kv of the system.	6



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

a). Kv= 2.5, b). ζ=0.5, c) Ts ≤ 2 sec.



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 diagonal canonical form of representation for the system defined by difference equation y(k+2)+3y(k+1)+ 2y(k) =5r(k+1)+3r(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	Derive the solution for the linear Time Invarient Discrete Time state Equation.	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 $$G(S) = \frac{Y(S)}{U(S)} = \frac{1}{S(S+2)}$$	8
c	Obtain the Controllable Canonical Form (CCF) of the given state space model by using transformation matrix. $$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 5 & 3 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix} u(k)$$ $$y(k) = \begin{bmatrix} 5 & 4 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix}$$	8

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	Derive Ackermanns formula for pole placement technique using state feedback for discrete time systems.	8
c	Consider the system $x(k+1) = Gx(k) + Hu(k)$ $y(k) = Cx(k)$Where $$G = \begin{bmatrix} 0 & -0.16 \\ 1 & -1 \end{bmatrix} \quad H = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C = \begin{bmatrix} 0 & 1 \end{bmatrix}$$ Design a full order state observer, the desired eigen values of the observer matrix are $z = 0.5 + j0.5$, $z = 0.5 - j0.5$	8