

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.

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).

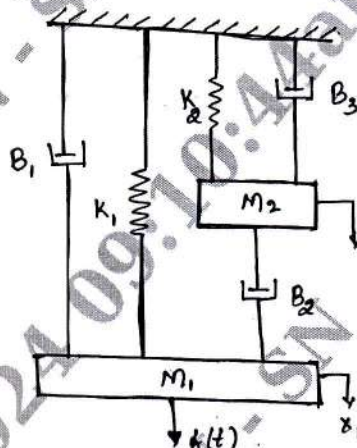


Fig.Q2(b)

(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) Settling time |
| (v) Rise 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).

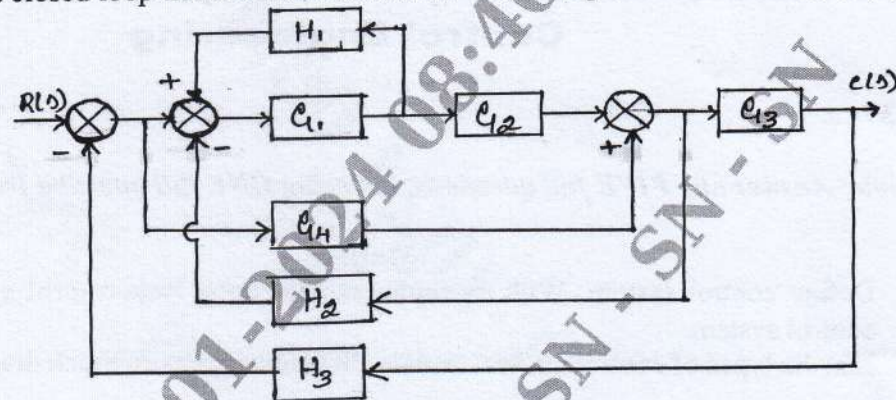


Fig.Q5(b)

(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.

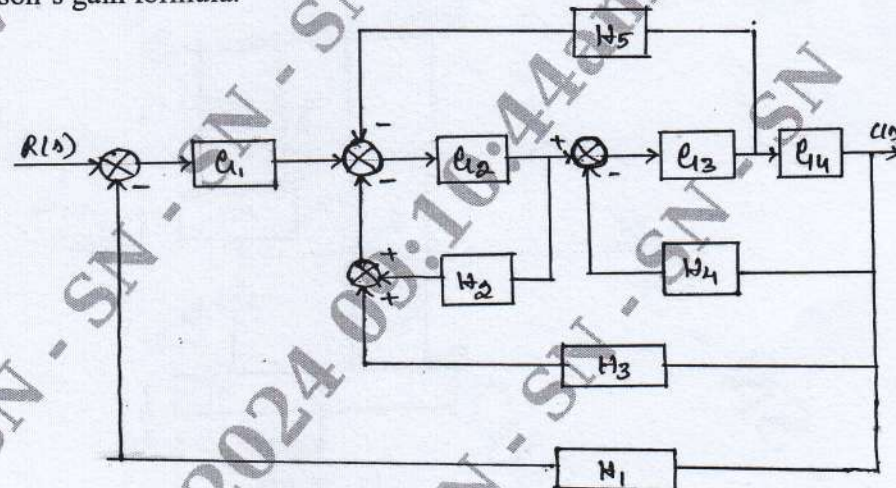


Fig.Q6(b)

(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.

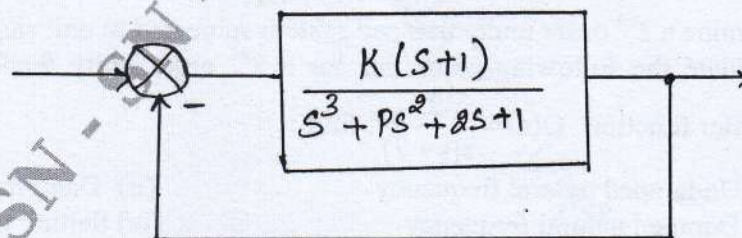


Fig.Q7(b)

(10 Marks)

OR

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

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

Module-5

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

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

OR

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

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