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10ME82

Eighth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Control Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain open loop and closed loop control system with block diagrams. **(10 Marks)**

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

c. Explain the proportional integral differential controller with applications. **(05 Marks)**

2 a. Obtain the differential equations for the mechanical system shown in Fig.Q2(a). **(10 Marks)**

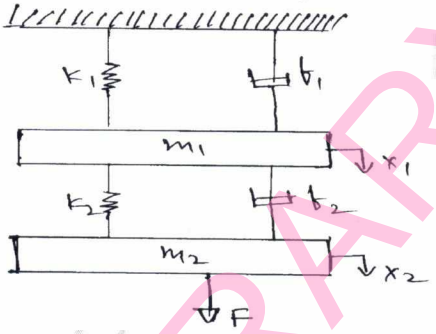

Fig.Q2(a)

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.Q3(a) to its simplest possible form and find its closed loop transfer function. **(10 Marks)**

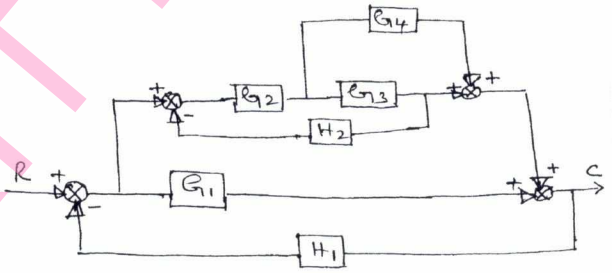

Fig.Q3(a)

b. Find C(s)/R(s) for the following system using Mason's gain rule shown in Fig.Q3(b).

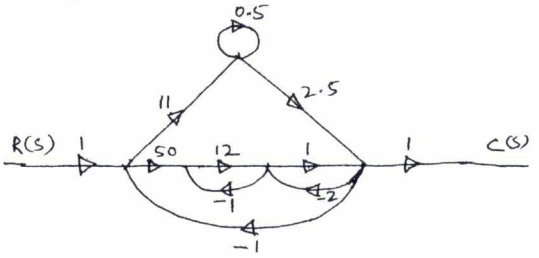

Fig.Q3(b) **(10 Marks)**

4 a. A unity feedback system has $G(s) = \dfrac{k}{s(s+2)(s^2+2s+5)}$

a) For a unit ramp i/p, it is desired $e_{ss} \leq 0.2$ Find k.

b) Determine e_{ss} if input $r(t) = 2 + 4t + \dfrac{t^2}{2}$ **(10 Marks)**

b. By applying Routh criterion, discuss the stability of the closed loop system as a function of k for the following open loop transfer function:

$$G(s)H(s) = \frac{k(s+1)}{s(s-1)(s^2+4s+16)}$$ **(10 Marks)**

PART – B

5 a. Sketch the polar plot for the transfer function $G(s) = \dfrac{1}{s(-s+a)}$ **(08 Marks)**

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

6 Sketch the Bode plot for

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

Also determine gain margin and phase margin and cross over frequencies. **(20 Marks)**

7 a. Explain the root locus rules with suitable examples. **(05 Marks)**

b. Sketch the root locus of a control system having open-loop transfer function is given by

$$G(s) = \frac{k}{s(s+2)(s^2+6s+25)}$$ **(15 Marks)**

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

b. Explain the series and feedback compensated system, with block diagrams. **(10 Marks)**

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