Department of Electrical and Electronics Engineering
Mar Athanasius College of Engineering, Kothamangalam
(Government Aided Autonomous Institution)

First Sessional Examination - August 2026
EET401_Advanced Control Systems - S7 EA & EB

Time: 1.5 Hrs. Max Marks: 40

Answer all questions from Part A and Part B

Part A [4*3 =12 marks]

1. A series RLC circuit is excited by a voltage source V(t), and the output is measured across the resistor. Derive the state model of the electrical system. **(CO1)**
2. Obtain the diagonal canonical form of the given system. **(CO1)**

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

3. Explain any three properties of the state transition matrix. **(CO2)**
4. Derive the relationship between transfer function and state model of a system. **(CO2)**

Part B [2*14 = 28 marks]

5. a) Develop the state space model of an armature-controlled DC motor. **[7 Marks] (CO1)**

   b) Consider the system given by transfer function,

$$\frac{Y(s)}{U(s)} = \frac{1}{s^3+7s^2+8s+2}$$

   Obtain state model in phase variable form of the system. **[7 Marks] (CO1)**

6. a) Compute the state transition matrix e^{At} for the system matrix A.

$$A=\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$

   [5 Marks] (CO2)

   b) Determine the transfer function of a system given below,

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} 1 & -2 \\ 4 & -5 \end{bmatrix}\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix} u \quad , \quad y = \begin{bmatrix} 1 & 1 \end{bmatrix}\begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

   [9 Marks] (CO2)

CO 1: Students will be able to develop the state variable representation of various physical systems.

CO 2: Students will be able to analyze the performance of LTI systems and discrete-time control systems using the state variable approach.

VISION

Endeavour to Ensure Excellence

MISSION

Mould technically competent and morally strong Engineers
Achieve dynamic leadership through quality Education
Cater the needs of industry and community through Emulation
Empower the students to serve the nation with Dedication