CBCS SCHEME

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18ME71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. Define control system. With example, explain open loop control system and closed loop control system. **(10 Marks)**

b. List the types of controllers and explain PID controller with block diagram. **(10 Marks)**

OR

2 a. A thermometer is dipped in a vessel containing a liquid at constant temperature "$\theta_i(t)$" with thermal capacitance "C" and Thermal Resistance (R). Temperature indicated by thermometer is "$\theta_0(t)$". Develop a transfer function for the system. **(10 Marks)**

b. Develop a transfer function $\frac{X_2(s)}{F(s)}$ for the Fig.Q2(b).

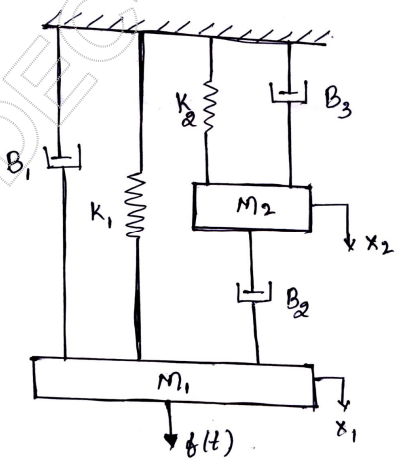

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. List and explain the various standard inputs used in control system analysis. **(10 Marks)**

b. Develop an expression for steady state error for a simple closed loop control system. **(10 Marks)**

OR

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

b. Evaluate the following quantities for a 2nd order unity feedback system with open loop transfer function $G(s) = \frac{25}{s(s+7)}$, find :

(i) Undamped natural frequency (ii) Damping ratio
(iii) Damped natural frequency (iv) Setting time
(v) Raise time (v) Peak time
(vi) The percentage over shoot for unit step input. **(10 Marks)**

Module-3

5 a. List the basic elements of block diagram. **(05 Marks)**

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

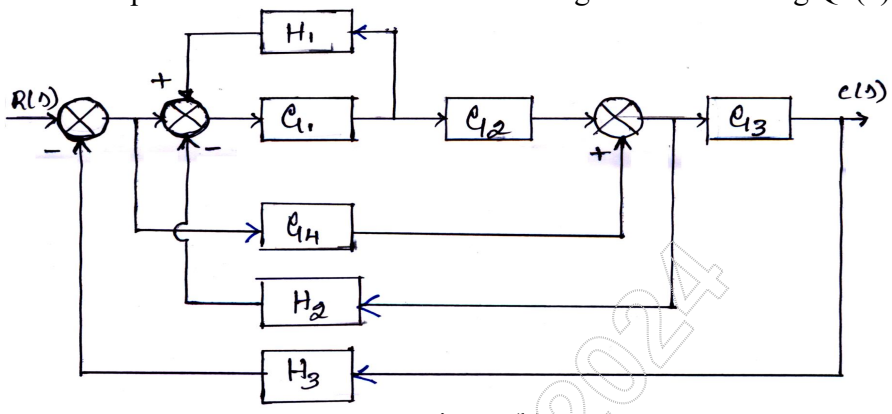

Fig.Q5(b) **(15 Marks)**

OR

6 a. Explain the terms (i) Node (ii) Input node (iii) Output node (iv) Branch (v) Path. **(05 Marks)**

b. Construct a S.F.G. for a block diagram shown in Fig.Q6(b) and obtain a transfer function using Mason's gain formula.

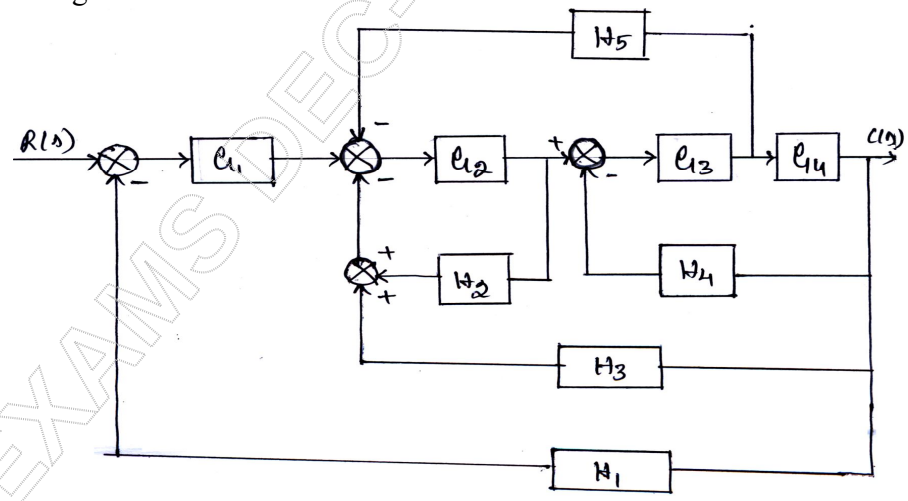

Fig.Q6(b) **(15 Marks)**

Module-4

7 a. For a system with characteristic equation $F(s) = s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. Examine stability using Routh Herwitz criterion. **(10 Marks)**

b. A given system oscillates with frequency 2 rad/sec. Find values of K_{mar} and 'P' are in RHS.

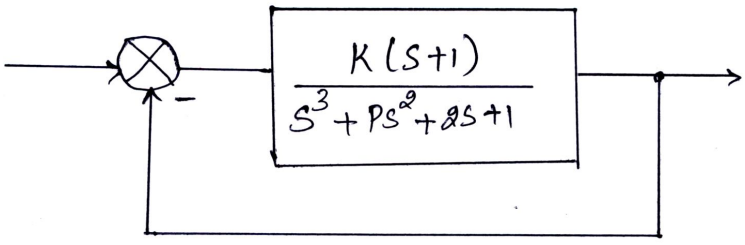

Fig.Q7(b) **(10 Marks)**

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OR

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

$$G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$ **(20 Marks)**

Module-5

9 Using Nyquist crieterion, examine the stability of a system whose open loop transfer function is

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

OR

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

$$G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$$ **(20 Marks)**

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