B.E. Sixth Semester (Electronics / Electronics Telecommunication / Electronics Communication Engineering) (C.B.S.)

Control System Engineering

P. Pages : 4 | NKT/KS/17/7381/7386

Time : Three Hours | Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Write differential equation for system shown in fig. 1(a) **7**

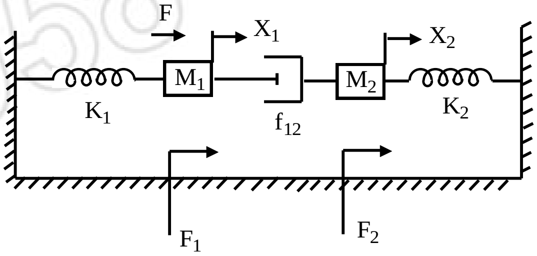

Fig. (1.a)

b) For the Electrical Network shown in Fig. 1(b) find the transfer function $\frac{v_o(s)}{v_i(s)}$ by Mason's gain formula. **7**

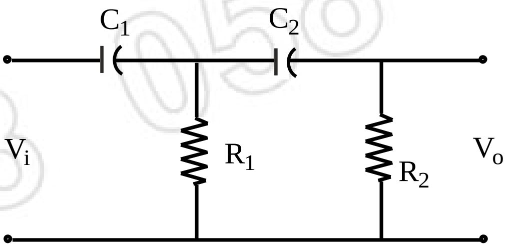

Fig. 1 (b)

OR

2. a) Find $\frac{C(s)}{R(s)}$. Using block reduction technique for the block diagrams shown in 'Fig. 2(a)' **7**

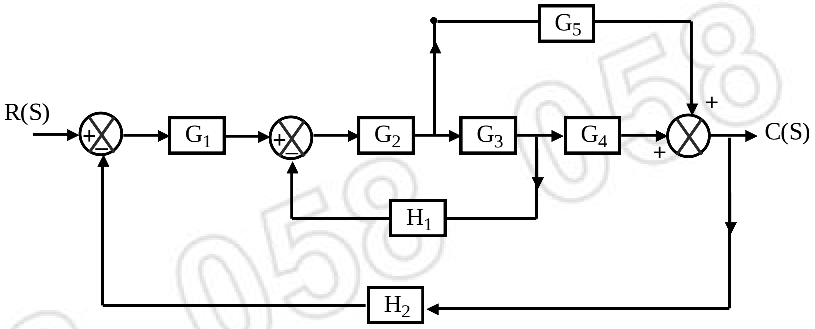

Fig. 2(a)

b) Derive the expression to prove that the use of feedback improves the transient response. **7**

3. a) For a system having forward path transfer function $G(s) = \frac{k}{s(s+6)}$ and $H(s) = 1$. Find the time response to an i/p r(t) = 2u(t) where **7**

i) k = 13; ii) k = 8

b) For a unity feedback system having forward path transfer function $G(s) = \frac{10}{s(s+2)(s+5)}$ **7**

Determine damping ratio, Dominant pole pair location and damped frequency of oscillation.

OR

4. a) For the system shown in 'Fig. 4(a)', **8**

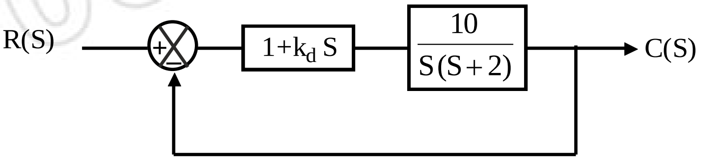

Fig. 4 (a)

i) Determine the derivative constant k_d so that $\zeta = 0.6$

ii) Find %, MP, settling time and number of oscillations before settling and the time required to reach over shoot and first under shoot. Sketch approximate time response

b) Derive the time Response of second order underdamped system to unit step Input. **6**

5. a) A feedback control system has $G(s)H(s) = \frac{ke^{-ST_d}}{s[s^2+5s+9]}$. For the closed loop system, obtain stability boundary in parameter plane $[k - T_d]$. Also obtain the maximum permissible gain for stability when $T_d = 1$ sec. **6**

b) Sketch the root locus of a unity feedback control system with $G(s) = \frac{k}{s(s+1)(s+3)}$ and determine the value of k for marginal stability. **7**

OR

6. a) The characteristics equation of a unity feedback system is given by $F(s) = S^3 + 4S^2 + [8+k]S + 3k = 0$ Draw the root locus for k = 0 to ∞. Determine the value of k for a damping ratio of 0.5. **10**

b) Define : **3**

i) Absolute stability
ii) Relative stability
iii) Order of the system

7. a) Given : $G(s)H(s) = \frac{12}{s(s+1)(s+2)}$ Draw the Polar Plot and hence determine if system is stable and if gain and phase margin. **9**

b) State and explain Nyquist criterion. **4**

OR

8. a) Draw the Bode Plot of a system with open loop transfer function: - **9**

$$G(s)\ H(s) = \frac{10(s+3)}{s(s+1)(s+2)}$$

Discuss STABILITY from the BODE PLOT.

b) Define : **4**

i) Phase margin
ii) Gain margin
iii) Resonance frequency
iv) Band width

9. a) Write the Transfer function for a lag-lead compensator. Draw its Pole Zero Plot, bode Plot and Electric RC network realization. **7**

b) What is the need for compensation? Explain in brief the selection process for type of compensator for a particular system. **6**

OR

10. a) Write short notes on Lead compensator. **7**

b) Explain transducers in brief. **6**

11. a) Determine the system transfer function using the following state equation:- **6**

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

$$y = [1 \quad 2] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

b) The closed loop transfer function of the system is given below: **7**

$$\frac{C(s)}{R(s)} = \frac{24}{(s+1)(s+2)(s+3)}$$

OR

12. a) Obtain the state equation for the network shown in fig.12 (a) **6**

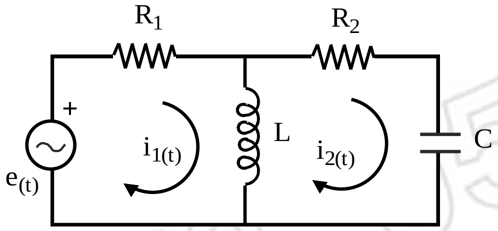

Fig. 12 (a)

b) A feedback system is characterized by the close-loop transfer function given as: **7**

$$T_{(s)} = \frac{S^2 + 3S + 3}{S^3 + 2S^2 + 3S + 2}$$

i) Draw the suitable signal flow-Graph representing the close-loop transfer function.

ii) Obtain the state space model representation of the same.

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