TE (ELEX.) sem (V) R-19 C-scheme 03/06/25.

Duration 3 Hours **[Maximum Marks 80]**

NOTE:-1) Question 1 is **compulsory**
2) Solve **any three** from the remaining five questions
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks

Q.1. a. Explain open loop system with suitable example 5

b. What are the properties of state transition matrix? 5

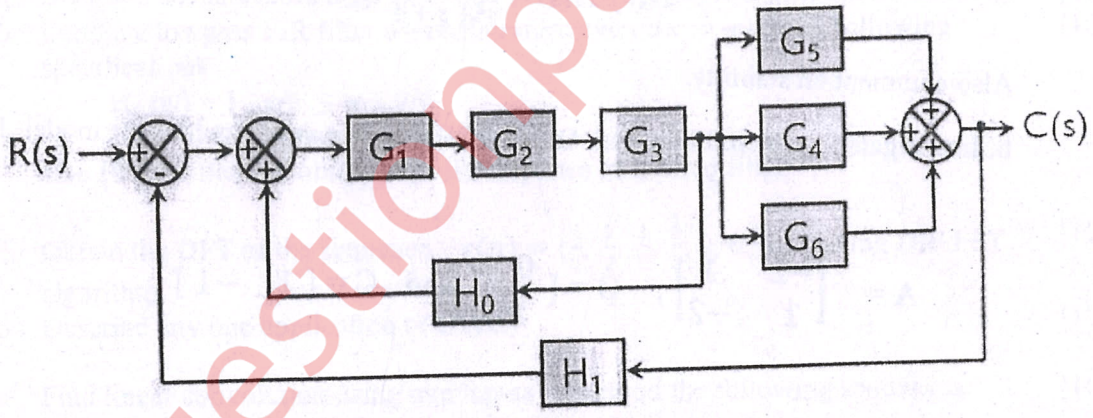
c. Explain Controllability & Observability with necessary condition for stability. 5

d. How to determine Gain Margin and Phase Margin from Polar Plot. 5

Q.2. a. Find Rise Time, Peak Time and Time Constant for system given by following transfer function 10

$$\frac{C(s)}{R(S)} = \frac{10}{(s^2 + 2s + 10)}$$

b. Obtain closed loop transfer function using **Block Diagram Reduction** Technique. 10



Q.3. a. For unity feedback system with open loop transfer function 10

$$G(s) = \frac{100}{(s^2)(s+4)(s+12)}$$

Determine, e_{ss} for k_p, k_v, k_a when input $r(t) = 2t^2 + 5t + 10$ is applied.

b. For unity feedback system with open loop transfer function 10

$$G(s) = \frac{4}{s(s+2)}$$

Determine damping factor, undamped natural frequency, resonant peak and resonant frequency.

Q.P. Code:- 82247

Program Code:- IT01135.

Q.4. a. Explain Lag Compensator design using Bode plot. 10

b. Obtain state variable model of transfer function 10

$$\frac{Y(s)}{R(s)} = \frac{30(s+1)}{(s+5)(s+2)(s+3)}$$

Q.5. a. The open loop transfer function of the system 10

$$G(s)\,H(s) = \frac{5}{s(s+1)(s+5)}$$

Using **Nyquist** criterion, examine closed loop stability of the system.

b. Sketch the **Root Locus** for open loop transfer function of the system 10

$$G(s)\,H(s) = \frac{k(s+1)}{s(s+2)(s+3)}$$

Q.6.a. Sketch the **Bode Plot** for open loop transfer function of the system 10

$$G(s)\,H(s) = \frac{4}{s^2+s+4}$$

Also comment on stability.

b. Investigate **Controllability** and **Observability** of the system with state model 10

$$A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix},\quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{ and } C = \begin{bmatrix} 1 & -1 \end{bmatrix}$$