Total No. of Questions : 12]

SEAT No. :

P2324

[Total No. of Pages : 5

[4758] - 59
T.E. (Electronics)
FEEDBACK CONTROL SYSTEMS
(2008 Course) (Semester - I)

Time : 3 Hours] *[Max. Marks : 100*

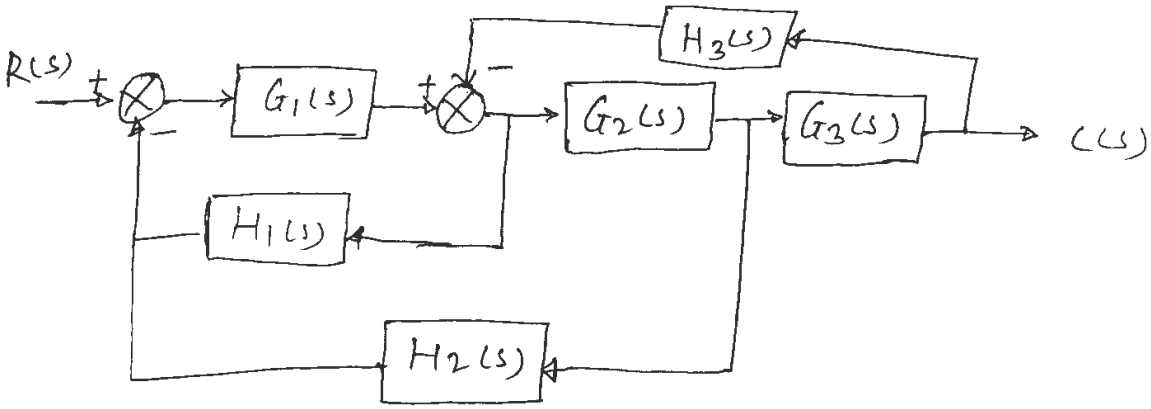
Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Assume suitable data, if necessary.***
6) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***

SECTION - I

Q1) a) Explain linear and Non-linear control systems with suitable example of each. **[8]**

b) Obtain $\frac{C(S)}{R(S)}$ of the system shown in Fig.Q.1(b) using block diagram reduction technique. **[8]**



Q. 1(b)

OR

P.T.O.

Q2) a) Obtain the transfer function $\frac{C(S)}{R(S)}$ using Mason's gain formula for the system shown in Fig. Q.2(a) by signal flow graph. **[8]**

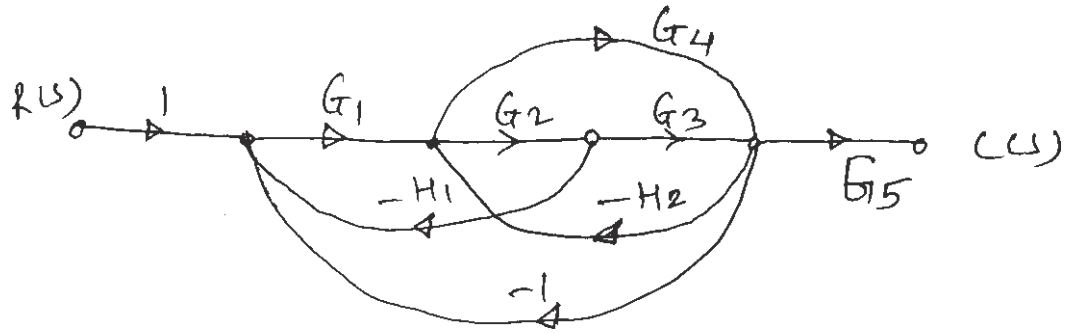


Fig.Q.2(a)

b) Explain basic elements of feedback control system with temperature control of a room as a practical example. **[8]**

Q3) a) A unity feedback system has open loop transfer function $G(s) = \frac{16}{s(s+6)}$.

Find **[8]**

i) undamped natural frequency,

ii) damping factor,

iii) damped natural frequency,

iv) rise time,

v) peak time,

vi) peak overshoot,

vii) settling time,

viii) steady state gain.

b) The characteristic equation of feedback control system is

$Q(s) = s^5 + 2s^4 + 3s^3 + 4s^2 + 5s + 6 = 0$ using Routh's criteria, comment on stability of system. **[8]**

OR

Q4) a) Sketch the root locus of $G(s) = \frac{k}{s(s+1)(s+3)}$ and comment on stability. **[8]**

b) Find steady state error for unit step, unit ramp and unit acceleration inputs for the following system **[8]**

$$G(s) \cdot H(s) = \frac{10}{s(0.1s+1)(0.5s+1)} \text{ with } H(s) = 1.$$

Q5) a) Design a lag compensator for the unity feedback system with **[12]**

$G(s) = \frac{k}{s(s+2)}$ to satisfy the condition: $K_v = 10$, PM $\geq 32^\circ$. Also draw the Bode plot of compensated system.

b) Explain: stability analysis using Nyquist plot. **[6]**

OR

Q6) a) Draw Bode plot and determine gain margin, phase margin, gain crossover frequency and phase crossover frequency if

$$G(s) = \frac{1}{s(0.5s+1)(0.05s+1)} \text{ \& } H(s) = 1. \quad \textbf{[12]}$$

b) Write short note on 'Time domain analysis versus frequency domain analysis'. **[6]**

SECTION - II

Q7) a) Obtain the transfer function for **[12]**

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

$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x + \begin{bmatrix} 0 \end{bmatrix} u$

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

$y = \begin{bmatrix} 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 \end{bmatrix} u$

b) Obtain state space representation in physical variable form if the system is represented by $\frac{y(s)}{u(s)} = \frac{1}{s^3 + 6s^2 + 11s + 6}$. **[6]**

OR

Q8) a) Obtain state transition matrix for the system $\dot{x} = \begin{bmatrix} -3 & 1 \\ 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$. **[8]**

b) State the properties of state transition matrix. **[4]**

c) What are the advantages of state space techniques over transfer function. **[6]**

Q9) a) Draw the diagram of architecture of PLC and explain it's working in short. **[8]**

b) Design a signal conditioning circuit for RTD such that at 0ºC temperature output should be OV and at 100ºC temp. output should be 5V. **[8]**

OR

Q10)a) Explain P, PI, PD and PID modes of controller with mathematical equations. **[8]**

b) Explain ladder diagram for application to bottle filling plant. **[8]**

Q11)Write short note on **[16]**

a) Fuzzy logic concept and its control scheme.

b) Application of fuzzy controller for temperature control system.

c) Neural network based controller.

OR

Q12)Explain the following. **[16]**

a) Concept of neural network.

b) Fuzzification and Defuzzification methods.

c) Application of neural network in control system.

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