ADAMAS UNIVERSITY PURSUE EXCELLENCE	**ADAMAS UNIVERSITY** **END-SEMESTER EXAMINATION : MAY 2021** (Academic Session: 2020 – 21)		
Name of the Program:	B. Tech.	**Semester:**	VIII
Paper Title :	Elective – VI (Modern Control Systems)	**Paper Code:**	EEE44114
Maximum Marks :	**40**	**Time duration:**	2 Hours
Total No of questions:	8	**Total No of Pages:**	2
(Any other information for the student may be mentioned here)	Read complete question paper before starting the examination.		

Answer all the Groups

Group A

Answer all the questions of the following $5 \times 1 = 5$

1. a) State the advantages of modern control systems.
b) What are the basic elements required to construct a state diagram.
c) What are the limitations of transfer function analysis?
d) What do you mean by eigenvalues?
e) What is the importance of state transition matrix?

GROUP –B

Answer *any three* of the following $3 \times 5 = 15$

2. Using Cayley-Hamilton theorem, determine the state transition matrix of $\mathbf{A} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}$.

3. Find $f(\mathbf{A}) = \mathbf{A}^{10}$ for $\mathbf{A} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$.

4. The transfer function of a dynamical system is given by, $\dfrac{Y(s)}{U(s)} = \dfrac{2(s+5)}{(s+2)(s+3)(s+4)}$.

Obtain the diagonal canonical state model of the system.

5. For the system given by $\mathbf{A} = \begin{bmatrix} 0 & 2 & 0 \\ 4 & 0 & 1 \\ -48 & -34 & -9 \end{bmatrix}$, determine (a) eigenvalues and (b) eigen vectors.

GROUP –C

Answer *any two* of the following $2 \times 10 = 20$

6. Develop state space model of armature controlled separately excited DC motor. Also obtain its equivalent transfer function.

7. A system is described by $\dot{\mathbf{x}} = \begin{bmatrix} 0 & 1 \\ 9 & 0 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 9 \end{bmatrix} u$. Compute the state feedback gain matrix **K** so that control law $u = -Kx$ places the closed loop poles at $-3 \pm j3$ by, (a) using direct substitution method, and (b) using Ackermann's formula.

8. A system is described by $\dot{\mathbf{x}}(t) = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix} \mathbf{x}(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$. The system is initially at $\mathbf{x}(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$. Determine $\mathbf{x}(t)$ (i) with no input, (ii) with unit step input.