Total No. of Questions : 12]

SEAT No. : [ ]

P2322

[Total No. of Pages :4

[4758] - 57
T.E. (Electrical)
CONTROL SYSTEM - I
(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Giving an example, explain a feedback control system. List the advantages of feedback. **[8]**

b) Obtain the transfer function $G(s)=\frac{V_2(s)}{V_1(s)}$ of the network as shown in fig 1b. **[8]**

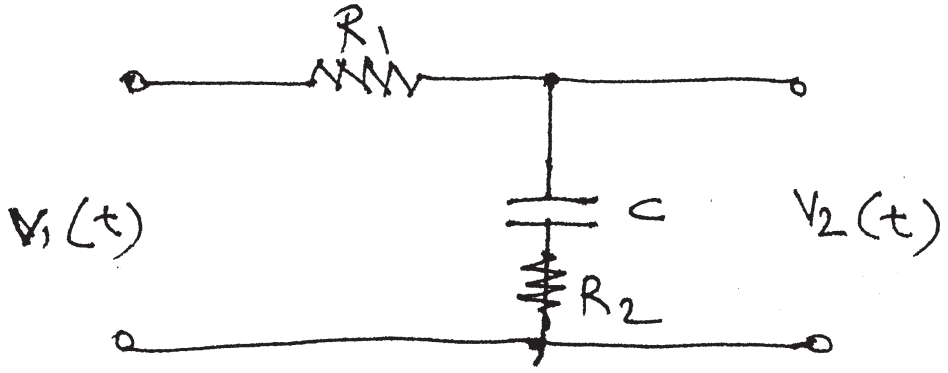

Fig 1

OR

P.T.O.

2) a) Find $\frac{C(s)}{R(s)}$ for the system signal flow graph as shown in fig. 2a. **[10]**

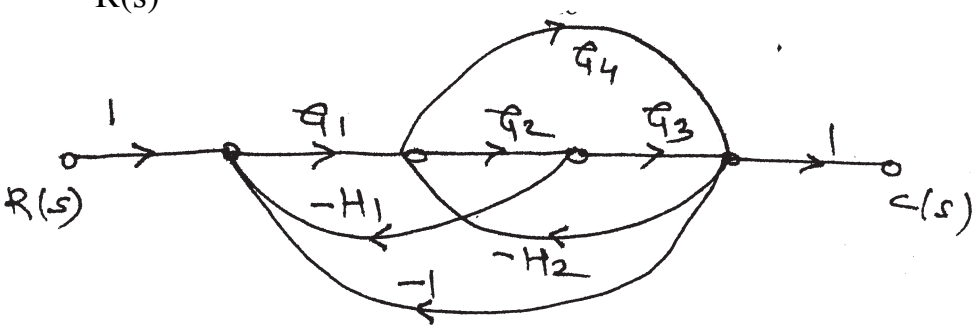

fig 2a

b) Write the equilibrium equations for the mechanical system as shown in fig 2b. **[6]**

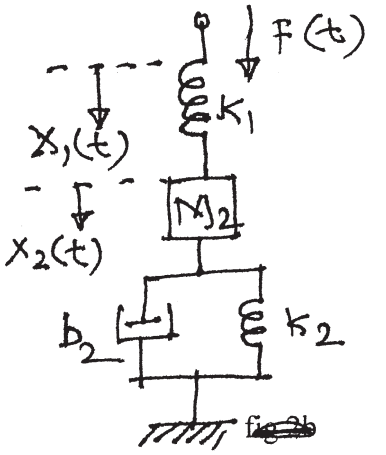

fig 2b

Q3) a) Discuss the response and steady state errors for a second order system if inputs are: **[8]**

i) Step unit signal

ii) Unit ramp signal and

iii) Unit parabolic signal

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

i) $G(s) = \frac{10}{s(0.1s+1)(0.5s+1)}$

ii) $G(s) = \frac{1000(s+1)}{(s+10)(s+50)}$

OR

Q4) a) Define and explain all the time domain specifications for a under damped control system with Unit step input. **[8]**

b) For the system given by $G(s) = \frac{25}{(s^2+6s+25)}$ find its rise time, peak time and peak overshoot. **[8]**

Q5) a) State and explain Routh's criterion and Hurwitz criterion. What are the limitations? **[8]**

b) For a unity feedback system, output is marginally stable and oscillates with frequency 4rad/sec. Find K marginal and 'q' with open loop transfer function **[10]**

$$G(s)\,H(s) = \frac{4}{s(s^2+qs+2K)}$$

OR

Q6) a) Explain magnitude condition and Angle condition for system to be stable. How they are applicable in Root locus sketch.

b) Sketch the root locus for a system with loop transfer function $G(s) = \frac{K}{(s^2+s+1)}$. Also discuss on stability of the system.

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SECTION - II

Q7) a) Define and explain all frequency domain specifications. **[8]**

b) The OLTF of unity feedback system is $G(s) = \frac{10(s+20)}{(s+1)(s+2)(s+3)}$.

Construct Bode plot. Determine Gain margin and Phase margin. Comment on stability. **[8]**

OR

Q8) a) State and explain Nyquist stability criterion. **[8]**

b) What is polar plot and how it is used to find stability of control system? Sketch and explain polar plots type '0', '1' and '2' systems. **[8]**

Q9) a) Define and explain: **[8]**

i) State

ii) State Vector

iii) State Space

iv) Output equation

b) Find the transfer function for the system represented as

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}-2 & 1 & 0\\ 0 & -3 & -1\\ -3 & -4 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$$

$$y=\begin{bmatrix}0 & 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$ **[8]**

OR

Q10)a) Explain the methods of obtaining state model from the transfer function. **[8]**

b) Derive transfer function from state model. **[8]**

Q11)a) Write note on potentiometer. **[8]**

b) With neat diagrams, explain the PD, PI, and PID controllers. **[10]**

OR

Q12)a) Write short notes on compensator networks. **[10]**

b) Explain and derive transfer function of D.C. Servomotor. **[8]**