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)**
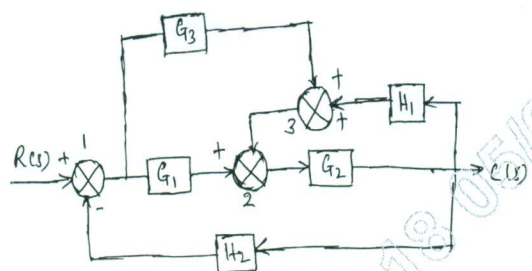

Fig. Q3 (a)

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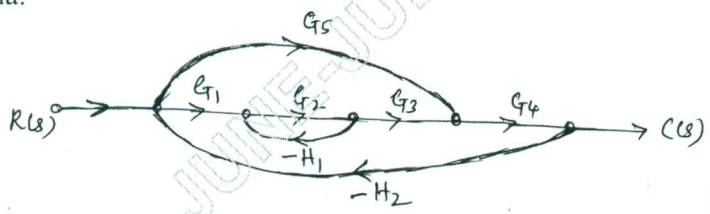

Fig. Q3 (b)

4   a.   A unity feedback control system is characterized by an open loop transfer function
         $G(s)H(s) = \dfrac{K}{s(s+10)}$. 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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PART – B

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

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

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

7   Sketch the root locus plot of a unity feed back with an open loop transfer function, $G(s) = \dfrac{K}{s(s+2)(s+4)}$. 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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