DEPARTMENT OF ELECTRICAL ENGINEERING, MNNIT ALLAHABAD

B. Tech. Electrical Engineering 5th Semester

Subject: Advance Control System (EE-1502) : End Semester Examination, Odd Semester (2015-16)

Time: 03:00 Hr **Max Marks: 60**

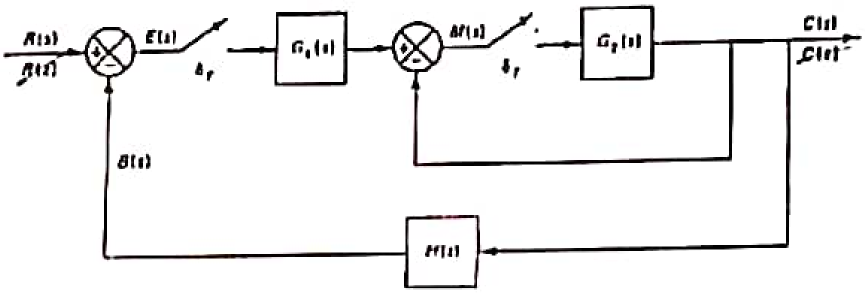
Note: Attempt All Questions. If any data is missing, assume as per requirement and mention the same.

---

1. Using inversion integral method, obtain the inverse z transform of 5

$$G(z) = \frac{1+6z^{-2}+z^{-3}}{(1-z^{-1})(1-0.2z^{-1})}$$

2. Obtain the discrete time output $C(z)$ and continuous time output $C(s)$ in terms of input and transfer function of the blocks for following discrete time control system 5



3. Consider the following filter defined by 15

$$G(z) = \frac{2+2.2z^{-1}+0.2z^{-2}}{1+0.4z^{-1}-0.12z^{-2}}$$

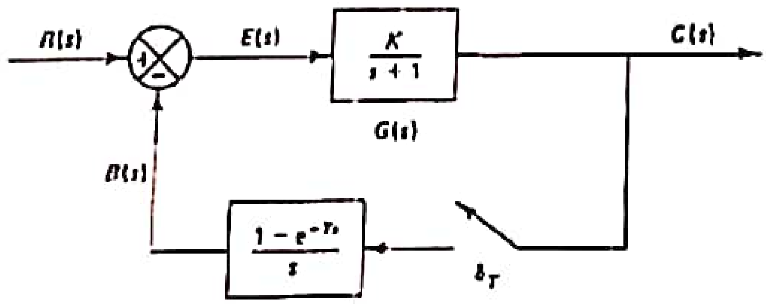
Realize this filter in (a) series, (b) parallel and (c) ladder schemes.

4. Discuss / Derive 10

a) Constant damping, Constant frequency and Constant damping ratio Loci for discrete time systems.

b) Ackerman's formula for pole placement design

5. Consider the following system with sampling period T as 0.2 sec and gain constant K as unity 5



21-G+H(c

Determine response $c(kT)$ for $k = 0, 1, 2, 3$ and 4 when the input $r(t)$ is unit step function and final value $c(\infty)$.

6. Consider the system defined by Ch.6 5

513

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \\ x_3(k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.16 & 0.84 & 0 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \\ x_3(k) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} u(k)$$

-0.5

Determine the state feedback gain matrix K such that when the control signal is given by $u(k) = -Kx(k)$, the closed loop system will exhibit the deadbeat response to any initial state $x(0)$.

7. Consider the system defined by ch 6 10

$x(k+1) = G[x(k) + C^* u(k)]$

$y(k) = Cx(k)$

511

and

$$G = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 & 0 & 0 \end{bmatrix}$$

Show system is completely state controllable and observable. Show also that given any initial state $x(0)$, every state vector can be brought to the origin in at most four sampling periods if and only if the control signal is given by $u(k) = -Cx(k)$.

8. Consider the pulse transfer function system defined by $G(z) = \dfrac{b_0 + b_1 z^{-1} + \cdots + b_n z^{-n}}{1 + a_1 z^{-1} + \cdots + a_n z^{-n}}$. Using nested programming method, derive the state space representation of this system. 5

ch5 338