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10ME82

**Eighth Semester B.E. Degree Examination, June/July 2018**  
**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. What are the requirements of an ideal control system? (05 Marks)
  - b. Differentiate between open loop and closed loop control systems. (05 Marks)
  - c. With a block diagram, explain (i) Proportional controller (ii) Integral controller. (10 Marks)
- 2 a. A thermometer is dipped in a vessel containing liquid at a constant temperature of  $\theta_1(t)$ . 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  $\theta_0(t)$ . Obtain the transfer function of the system. (10 Marks)
  - b. With the help of circuit diagram for armature controlled D-C motor, obtain transfer function which relates angular displacement  $\theta$  of motor shaft to the armature input voltage. (10 Marks)
- 3 a. Obtain the overall transfer function of the block diagram, shown in Fig. Q3 (a) by reduction technique. (10 Marks)

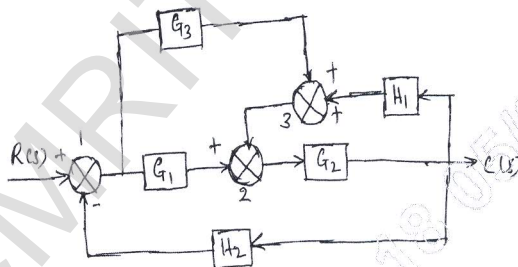


Fig. Q3 (a)

- b. Find the transfer function for the signal flow graph shown in Fig. Q3 (b) by using Mason's gain formula. (10 Marks)

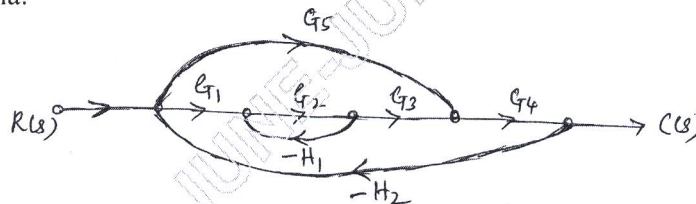


Fig. Q3 (b)

- 4 a. A unity feedback control system is characterized by an open loop transfer function  $G(s)H(s) = \frac{K}{s(s+10)}$ . Determine the system gain K, so that the system will have a damping ratio of 0.5. For this value of K, find the peak time, settling time and peak over shoot for a unit step input. (10 Marks)
- b. Comment on the stability of the system for the characteristic equation,  $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$  by Routh-Hurwitz criterion? (10 Marks)

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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.

**PART - B**

5 Using Nyquist criterion, 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)

6 Draw the Bode plot for the following transfer function and determine Gain margin and Phase margin,

$$G(s)H(s) = \frac{10.5}{(s+0.2)(s+0.8)(s+10)}$$
 (20 Marks)

7 Sketch the root locus plot of a unity feed back with an open loop transfer function,

$$G(s) = \frac{K}{s(s+2)(s+4)}$$
. Find the value of K for stability. (20 Marks)

8 a. Explain the series and feedback compensation, with block diagrams. (10 Marks)

b. Determine the controllability of control system with state equation,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

by Gilbert's test?

(10 Marks)

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