Total No. of Questions : 8]

SEAT No. :

P3135

[Total No. of Pages : 3

[5354]-623
B.E. (Electrical)
CONTROL SYSTEM - II
(2012 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) Explain in detail design procedure of lead compensator. **[8]**

b) A system is represented by the state model. **[6]**

$$\dot{X} = \begin{bmatrix} -2 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -3 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} u, \qquad Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} X$$

Determine controllability & observability of above using Kalman's test.

c) Define the terms : **[6]**

i) State variable

ii) State vector

iii) State space

iv) State trajectory.

OR

Q2) a) A system is represented by a state model

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -1 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u, \qquad Y = \begin{bmatrix} 1 & 0 \end{bmatrix} X$$

. It is required to place the poles of the system at $S = -3 \pm j4$. Design a suitable state feedback gain matrix 'K' using transformation matrix method. **[8]**

P.T.O.

b) Solve the homogeneuous state equation, given that

$$\dot{X}=\begin{bmatrix}-4 & 1\\ -3 & 0\end{bmatrix}X \qquad Y=\begin{bmatrix}1 & 0\end{bmatrix}X \qquad X_o=\begin{bmatrix}1 & 1\end{bmatrix}^T$$ **[8]**

c) What is lag compensator? Explain with the help of pole-zero plot, TF & circuit diagram. **[4]**

Q3) a) Define the terms phase trajectory and phase portrait and explain the procedure of construction of phase trajectory using delta method. **[10]**

b) With suitable sketches write a short note on stability Analysis of a non linear system using describing function method. **[8]**

OR

Q4) a) In a unity feedback system, an ideal relay with output ± 2units is connected in cascade with $G(s)=\dfrac{10}{s(s+3)(s+4)}$ Determine the amplitude & frequency of limit cycle, if it exists, by describing function method.**[10]**

b) With suitable sketches show various types of singular points. Also mention the location of closed loop poles in each case. **[8]**

Q5) a) What is ZOH? Derive its transfer function. **[8]**

b) Obtain Z transform of following sequences. **[8]**

i) $f(k)=\{2,4,\underset{\uparrow}{5},7,3\}$

ii) $f(k)=\left(\dfrac{1}{2}\right)^k u(k)$

Also state ROC in both cases.

OR

Q6) a) Explain with neat diagram process of analog to digital conversion of a signal. **[8]**

b) Solve following difference equation. **[8]**

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

given that $x(0)=0$ and $x(1)=1$

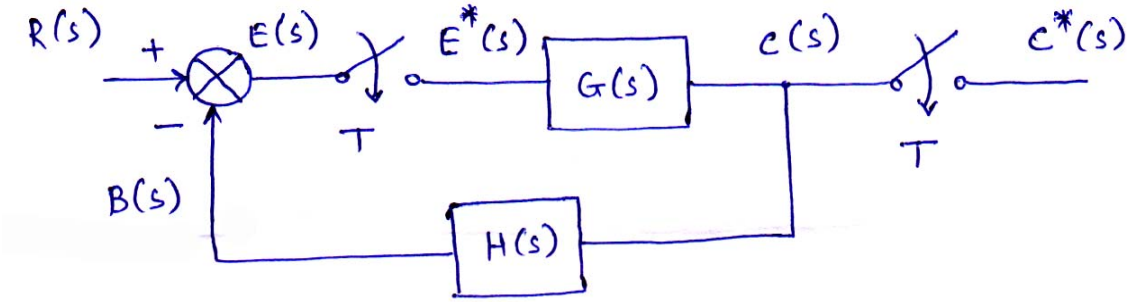
Q7) a) What is pulse transfer function? Write general procedure to obtain pulse transfer function. **[8]**

b) Obtain the cascade realization of the system described by - **[8]**

$$D(z)=\frac{z^3+3z^2+7z+5}{z^3+3z^2+9z+14}.$$

OR

Q8) a) Obtain the pulse transfer function of following closed loop system. **[8]**



b) Obtain parallel realization of the system described by

$$D(z)=\frac{z^2+11z+15}{z^2+7z+12}.$$ **[8]**