Total No. of Questions : 8]

P1988

SEAT No. :

[Total No. of Pages : 3

[5059]-583
B.E. (Electrical)
CONTROL SYSTEM - II
(2012 Pattern) (End Sem.)

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) Design a suitable compensator for a unity feedback system with open loop transfer function $G(s) = K / s^2 (0.2s + 1)$ to satisfy the following specifications **[10]**

i) Acceleration error constant, Ka = 10

ii) PM = 35°.

b) State the advantages of state space modeling over transfer function modeling. **[6]**

c) Ascertain the condition for controllability for a LTI system described by the state equation **[4]**

$$\dot{x} = \begin{bmatrix} 3 & 1 & 0 & 0 \\ 0 & 3 & 1 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix} x(t) + \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \\ b_{31} & b_{32} \\ b_{41} & b_{42} \end{bmatrix} u(t)$$

OR

Q2) a) For the system, defined by **[10]**

$$\dot{x} = \begin{bmatrix} 1 & 1 & -1 \\ 4 & 3 & 0 \\ -2 & 1 & 10 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = [20 \quad 30 \quad 10]\, x$$

By using state feedback control u = –Kx, it is desired to have the closed loop poles at s = –2 ± j2 & s = –5. Determine the state feedback gain matrix K.

P.T.O.

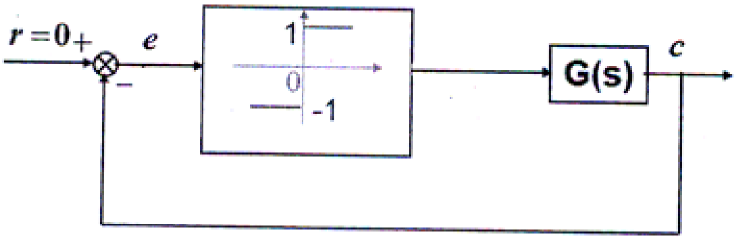
b) Realize the lead-lag compensator with active electrical network. **[4]**

c) Obtain the state model using Phase variables if a system is described by the differential equation: **[6]**

$$\frac{d^3y(t)}{dt^3}+8\frac{d^2y(t)}{dt^2}+14\frac{dy(t)}{dt}+4y(t)=10u(t)$$

Q3) a) Explain the common types of non- linearities observed in physical systems. **[6]**

b) A non -linear control system shown below, has Relay as a non linearity with describing function N(X) = 4/πX, **[10]**



The transfer function of the plant is $G(s)=\frac{10}{s(1+5s)(1+10s)}$

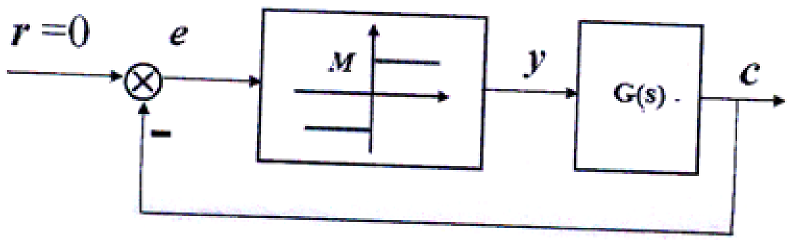
Determine frequency and amplitude of limit cycle if it exists by using Describing function method.

OR

Q4) a) Explain Jump Resonance phenomenon observed in non-linear control systems. **[6]**

b) A non linear control system shown below is applied with unit step input.

The transfer function of the plant is $G(s)=\frac{4}{s(1+s)}$. Assuming system is initially at rest & M = 1. Draw the phase trajectory using method of Isocline. Comment on the system's stability. **[10]**



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

b) Given the z transform $X(z)=\dfrac{(1-e^{-aT})z}{(z-1)(z-e^{-aT})}$

where a is a constant and T is the sampling period, determine the inverse *z* transform X(kT) by use of the partial-fraction-expansion method. **[8]**

OR

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

b) Solve the following difference equation by use of the z transform method: **[8]**

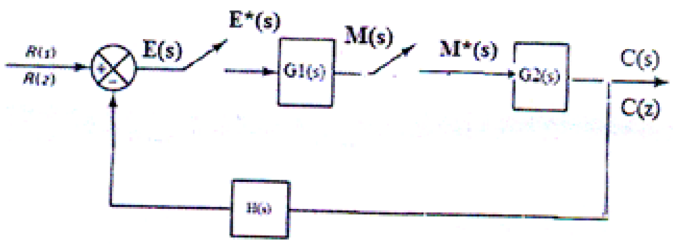
$x(k+2)+6x(k+1)+5x(k)=0,\ x(0)=0,\ x(1)=1$

Q7) a) Explain the following methods of realizing digital controller **[8]**

i) direct

ii) cascade

b) Obtain the closed loop pulse transfer function C(z)/R(z) for the system. **[10]**



OR

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

b) A digital filter is defined by **[10]**

$$G(z)=\frac{Y(z)}{X(z)}=\frac{4(z-1)(z^2+1.2z+1)}{(z+0.1)(z^2-0.3z+0.8)}$$

Obtain the series & parallel block diagram realization.

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