CBCS SCHEME

USN

21ME72

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain open loop and closed loop system with block diagram and examples. **(10 Marks)**

b. Explain : (i) Proportional control action.
(ii) Differential control action. **(10 Marks)**

OR

2 a. Define control system. Explain basic terminologies involved in developing it. **(08 Marks)**

b. Find the transfer function $\frac{X_2(s)}{F(s)}$ for the given mechanical system. Refer Fig.Q2 (b).

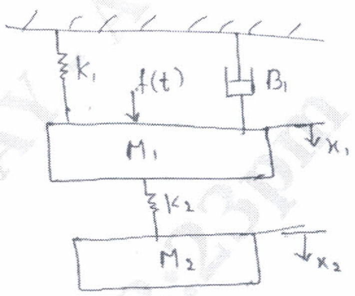

Fig. Q2 (b) **(12 Marks)**

Module-2

3 a. List and explain standard Test Inputs used in control system analysis. **(10 Marks)**

b. Explain 1st order system subjected to unit step input. **(10 Marks)**

OR

4 a. Examine a 2nd order under damped system subjected to unit step input. **(10 Marks)**

b. Identify the following quantities for 2nd order unit feedback system with open loop transfer function $G(s)H(s) = \frac{361}{s^2 + 16s + 361}$. Find

(i) Damping ratio
(ii) Natural frequency
(iii) Settling time
(iv) Peak time
(v) Peak over shoot. **(10 Marks)**

Module-3

5 a. List and explain rules of block diagram reduction technique. **(10 Marks)**

b. Develop a closed loop transfer function for the block diagram shown in Fig. Q5 (b).

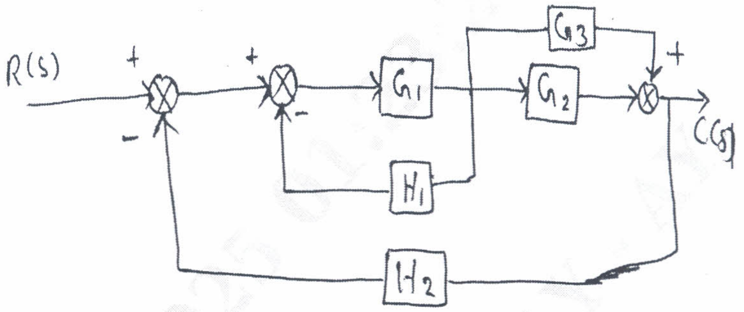

Fig. Q5 (b) **(10 Marks)**

OR

6 a. For the system shown in Fig. Q6 (a). Examine $\frac{C(s)}{R(s)}$ using Mason's gain formula.

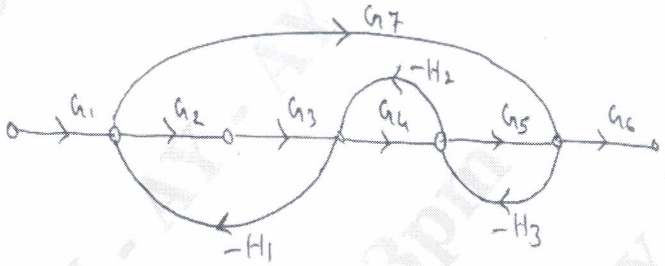

Fig. Q6 (a) **(10 Marks)**

b. For the system shown in Fig. Q6 (b), determine $\frac{C(s)}{R(s)}$ using Mason's gain formula.

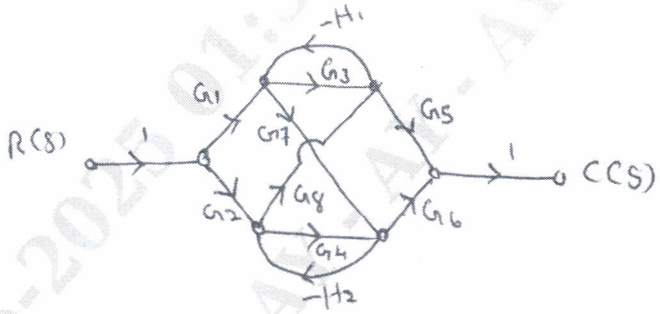

Fig. Q6 (b) **(10 Marks)**

Module-4

7 a. A system oscillates with a frequency 'w' if it has poles at $s = \pm j\omega$ and no poles in the right half of the s-plane. Determine the values of 'K' and 'a' so that the system shown in Fig. Q7 (a) below, oscillates at a frequency of 2 rad/sec.

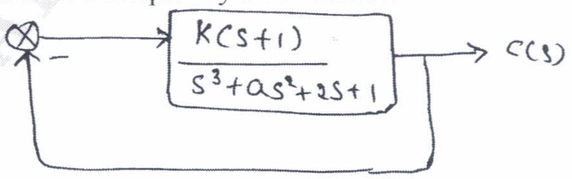

Fig. Q7 (a) **(10 Marks)**

b. The open loop T.F of a unit F.B control system is given by, $G(s) = \dfrac{K}{(s+2)(s+4)(s^2+6s+2s)}$.

Determine the range of values of K for system stability. What is the value of K which gives sustained oscillations? What is the oscillation frequency? **(10 Marks)**

OR

8 Construct a root locus for all values of 'K' ranging from 0 to ∞ for a feedback control system characterized by,

$$G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}.$$ **(20 Marks)**

Module-5

9 Using Nyquist criterion, examine the stability of a system whose open loop transfer function is, $G(s)H(s) = \dfrac{K}{(s+1)(s+2)}$. **(20 Marks)**

OR

10 Construct a Bode plot for the following transfer function and determine gain margin and phase margin.

$$G(s)H(s) = \frac{50}{s(0.5s+1)(0.05s+1)}.$$ **(20 Marks)**

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