

(3 Hours)

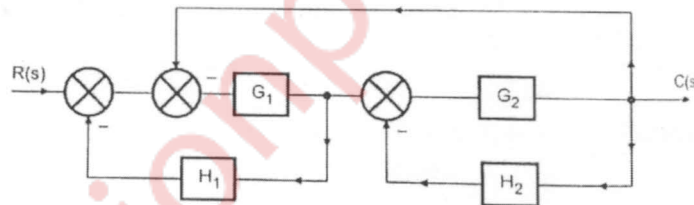


[Total marks: 80]

Instructions:

1. **Question 1 compulsory.**
2. **Schematic Diagrams/sketches** carry weightage.
3. Attempt any **three** questions from the remaining **five** questions.
4. Assume suitable data, **if necessary.**

- Q1) a) Temperature measurement devices, Enlist contact and non-contact types that are widely used in Industry and social life. Give their merits and demerits based on technology and handling of gazettes w.r.t. applications. 5
- b) Differentiate between open and closed loop system with example. 5
- c) What is the resolution in degrees of an encoder with 6 tracks? The number of increments per revolution is  $2^6$ . 5
- d) Comment on the stability for a given CE of a system  $S^6+2+3s^5+6s^3+4s^4+5s^2+3s=0$  5
- Q2) a) Obtain the Transfer function for the Block diagram using Standard Block reduction rules 7



- b) A strain gauge has gauge factor of 4. If the strain gauge is attached to a metal bar that stretches from 0.25m to 0.255m when strained, what is the percentage change in resistance? If the unstrained value of gauge is  $120 \Omega$ , what is the resistance value of gauge after application of strain? 5
- c) Illustrate the working principle for displacement measurement using "L.V.D.T." 8
- Q3) a) Enumerate the types of pressure measurement devices w.r.t. levels i.e. low, medium and high pressures to be measured. State the working principle for each pressure level with example. 10
- b) What are the different temperature compensation techniques used in the measurement of strain using strain gauges? Explain any two method's in details. 10
- Q4) a) Illustrate a mathematical model for a thermal system given in the **fig: 1** and represent its transfer function. The bath temperature is  $\theta_i$  and temperature indicated by thermometer is  $\theta_o$ . 10

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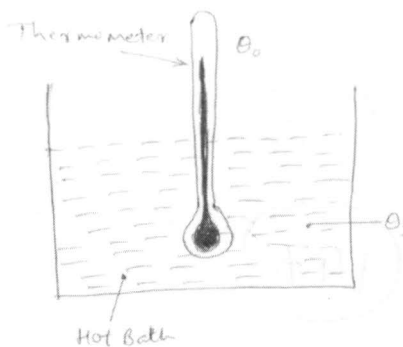


Fig: 1

- b) A system is given by differential equation ,  $\frac{d^2y}{dt^2} + 4 \frac{dy}{dt} + 8y = 8x$ , 10  
 where  $y =$  output and  $x =$  input. Determine all time domain specifications for unit step input and plot the response curve.
- Q5) a) Addition of Zeros in the numerator of a given system  $G(s) H(s)$  improves the stability of the system, then If  $(S + 4)$  is a zero added to a given system  $G(s) H(s) = K / s (s^2 + 2s + 2)$  ( $K$ , in numerator is a constant), Sketch the root locus and comment on its stability. 10
- b) A servomechanism is designed to keep a radar antenna pointed at a flying aeroplane. If the aeroplane is flying with a velocity of 600 km/hr, at a range of 2 km and the maximum tracking error is to be within  $0.1^\circ$ . Determine the required velocity error coefficient. 10
- Q6) a) What do you understand by a State-space modeling of a system? Define state space and state variables. 5
- b) Write a short note on PID controller. 5
- c) A feedback system has  $G(s) H(s) = 100 (s+4) / s (s + 0.5) (s + 10)$ . Determine GM, PM,  $\omega_{gc}$  and  $\omega_{pc}$ . Draw Bode plot and comment on its stability. 10