CBCS SCHEME

15ME73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Control Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Compare open loop and closed loop control system with example. **(08 Marks)**

b. Explain basic structure of a feedback control system with a suitable example and block diagram. **(08 Marks)**

OR

2 a. Explain the ideal requirements of control system with example. **(06 Marks)**

b. What is controller? Compare PI, PD and PID controllers, with block diagram and relevant characteristics equation. **(10 Marks)**

Module-2

3 a. Determine system equation of the system shown in Fig.Q.3(a) and draw force-voltage analogy. **(08 Marks)**

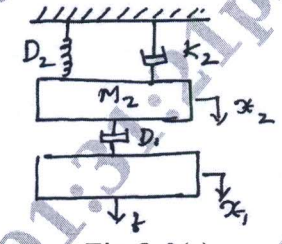

Fig.Q.3(a)

b. A thermometer is dipped in a vessel containing liquid at a constant temperature of θ_1. thermometer has a thermal capacitance for storing heat as C and thermal resistance to limit heat flow as R. If the temperature indicated by thermometer is θ_r, obtain the transfer function of the system. **(08 Marks)**

OR

4 a. Determine the transfer function of the system by block diagram reduction technique. **(08 Marks)**

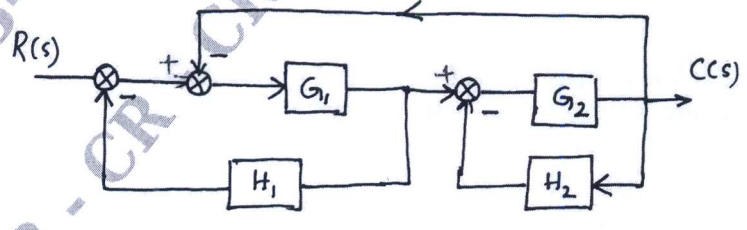

Fig.Q.4(a)

b. Determine the transfer function of the system by Mason's gain formula. **(08 Marks)**

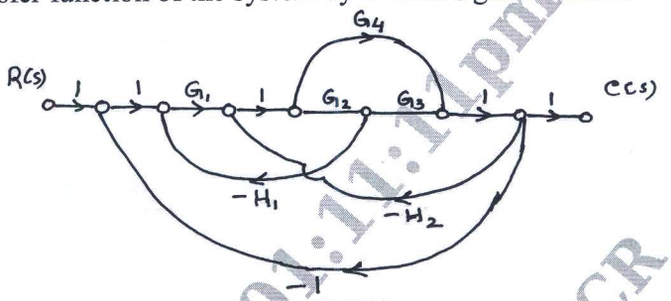

Fig.Q.4(b)

Module-3

5 a. Examine the stability of the system represented by the characteristic equation $2s^4 + 10s^3 + 2s^2 + 5s + k = 0$. Using RH criterion. Suggest the range of K for the system to be stable. **(08 Marks)**

b. Derive the governing expression for the first order system subjected to unit step response. **(06 Marks)**

c. Explain the transient response characteristics of a control system to a unit step input. **(02 Marks)**

OR

6 A negative feedback control system is characterized by $G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}$. Generate the root locus plot forth values of K ranging from 0 to ∞. **(16 Marks)**

Module-4

7 Sketch the Bode plot for a unit feedback system with $G(S) = \frac{242(S+5)}{S(S+1)(S^2+5S+121)}$ and comment on stability. **(16 Marks)**

OR

8 Draw the Nyquist plot for a system with $G(S)H(S) = \frac{K}{S(S+1)(S+2)}$ and find the range of values of K for stability. **(16 Marks)**

Module-5

9 a. Explain series and feedback compensation of a system with a diagram. **(08 Marks)**

b. Explain lag compensator and lead compensator with a diagram. **(08 Marks)**

OR

10 a. Explain in brief controllability and observability. **(10 Marks)**

b. Using Kalman's test determine whether the system represented by following state matrix is controllable or not.

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -1 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix} u \quad \text{and} \quad C = \begin{bmatrix}1 & 1\end{bmatrix} x.$$ **(06 Marks)**

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