

N.B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable calculator is **ALLOWED**.
- 4) Assume suitable data, if necessary.

Q.1 Explain in detail the state space representation of control system using physical variable. Consider an RLC network for explanation. (10)

OR

Q.1 a) Explain the concept of Eigen values and Eigen Vectors with example. (05)
b) Describe diagonalization technique for the system matrix with distinct and repeated roots. (05)

Q.2 a) Explain the concept of controllability with suitable example. (05)
b) Describe **Gilberts test** for complete state controllability. (05)

OR

Q.2 a) Explain the concept of controllability with suitable example. (05)
b) Describe **Kalman's test** for complete state controllability. (05)

Q.3 Explain in detail the phase plane method used in nonlinear system. State the necessary mathematical equations and draw required diagrams. (10)

OR

Q.3 a) Justify stability analysis using describing function. List the merits and demerits of describing function method. (05)
b) Explain the concept of existence of limit cycle. (05)

Q.4 Find the sequence $f(k)$ when $F(z)$ is given by (10)

$$F(z) = \frac{10z}{(z-1)(z-2)}$$

Use **power series** expansion method of finding inverse Z transform process.

OR

Q.4 Find the sequence $f(k)$ when $F(z)$ is given by (10)

$$F(z) = \frac{10z}{(z-1)(z-2)}$$

Use **partial fraction** expansion method of finding inverse Z transform process.

Q.5 Explain the Bilinear transformation used in analysis of discrete time system. Write necessary mathematical equations and draw figure/block diagram. (10)

OR

Q.5 Explain the solution of state equations for linear time invariant discrete time systems with reference to analysis of discrete time system. Write necessary mathematical equations and draw figure/block diagram. (10)

Q.6 Write short notes on the following with reference to advances in control system (Draw block diagram and explain working with practical applications) : Robust control system. (10)

OR

Q.6 Write short notes on the following with reference to advances in control system (Draw block diagram and explain working with practical applications) : Fuzzy logic system. (10)