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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 $\theta_i(t)$. 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 $\theta_0(t)$. 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 θ 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)**

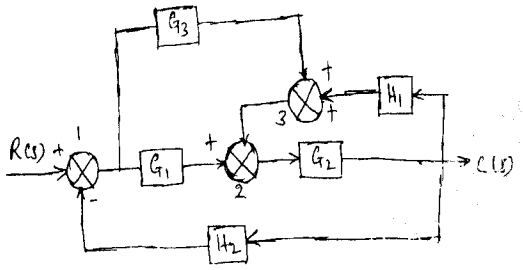

Fig. Q3 (a)

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

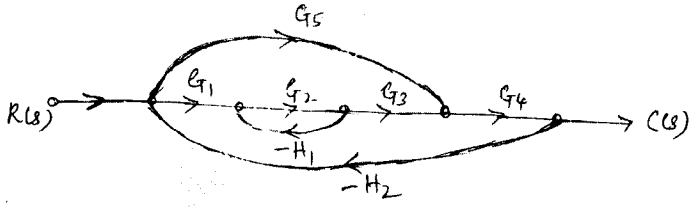

Fig. Q3 (b)

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)**

PART – B

5 Using Nyquist criterion, investigate the stability of a system whose open loop transf function is $G(s)H(s) = \frac{K}{(s+1)(s+2)(s+3)}$. (20 Mark

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

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

7 Sketch the root locus plot of a unity feed back with an open loop transfer functio $G(s) = \frac{K}{s(s+2)(s+4)}$. Find the value of K for stability. (20 Mark

8 a. Explain the series and feedback compensation. with block diagrams. (10 Mark

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 Mark

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