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

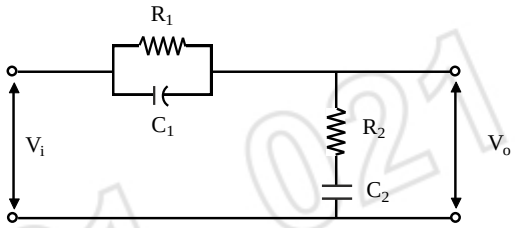
Control System Engineering

P. Pages : 3 **NJR/KS/18/4520/4525**

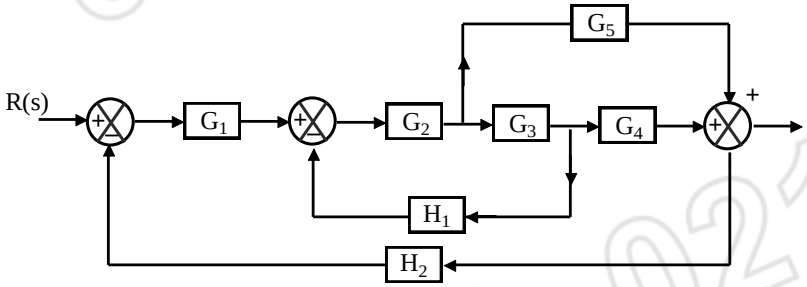
Time : Three Hours * 0 6 6 5 * Max. Marks : 80

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 chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Find the transfer function of the circuit given. **6**



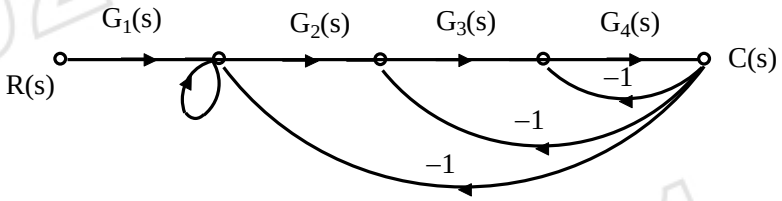
b) Find $\frac{C(s)}{R(s)}$ using block reduction technique for the block diagram shown in fig. **7**



OR

2. a) What is the effect of a feedback on control system sensitivity. **6**

b) Using Mason's gain formula, find $\frac{C(s)}{R(s)}$ for the system shown in fig. **7**



3. a) A unity feedback system has forward path **7**

T.F. $G(s)=\dfrac{K(2s+1)}{s(4s+1)(s+1)^2}$

i) State type & order of the system.

ii) It is desired that steady state error for anilp $r(t)=1+t$ should be equal to actress than 1. find minimum value of K.

b) Define. **6**

1) Delay time.
2) Rise time
3) Peak time
4) Deak overshoot.
5) Settling time
6) Steady state error.
7) Time response.

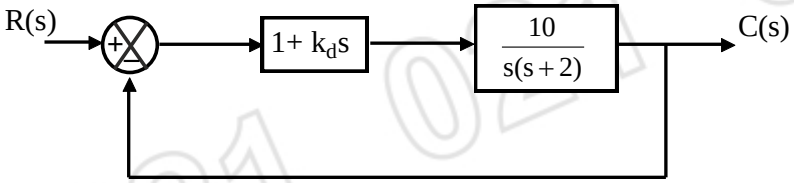
OR

4. a) Derive the time response of second order underdamped system to unit step input. **6**

b) For the system shown, **7**

i) Determine the derivative constant kd so that $\xi=0.6$.

ii) Find % MP, settling time & number of oscillations before settling setting time & time required to reach over shoot & first under shoot sketch approximate time response.



5. a) Define stability & its types. **6**

b) State Hurwitz's stability criteria & what are its limitation. **2**

c) The open loop transfer function of feedback control system is given by **6**

$G(s)\cdot H(s)=\dfrac{K}{s(s+4)(s^2+2s+1)}$.

using Routh criterion, determine the range of 'K' for which the system will be stable.

OR

6. The characteristics equation of a unity feedback system is given by **14**

$F(s)=s^3+4s^2+[8+k]s+3K=0$

Draw the root locus for $K=0$ to ∞. Determine the value of K for a damping ratio of 0.5.

7. a) Explain the forms related with Bode plot. **4**

1) Gain margin.
2) Phase Margin.
3) Gain crossover frequency.
4) Phase crossover frequency.

b) Draw the Bode plot of a system with open loop transfer function:- **9**

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

OR

8. a) Given : $G(s)H(s)=\frac{12}{s(s+1)(s+2)}$ Draw the polar plot & hence determine phase margin & gain Margine. **9**

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

9. a) Write the transfer function of a log-lead compensator. Draw its pole zero plot, bode plot & 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 equations: **7**

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

$$y=\begin{bmatrix}1 & 2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}.$$

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

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

Derive tow different state models for the system.

OR

12. a) Transfer function of a system is defined by **8**

$$\frac{y(s)}{v(s)}=\frac{s^2+2s+3}{s^3+5s^2+4s}.$$

Obtain canonical state space model & draw its block diagram representation.

b) "Transfer function is unique & state variable is not unique" Justify the statement. **3**

c) Also define **3**

1) State variable
2) State space
3) State vector

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