

M.E. First Semester (Electrical & Elect.) (New- CGS) -
13281 : Advanced Control Systems : 1 EEEME 1

P. Pages : 2

Time : Three Hours



AX - 3565

Max. Marks : 80

- Notes : 1. Due credit will be given to neatness and adequate dimensions.
 2. Assume suitable data wherever necessary.
 3. Illustrate your answer necessary with the help of neat sketches.

SECTION - A

1. State and explain sampling theorem. 13

OR

2. 13



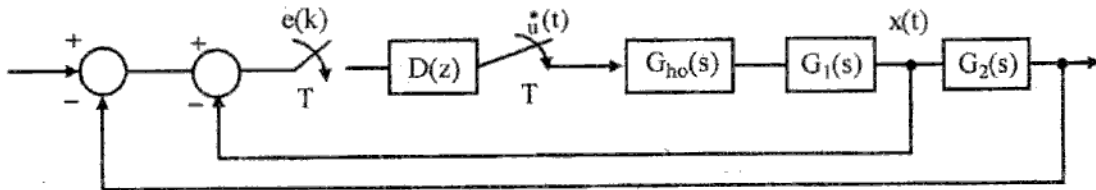
Derive transfer function model relating $r(kT)$ and $y(kT)$: $T = 0.4$ sec

3. 13

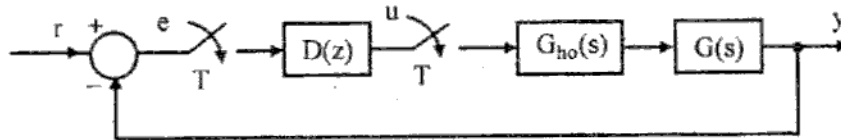
$$D(z) = \frac{U(z)}{E(z)} = \frac{4(z-1)(z^2 + 1.2z + 1)}{(z+0.1)(z^2 - 0.3z + 0.8)}$$

OR

4. Obtain transfer function for closed loop control system $\frac{Y(z)}{R(z)}$ 13



5. 13



Design digital control scheme having $G(s) = \frac{k}{s(s+2)}$ for

- i) $k_v = 6$ ii) M_p to step input $\leq 15\%$
 iii) T_s (2% tolerance) ≤ 5 sec

OR

6. Use fig. of Q. 5 13

Design a compensator $D(t)$ for

- a) $\xi = 0.5$ b) $w_n = 1.5$ c) $k_p \geq 7.5$

Use root locus method.

SECTION - B

7.
$$\dot{x} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix} u \quad y = [1 \ 0 \ 0]x$$
 13

- a) Find eigen values of A & find stability
b) Find transfer function model.

OR

8. Find controllability & observability for 13

$G(s) = \frac{1}{s+1}$ i when

1) $A = \begin{bmatrix} -1 & 0 \\ 0 & -3 \end{bmatrix}$ i $b = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ i $c = [1 \ 0]$

2) $A = \begin{bmatrix} -2 & 0 \\ 0 & -1 \end{bmatrix}$ i $b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ i $c = [0 \ 1]$

3) $A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$ i $b = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ i $c = [0 \ 1]$

9. Prove that discrete time system obtained by zero order hold sampling of asymptotically stable continuous time system is also asymptotically stable. 14

OR

10. Give three different canonical state variable models for – 14

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

11. Explain full order state observer in detail. 14

OR

12.
$$\frac{Y(z)}{U(z)} = \frac{z^{-2}}{(1+0.8z^{-1})(1+0.2z^{-1})}$$
 14

- a) Find (F, g, c) for plant in controllable canonical form
b) Find k_1 and k_2 for $G(k) = -k_1 x_1(k) - k_2 x_2(k)$ gives closed loop roots at $0.7 \pm j 0.5$
