



- 4 a. Obtain an expression for time response of the first order system subjected to unit step input. (08 Marks)
- b. A unity feedback 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 peak time, settling time and peak overshoot for a unit step input. (08 Marks)
- c. Examine the stability of system whose characteristic equation is  $s^4 + 2s^3 + 3s^2 + 8s + 2 = 0$  using R-H criteria. (04 Marks)

**PART - B**

- 5 a. Sketch polar plot for the transfer function  $G(s)H(s) = \frac{12}{s(s+1)(s+2)}$ . (08 Marks)
- b. Obtain Nyquist diagram for the system shown in Fig. Q5 (b) and ascertain its stability. (12 Marks)



Fig. Q5 (b)

- 6 Sketch the Bode plot for a unity feed back system whose open loop transfer function is given by,
- $$G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$$
- From the Bode plot, determine
- Gain and phase cross over frequencies
  - Gain and phase margins
  - Comment on the stability of the closed loop system. (20 Marks)
- 7 Sketch the root locus for a negative feedback system whose open loop transfer function is given by,
- $$G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+4.5)}$$
- Comment on the stability of the system. (20 Marks)
- 8 a. Write notes on: (i) Lead compensator (ii) Lag compensator. (14 Marks)
- b. Verify whether the following system is observable or not.
- $$\begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} = \begin{bmatrix} -5 & 4 \\ -6 & 5 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} + \begin{Bmatrix} 1 \\ 1 \end{Bmatrix} u \text{ and } y = \begin{bmatrix} -2 & 3 \end{bmatrix} x$$
- (06 Marks)

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