

2063  
M.E. Electrical Engineering (Power System)  
Second Semester  
EE-8208: Digital Control System

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt any five questions. Assume any missing data.

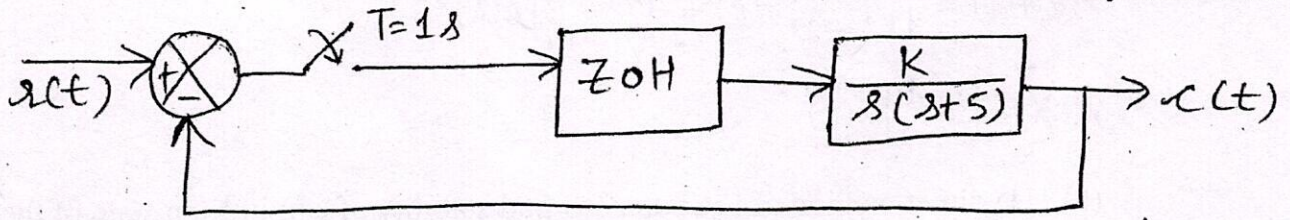
x-x-x

1. (a) Find z-transform of  $F(s) = \frac{1}{s^2+2s+2}$  if sampling time  $T = 1$  sec.

(b) Explain sampling process with neat and clean waveforms.

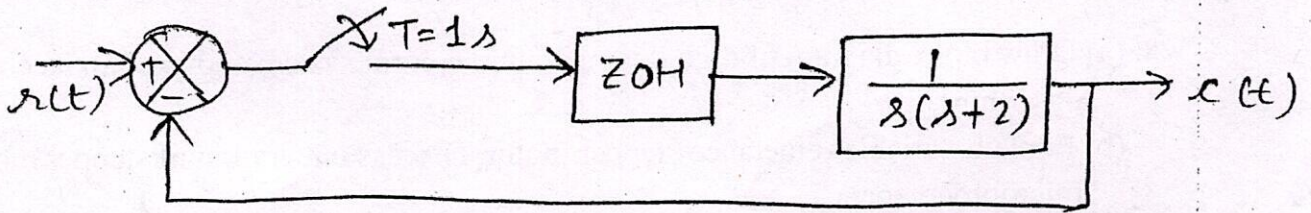
(5, 5)

2. Determine K for the system to be stable. If  $r(t) = (1 + t)$ , determine steady state error.



(10)

3. Find pulse transfer function for the following system:



(10)

4. Find stability using Jury's stability test for the following system:

$$2z^4 + 8z^3 + 12z^2 + 5z + 1 = 0$$

(10)

5. (a) Discuss necessary and sufficient condition for pole placement.

(b) Explain how root locus can be drawn for digital control system?

(5, 5)

P.T.O.



(2)

6. Consider the system:

$$\dot{x} = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u; \quad y = [1 \ 0]x$$

A similarity transformation is defined by  $x = P\bar{x} = \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix} \bar{x}$

- (a) Express state model in terms of states  $\bar{x}(t)$   
 (b) Draw state diagram in SFG form for state models in  $x(t)$  &  $\bar{x}(t)$

(5, 5)

7. (a) Investigate controllability and observability:

$$x(k+1) = \begin{bmatrix} 1 & -2 \\ 1 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x(k)$$

- (b) Use direct method of Lyapunov to find stability of equilibrium state of the following system:

$$x(k+1) = F x(k) \quad \text{with} \quad F = \begin{bmatrix} 0 & 0.5 \\ -0.5 & -1 \end{bmatrix}$$

(5, 5)

8. (a) Draw block diagram of digital temperature control system and explain its control algorithm.  
 (b) Explain variable reluctance stepper motor. Discuss integration of stepper motor to microprocessor.

(5, 5)