Total No. of Questions : 8]

SEAT No. :

P3067

[Total No. of Pages : 3

[5154]-633
B.E. (Electrical)
CONTROL SYSTEM - II
(2012 Course) (Semester - I) (403145)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) A unity feedback system is represented by an open loop transfer function $(S)=\frac{K}{s(s+2)}$. Design a suitable Lag Compensator such that phase margin of compensated system is 40°. Take $K_v = 10$ and $\varepsilon = 4°$. **[10]**

b) Obtain State Observer Gain matrix G for the system given by

$$\dot{X}=\begin{bmatrix}-1 & 1\\ 0 & -2\end{bmatrix}X+\begin{bmatrix}1\\ 1\end{bmatrix}u \text{ and } y=\begin{bmatrix}1 & 0\end{bmatrix}X$$

The desired Eigen values for the observer matrix are $-3 \pm 2j$. **[6]**

c) Obtain the transfer function of the state model given by

$$\dot{X}=\begin{bmatrix}-3 & 1\\ 0 & -1\end{bmatrix}X+\begin{bmatrix}1\\ 1\end{bmatrix}u \text{ and } y=\begin{bmatrix}1 & 1\end{bmatrix}X$$ **[4]**

OR

Q2) a) Obtain the state response and output response for the system represented by a homogeneous state model as: **[10]**

$$\dot{X}=\begin{bmatrix}0 & 1\\ -6 & -5\end{bmatrix}X \text{ and } y=\begin{bmatrix}1 & 1\end{bmatrix}X$$. Take $X_0 = [1 \quad 0]^T$.

P.T.O.

b) Comment on the controllability of the system using Kalman's test, given that **[6]**

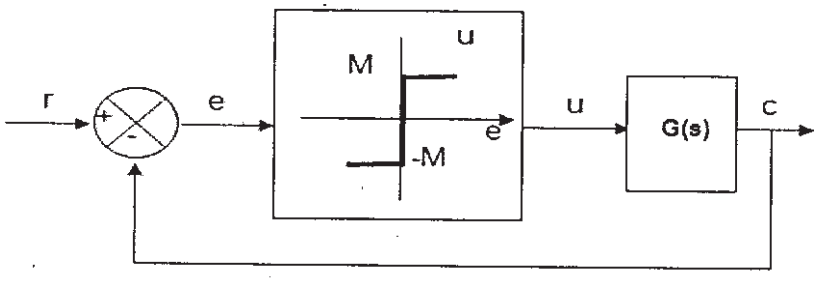
$$A=\begin{bmatrix} -2 & 1 & 0 \\ 0 & -3 & 1 \\ -3 & -4 & -3 \end{bmatrix} \text{ and } B=\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

c) What is Lead Compensator? Draw its pole-zero plot and Bode plot and write down its transfer function. **[4]**

Q3) a) Explain method of isoclines for drawing phase trajectory for the given non linear system. **[8]**

b) For a unity feedback system as shown in figure, determine amplitude and frequency of limit cycle if it exists by describing function method. Also comment on the stability of system. M = 1,

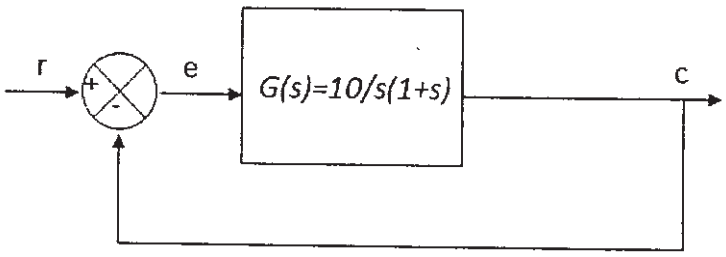
$$G(s) = \frac{10}{s(s+2)(s+6)}.$$ **[8]**



OR

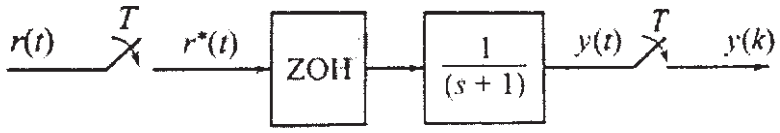
Q4) a) What are the singular points in phase plane? Draw phase portraits of singular points pertaining to various types of Eigen values of 2nd order linear system. **[8]**

b) For a second order linear control system as shown in figure, if the input applied is Unit step, draw the phase trajectories using method of Isoclines, assuming zero initial conditions. **[8]**



Q5) a) Draw the block diagram of digital control system & Explain the function of each block in short. **[8]**

b) Find the transfer function G(z) of the system shown in figure. Also find y(k) for unit step input. (Assume T = 1) **[10]**



OR

Q6) a) What is Zero order hold (ZOH)? Derive its transfer function. **[8]**

b) Solve the following difference equation by using z-transform method. **[10]**

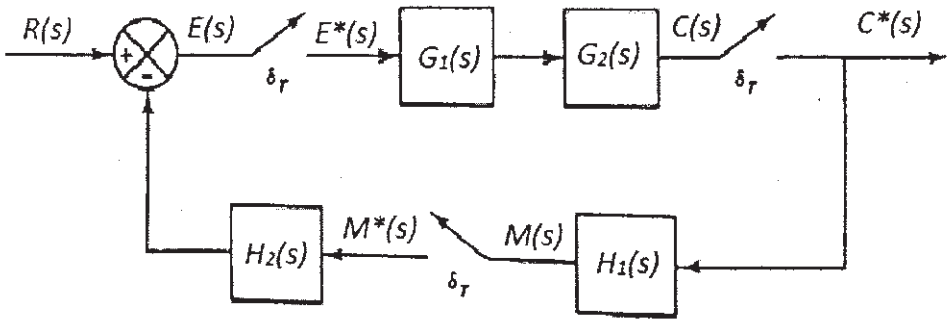
$x(k+2) + 4x(k+1) + 3x(k) = u(k+1)$

where $x(0) = 0$; $x(1) = 1$. The input function $u(k)$ is given by

$u(k) = 1$, $k = 0, 1, 2, ...$

Q7) a) Write a short note on Digital PID Controller. **[8]**

b) Obtain the closed loop pulse transfer function C(z)/R(z) for the given system. **[8]**



OR

Q8) a) Define Pulse transfer function. State General procedure for obtaining Pulse-transfer function. **[8]**

b) Obtain direct and cascade realization from given transfer function. **[8]**

$$D(z) = \frac{z^3 + 0.9z^2 + 0.26z + 0.024}{z^3 + 5z^2 + 8z + 6}.$$