USN

06ME71

Seventh Semester B.E. Degree Examination, Dec.09/Jan.10
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain open loop and closed loop control systems, with block diagrams. What are the advantages and disadvantages of a closed loop system over an open loop system? **(10 Marks)**

b. What are the requirements of a control system? Briefly explain. **(05 Marks)**

c. Draw the block diagram of proportional integral controller and explain. **(05 Marks)**

2 a. Obtain the differential equations for the mechanical system shown in Fig.2(a). **(10 Marks)**

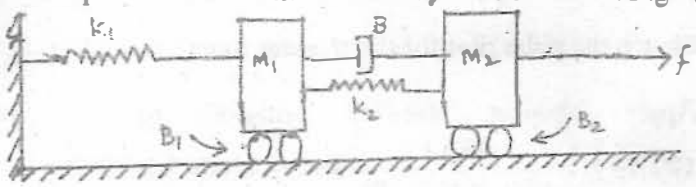

Fig.2(a)

b. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_i(t)$. 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 the thermometer is $\theta_o(t)$, obtain the transfer function of the system. **(10 Marks)**

3 a. Reduce the block diagram shown in Fig.3(a) to its simplest possible form and find its closed loop transfer function. **(10 Marks)**

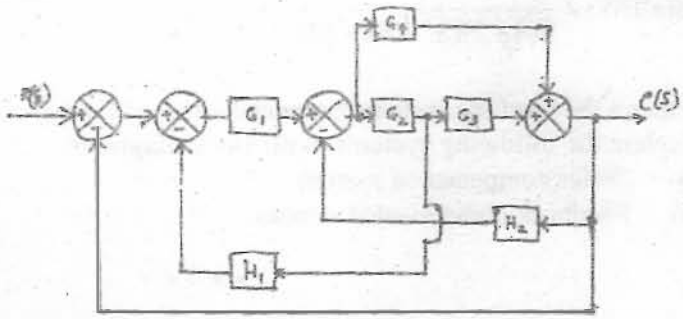

Fig.3(a)

b. For the system shown in Fig.3(b) determine $\frac{C(s)}{R(s)}$ using Mason's gain formula. **(10 Marks)**

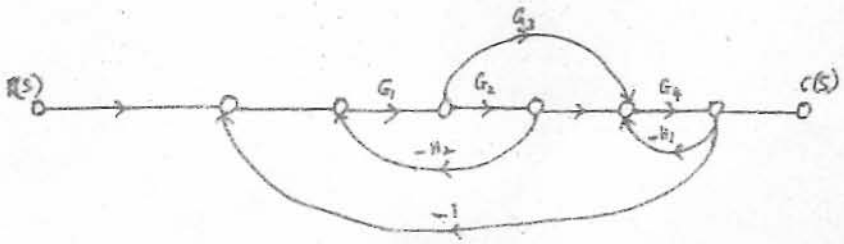

Fig.3(b).

4 a. Aunity feedback system is characterized by an open loop transfer function $G(S) = \frac{10}{S^2 + 5S + 6}$

Determine the following, when the system is subjected to a unit step input.

i) Undamped natural frequency
ii) Dampimg ratio
iii) Peak overshoot
iv) Peak time
v) Setting time. **(12 Marks)**

b. Ascertain the stability of the system given by the characteristic equation, $S^6 + 3S^5 + 5S^4 + 9S^3 + 8S^2 + 6S + 4 = 0$, by Routh Hurwitz criterion. **(08 Marks)**

PART – B

5 a. Sketch the polar plot for the transfer function $G(S) = \frac{10}{S(S+1)(S+2)}$. **(08 Marks)**

b. Apply Nyquist stability criterion to the system with transfer function $G(s)H(s) = \frac{4S+1}{S^2(1+S)(1+2S)}$ and ascertain its stability. **(12 Marks)**

6 Sketch the Bode plot for $G(s)H(s) = \frac{2}{S(S+1)(1+0.2S)}$. Also obtain gain margin and phase margin and crossover frequencies. **(20 Marks)**

7 Sketch the root locus plot for the system, whose open loop transfer function is given by $G(s)H(s) = \frac{K}{S(S+2)(S^2+8S+20)}$. **(20 Marks)**

8 a. Explain the need for system compensation. List the types of compensators used. **(10 Marks)**

b. Explain the following systems, with block diagrams.

i) Series compensated system
ii) Feedback compensated system. **(10 Marks)**

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