B.E. Fifth Semester (Power Engineering) (C.B.S.)

Control Systems Engineering

P. Pages : 3 **NKT/KS/17/7367**

Time : Three Hours * 0 0 7 4 * Max. Marks : 80

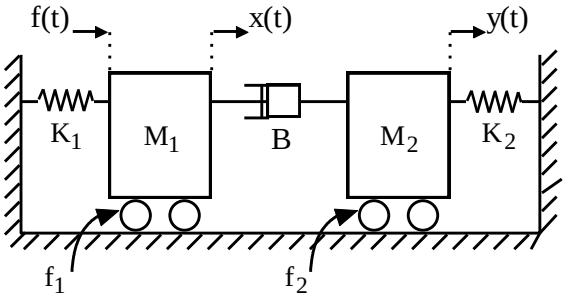
Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Use of non programmable calculator is permitted.

1. a) Explain open loop and close loop control system in detail. **6**

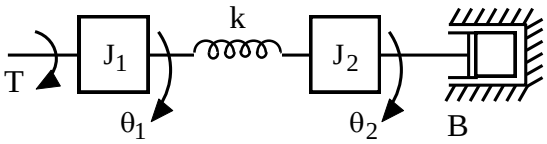
b) Explain automobile power steering control and speed control system in detail. **7**

OR

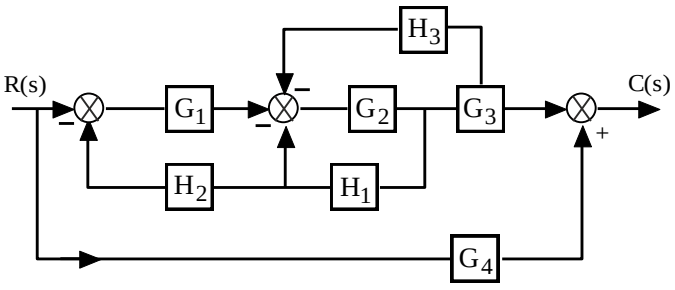
2. a) Find Transfer Function $\frac{Y_{(s)}}{F_{(s)}}$ **8**



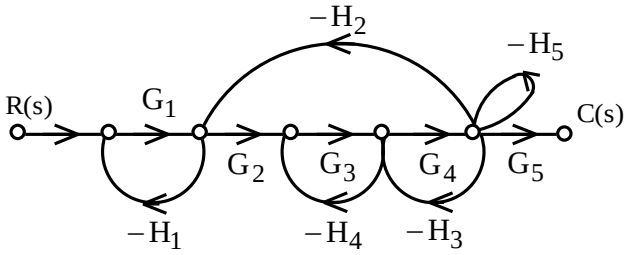
b) Find T. F. $\frac{\theta_2(Cs)}{T(s)}$ **5**



3. a) Find $\frac{C(s)}{R(s)}$ by using block reduction technique. **7**



b) Find T. F. by using Mason's Gain Formula. **6**

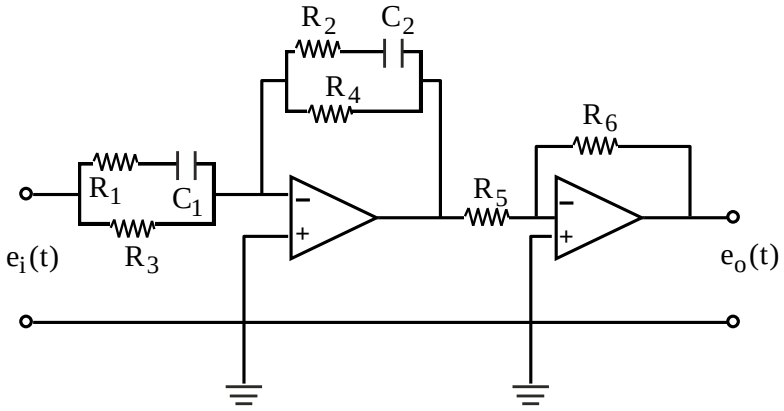


OR

4. a) Define the following terms with respect to SFG. **5**

i) Forward path gain.
ii) Self loop.
iii) Non-touching loop.
iv) Signal flow graph.
v) Masson's gain formula.

b) Find T. F. $\frac{Eo(s)}{Ei(s)}$ **8**



5. a) What is PID controller? Explain the classification of industrial controller in detail. **8**

b) Derive the relationship between steady state error for step, ramp and parabolic input and error constant. **6**

OR

6. a) A unity feedback control system has forward path T. F. $G(s) = \frac{k}{S(S+25)}$ **8**

i) Find k for $\xi = 0.6$.
ii) Find rise time, peak time peak overshoot, setting time.
iii) Steady state error and number of oscillation.
iv) Draw response curve with all specification.

b) The given system : $G(s) = \frac{200}{S(S+8)}$; $H(s) = 1$ Find steady state error for $r(t) = 2t$ Find value of "k" to reduce the error by 5%. **6**

7. a) Explain Routh-Hurwitz criterion and its application for determination of stability. **6**

b) Examine stability of (Routh-Hurwitz) R. H. Criteria **7**

$S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0$.

OR

8. a) Find "K_{mar}" for $G(s)\ H(s) = \dfrac{K(S+2)}{S^2(S+5)\ (S+7)}$ Find the "Range of K". **6**

b) The O. L. T. F. of the given system is - $G(s)\ H(s) = \dfrac{0.4S+1}{S(S+0.6)}$ **7**

Find all domain specification and draw response curve.

9. Draw polar plot and determine gain margin, phase margin. Also comment on stability. **14**

$G(s)\ H(s) = \dfrac{100}{S^2\ (S+4)\ (S+24)}$.

OR

10. Draw root locus $G(s)\ H(s) = \dfrac{k}{S(S+1)\ (S+4)\ (S+6)}$ **14**

11. a) Explain transportation lag and design lag lead compensation in detail. **5**

b) Check for given system that it is observable and controllable or not. **8**

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \mu \text{ and}$$

$$y = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

OR

12. a) Express the given differential equation in state space model form - **7**

$S^3y + S^26y + S^{11}y + 6y = 6u$

b) Explain transfer function for DC field motor in detail. **6**

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