

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2018

**MODERN CONTROL THEORY**  
(Electrical & Electronics Engineering)

Time: 3 hours

Max. Marks: 70

**PART – A**  
(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- What are the drawbacks in transfer function model analysis?
  - Write the properties of state transition matrix.
  - Define controllability and observability.
  - What is canonical form of state model?
  - What is pole placement by state feedback?
  - What is state observer?
  - What are limit cycles?
  - What is describing function?
  - Define the stability in the sense of Lyapunov.
  - State and explain the Lyapunov stability problem.

**PART – B**  
(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

- 2 Obtain the transfer function for the following state model.

$$\dot{x} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u \quad y = [0 \quad 1]X$$

OR

- 3 Construct a state model for a system characterized by a differential equation:

$$\ddot{y} + 6\dot{y} + 11y = \ddot{u} + 8\dot{u} + 17u + 8u$$

**UNIT – II**

- 4 Obtain Jordan canonical model for the system whose transfer function is:

$$\frac{Y(s)}{U(s)} = \frac{(s+3)}{(s+2)^2(s+5)}$$

OR

- 5 Explain with an example, the concept of controllability in continuous time-invariant systems.

**UNIT – III**

- 6 What are the effects of pole placement by state feedback? Explain the method of control system design by pole placement.

OR

- 7 Consider the system defined by:

$$\dot{x} = Ax, \quad y = Cx$$

$$\text{Where } A = \begin{bmatrix} -1 & 1 \\ 1 & -2 \end{bmatrix}, \quad C = [1 \quad 0]$$

Design a full order state observer. The desired Eigen values for the observer matrix are  $\mu_1 = -5, \mu_2 = -5$ .

**UNIT – IV**

- 8 Derive the describing function for relay with dead zone and hysteresis.

OR

- 9 Explain the stability analysis of non linear systems using phase trajectories.

**UNIT – V**

- 10 Check the stability of the system described by the state equation using Lyapunov's method:

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2; \quad \dot{x}_2 = -x_2$$

OR

- 11 Explain method of constructing Lyapunov functions by nonlinear continuous time autonomous systems.

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