CBCS SCHEME

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18ME71



# Seventh Semester B.E. 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. Discuss the main requirements of an ideal control system. **(10 Marks)**

b. With block diagram, discuss:
i) Proportional controller
ii) Integral controller. **(10 Marks)**

**OR**

2 a. Derive the transfer function for an armature controlled D.C motor, which relates output angular displacement ($\theta$) with input voltage (e). **(10 Marks)**

b. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_1$. The 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 $\theta_0$. Obtain the transfer function of the system. **(10 Marks)**

### Module-2

3 a. Obtain an expression for unit step response of first order system and steady state error. **(10 Marks)**

b. Derive an expression for unit ramp response of first order system. **(10 Marks)**

**OR**

4 Obtain the expression for rise time, peak time, peak overshoot and settling time of a second order system. **(20 Marks)**

### Module-3

5 a. Describe the rules of reduction of block diagram. **(10 Marks)**

b. Obtain the overall transfer function of the block diagram as shown in Fig.Q.5(b) by reduction technique. **(10 Marks)**

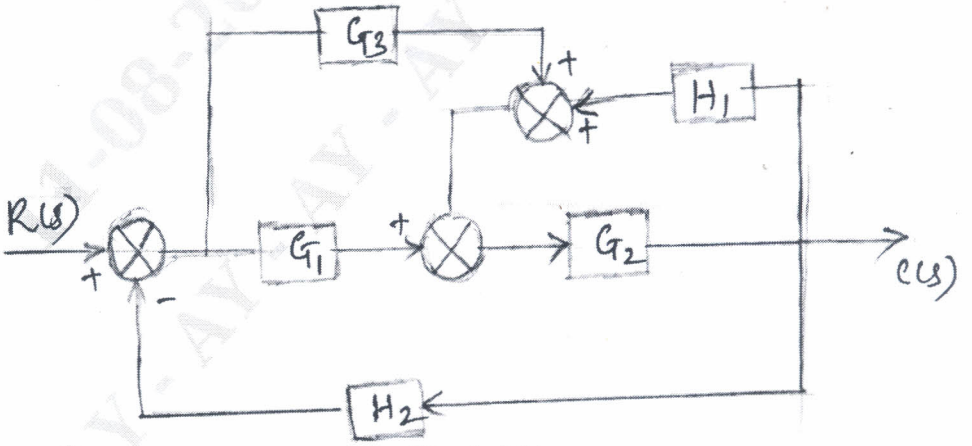


Fig.Q.5(b)

**OR**

6 a. Discuss the following with respect to signal flow graphs:
i) Input node
ii) Output node
iii) Forward path gain
iv) Feedback loop
v) Self loop. **(05 Marks)**

b. Discuss Mason's gain formula used to find the transfer function of signal flow graphs. **(05 Marks)**

c. Obtain overall transfer function of the signal flow graph as shown in Fig.Q.6(c) using Mason's gain formula. **(10 Marks)**

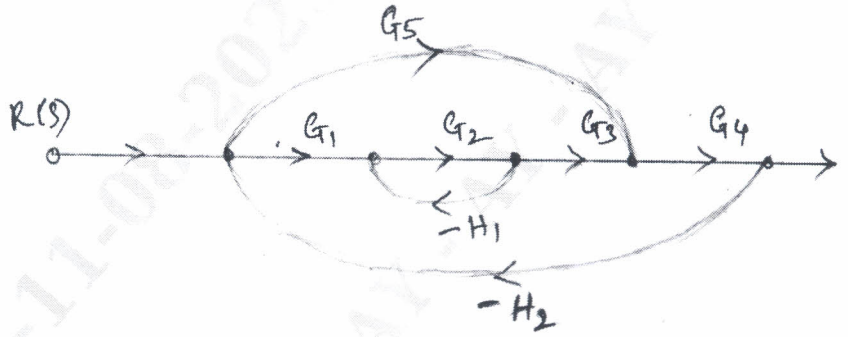


Fig.Q.6(c)

## Module-4

7 a. Investigate the stability of the system, using Routh Hurwitz criteria having the following characteristic equation.
$s^5 + 4s^4 + 12s^3 + 20s^2 + 30s + 100 = 0$ **(10 Marks)**

b. Ascertain the stability of the system using R.H. criteria having characteristics equation.
$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ **(10 Marks)**

**OR**

8 Sketch the root locus of the unity feed back system whose forward path transfer function is

$$G(s) = \frac{K}{(s^2 + 5s + 6)s}$$

Determine the range of K for the system to be stable. **(20 Marks)**

## Module-5

9 Using Nyquist criteria, investigate 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 Sketch the Bodeplot for

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

Determine:
i) Gain margin and phase margin
ii) Stability of the closed loop system. **(20 Marks)**

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