

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** a) State the drawbacks of transfer function approach of analysis. What are the advantages of state-variable approach over classical approach? (05)
b) Define the concept of state, state variables, state vector and state space. Draw the block diagram representation of General Control System. (05)

OR

- Q.1** a) Explain in detail with diagram and mathematical expressions the state model of a linear single input single output system. (05)
b) State one application of state model in Power Sector. (05)

- Q.2** a) Explain homogeneous and non-homogeneous linear time invariant systems. (05)
b) Derive the solution of state equation for linear time invariant system. (05)

OR

- Q.2** a) Describe the importance of State Transition Matrix (STM). (05)
b) Explain the methods to determine STM using Infinite series method. (05)

- Q.3** a) Explain the concept of describing function. (05)
b) Describe the derivation of describing function of various non linear elements. (05)

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** Solve the following difference equation by using z-transform method. (10)
 $f(k+2) + 3f(k+1) + 2f(k) = 0;$
 $f(0) = 0, f(1) = 1$

OR

- Q.4** Find the response of the system described by the difference equation: (10)
 $f(k+2) - 5f(k+1) + 6f(k) = u(k)$
Given that, $f(0) = 0$ and $f(1) = 1$

- Q.5** Explain in detail analysis of discrete time system using routh's criteria with suitable mathematical equations/example. (10)

OR

- Q.5** Explain derivation of Pulse Transfer function of closed loop system. Write necessary mathematical equations and draw figure/block diagram. (10)

- Q.6** Write short notes on adaptive control system. Draw block diagram and explain working with practical applications. (10)

OR

- Q.6** Write short note on Model reference Adaptive control system. Draw block diagram and explain working with practical applications. (10)