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10ME82

Eighth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 the concepts of openloop and closed loop control systems with two examples for each. (10 Marks)
- b. What are the requirements of an ideal control systems? (04 Marks)
- c. Explain the proportional Integral and Differential (PID) controller. (06 Marks)
- 2 a. Obtain the differential equations for the mechanical system shown in Fig.Q2 (a) and obtain the analogous electrical circuit based on the force voltage analogy. (12 Marks)

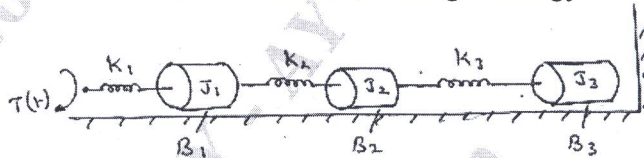


Fig. Q2 (a)

- b. A thermometer is dipped in a vessel containing liquid at a constant temperature θ_i . The thermometer has a thermal capacitance for storing heat as C and thermal resistance to heat flow as R. If the temperature indicated by the thermometer is θ_o , obtain the transfer function of the system. (08 Marks)
- 3 a. Reduce the block diagram, shown in Fig. Q3 (a) and determine its transfer function. (10 Marks)

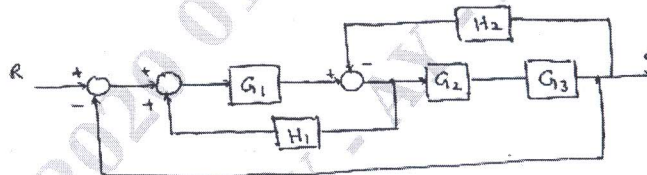


Fig. Q3 (a)

- b. Find $\frac{C(s)}{R(s)}$ by Mason's gain formula for the system shown in Fig. Q3 (b). (10 Marks)

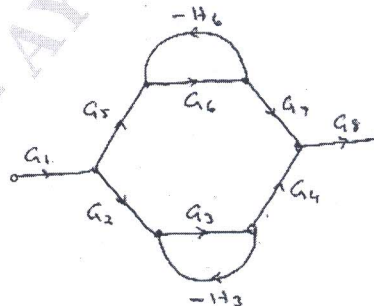


Fig. Q3 (b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 4 a. Derive an expression for the response of a first order system subjected to a unit step input. (04 Marks)
- b. When the system shown in Fig. Q4 (a) is subjected to a unit step input, its response is as shown in Fig. Q4 (b). Determine the values of K and T from the response curve. (08 Marks)

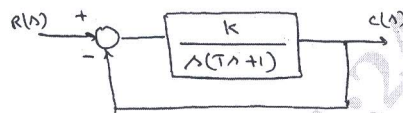


Fig. Q4 (a)

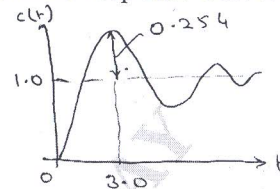


Fig. Q4 (b)

- c. By applying Routh's criterion, discuss the stability of the closed loop system whose characteristic equation is $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$. (08 Marks)

PART - B

- 5 a. Sketch the polar plot for $G(s)H(s) = \frac{1}{(1+5s)(1+10s)}$. (05 Marks)
- b. Sketch the Nyquist plot for a system whose open loop transfer function is, $G(s)H(s) = \frac{K}{s(s+2)(s+10)}$. Determine the range of K for which the system is stable. (15 Marks)
- 6 A unity feedback system has $G(s) = \frac{K}{s(s+4)(s+10)}$. Sketch the Bode plot and find the value of K for which the system is marginally stable. (20 Marks)
- 7 Sketch the root locus for the system $G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$. Discuss the stability of the system. (20 Marks)
- 8 a. Explain the need for system compensation. List the types of compensator used. (05 Marks)
- b. Explain : (i) Lead compensator (ii) Lag compensator (iii) Lag-Lead compensator. (15 Marks)

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