

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

**CLASS: B.TECH
BRANCH: EEE**

**SEMESTER: VII
SESSION: MO/2022**

SUBJECT: EE439 APPLIED CONTROL THEORY

TIME: 2 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 25.
 2. Candidates attempt for all 25 marks.
 3. Before attempting the question paper, be sure that you have got the correct question paper.
 4. The missing data, if any, may be assumed suitably.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q1 (a) Define state variable. What is the general representation of a LTI system in state space form. [2]
- Q1 (b) Construct the state model for a system characteristic by the differential equation $D^3y/dt^3 + 4 d^2y/dt^2 + 3 dy/dt + 2y = u$. Give the block diagram representation of state model. [3]

Q2 For the transfer function $G(s) = \frac{10(s+2)}{(s+1)(s+3.5)}$ Obtain

- (a) Controllable Canonical Form [2]
- Q2 (b) Observable Canonical Form [3]

Q3 (a) Obtain the transfer function of the system given below and hence comment on the order of the system $\dot{x} = \begin{bmatrix} -1 & 0 \\ 0 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$; $y = [1 \ 0] x$ [2]

Q3 (b) Investigate the following system for controllability and observability [3]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \ 0] x$$

Q4 Obtain the state space representation of an armature-controlled DC motor. [5]

Q5 Find the state space model of the given electrical system [5]

