

PART - A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. What are the advantages of state space analysis?
2. Write the canonical form for state model of nth order system.
3. Define controllability.
4. What is the need for observability test?
5. Draw the block diagram of a system with state feedback.
6. What is dynamic state feed back?
7. What is the necessary condition to be satisfied for design of state observer?
8. List the draw backs in transfer function model analysis.
9. Define sampling theorem.
10. List the advantages of digital controller.
11. Define region of convergence.
12. What is meant by sample data control system?
13. List the characteristics of non-linear systems.
14. Define dead zone.
15. What is meant by jump resonance?
16. Write the describing function of backlash non linearity.
17. Define asymptotic stability.
18. Define BIBO stability.
19. State the stability criterion for non-linear system.
20. Define frequency domain stability criteria.

PART - B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. The State model of a system is given by,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} [u], \quad Y = [1 \ 0 \ 0] \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$

Convert the state model to controllable phase variable form.

22. What is a state observer? Draw the block diagram of full order state observer and explain. Derive the necessary and sufficient condition for state observation.

23. Consider the system defined by $\dot{X} = \begin{bmatrix} -1 & 1 \\ 0 & 2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$

Show that this system cannot be stabilized by the feedback $\mu = -kx$ whatever matrix k is chosen.

24. Determine inverse Z-transform of $F(z) = \frac{1}{1 - \frac{3}{2}Z^{-1} + \frac{1}{2}Z^{-2}}$ when (a) Roc: $|z| > 1.0$ and (b) Roc: $|z| < 0.5$

25. Determine the Z transform of the following discrete sequences.

(a) $f(k) = u(k)$ (4)

(b) $f(k) = (1/2)^k u(k)$ (4)

(c) $f(k) = \alpha^k u(-k-1)$ (4)

26. Derive the describing function for dead zone and saturation point non linearity.

- 27.(i) Write notes on Limit cycles. (6)

(ii) Discuss the basic concept behind phase plane method. (6)

- 28.(i) Discuss the stability of non-linear system using Popov's stability criterion. (6)

(ii) Explain the Liapunov's stability analysis of the dynamical systems. (6)