PART – A

Answer all questions in Part A. Each question carries 4 marks.

1. Explain the merits and demerits of open loop and closed loop systems.

2. What do you mean by poles and zeros of a transfer function? Briefly explain how they influence the performance of a system.

3. State and explain Routh’s stability criterion.

4. Find the range of $K$ for which the system whose characteristic equation is given by $s^4 + 3s^3 + 3s^2 + 2s + K = 0$, is stable.

5. Explain the working of a tachogenerator.


7. What are dynamic error coefficients? What are their merits?

8. Explain the significance of Gain margin and Phase margin.

9. Explain frequency domain specifications.

10. What are compensators? Explain.
PART – B

Answer any one full question from each Module. Each question carries 20 marks.

Module – I

11. a) State and explain Mason’s gain formula.
   
   b) Find the transfer function by using signal flow graph method for the system given below:

   ![Signal Flow Graph Diagram]

   OR

12. a) Derive the transfer function of a field controlled DC servomotor.
   
   b) Find the transfer function $X_2(s)/F(s)$, for the given mechanical system.

   ![Mechanical System Diagram]
Module – II


b) The closed loop transfer function of a system is given by \( \frac{25}{s^2 + 6s + 25} \). Find all time response specifications.

OR

14. a) Explain the effect of adding zeros and poles on the performance of a system.

b) A unity feedback control system has an open loop transfer function

\[ G(s) H(s) = \frac{K(s + 1)}{s(s - 1)} \]. Sketch the root locus and show that the loci of complex roots are part of a circle. Find:

a) Centre and radius of the circle
b) Damping co-efficient for \( K = 3 \).

Module – III

15. a) Explain the following:

a) Non-minimum phase systems

b) Transportation lag

c) Log Magnitude Vs Phase plot.

b) Sketch the polar plot for \( G(s) H(s) = \frac{10}{s(s + 1)(s + 2)} \). Comment on the relative stability of the system.

OR

16. a) Explain how frequency domain analysis is useful for design of compensators.

b) A unity feedback control system has an open loop transfer function

\[ G(s) H(s) = \frac{K}{s(s + 1)} \]. Sketch the complete Nyquist plot and check the stability of the system.