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

Control System Engineering

P. Pages : 4 **KNT/KW/16/7381/7386**

Time : Three Hours * 0 0 9 8 * 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. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Reduce the block diagram for C(s)/R(s) using block diagram reduction technique. **7**
Refer 'fig 1 (a)'

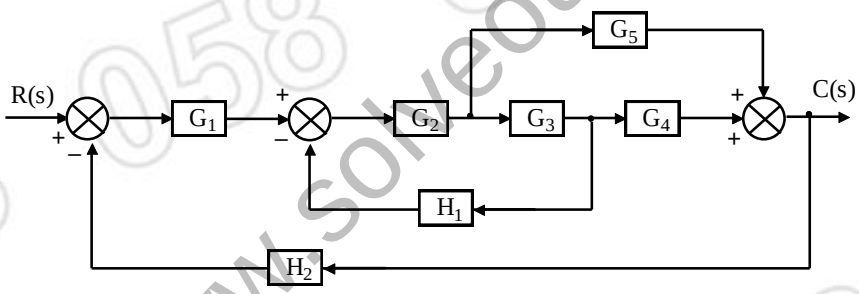


Fig. 1(a)

b) Write the differential equation governing the behaviour of mechanical system shown in fig 1 (b). Obtain an analogous electrical circuit using force voltage analogy. **6**

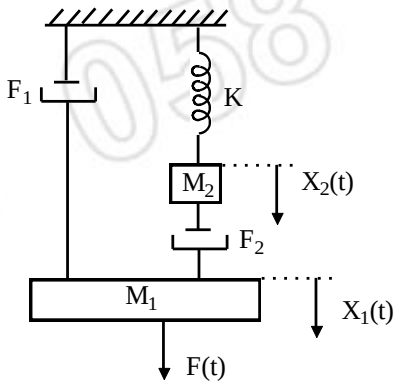
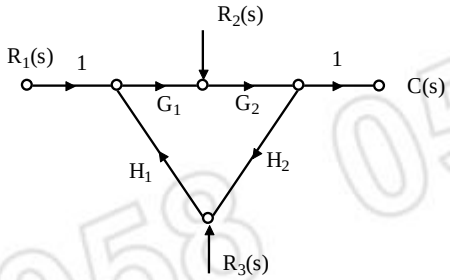


Fig. 1(b)

OR

2. a) Determine overall gain using Mason's gain formula of the following SFG. **7**



b) What is the effect of a feedback on control system sensitivity? **6**

3. a) A unity feedback system has forward path **6**

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

i) State type & order of the system.
ii) It is desired that steady state error for an i/P r(t) = 1 + t should be equal to or less than 1. Find minimum value of K.

b) Define: **7**

i) Delay time
ii) Rise time
iii) Peak time
iv) Peak overshoot
v) Settling time
vi) Steady state error
vii) Time Response

OR

4. a) An instrument serve for controlling position is damped with velocity feedback as shown in fig. 4(a): **7**
i) If input R is unit step. What is the response of the system & the steady state error?
ii) What is the system static error coefficient?

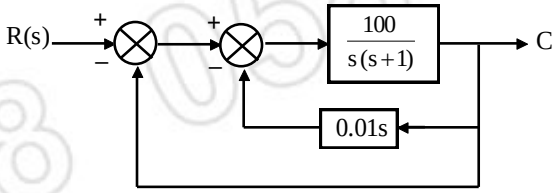


Fig. 4 (a)

b) Discuss the effect of 'r_1' on response & root location of second order system? **6**

5. a) Define stability & its types. **2**

b) State Hurwitz's stability criteria & what are its limitation. **6**

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

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

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

OR

6. The open loop transfer function of a unity feedback control system is **14**

$$G(s)\cdot H(s) = \frac{K}{s(s+2)(s+5)}$$

Sketch the root locus of the system & determine the value of K for

i) Critical damping ii) Marginal stability

7. Draw the open loop Bode diagram. Determine the gain crossover frequency, phase crossover frequency, gain margin, phase margin. Determine the stability of closed loop system. **13**

$$\text{Given } G(s) = \frac{170\left(\frac{s}{10}+1\right)}{s\left(1+\frac{s}{1.75}\right)\left(1+\frac{s}{60}\right)} : H(s) = 1$$

OR

8. a) Write a short note on Nyquist stability criteria. **5**

b) Draw polar plat of **8**

$$G(s)\cdot H(s) = \frac{100}{(s+2)(s+4)(s+8)}$$

9. a) i) Compare the lag & lead compensator. **3**

ii) Compare feedback compensation & cascade compensation. **3**

b) Derive the transfer function of lead lag compensator. **7**

OR

10. a) Compare & justify the selection of 'Lag' & 'Lead' compensator for following **6**

i) Bandwidth

ii) Noise susceptability

iii) Type of system

b) Explain the signal conditioning system with the help of block diagram. **7**

11. a) State the advantages of state variable feedback design over the classical design technique. **4**

b) Obtain the state space model for given network. Refer 'Fig 11. (b)' **5**

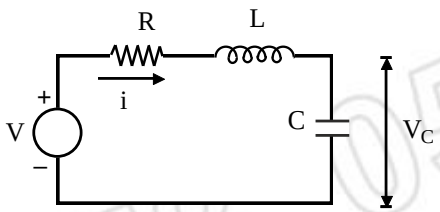


Fig. 11(b)

c) Given transfer function of the system is **5**

$$\frac{Y(s)}{V(s)} = \frac{a s^2 + bs + c}{s^3 + ds^2 + es + f}$$

form the state space model

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**

i) State variable ii) State

iii) State vector iv) State space

Solve any three.

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