



- (b) Consider that the characteristic equation of a third-order discrete - data control system is given as

$$F(z) = z^3 - 1.25z^2 - 1.375z - 0.25.$$

State whether system is stable or not stable.

- (c) Find the state space representation in the (i) Controllable Canonical form (ii) Diagonal canonical form for the system with transfer function.

$$C(z)/R(z) = (z + 6)/(3z^2 + 5z + 1).$$

3 Attempt any **two** parts : **10×2=20**

- (a) Write the statement of Cayley Hamilton theorem; also compute state transition matrix and matrix exponential.
- (b) Explain the non linearity issues of Dead Zone and Relay.
- (c) What is Lyapunov stability criterion ? Determine whether the following system is stable or not :

$$d^2x/dt^2 + dx/dt + (dx/dt)^3 + x^2 = 0.$$

4 Attempt any **two** parts : **10×2=20**

- (a) Formulate the optimal control problem using state space approach.
- (b) With the help of schematic diagram explain the principle of causality in dynamic programming.
- (c) Discuss the Bang-Bang control concept.

5 Attempt any **two** parts : **10×2=20**

- (a) What is a fuzzy-neural integrated system ? Discuss the salient features of neural network, also discuss its application.
- (b) Establish the relationship between PI and Fuzzy control, PD and Fuzzy logic control.
- (c) Compare PI, PD and PID controllers with the Fuzzy logic controller.

