K25FY3271 Pages: 2 Reg No:................
Name:................

Third Semester FYUGP Degree (Reg) Examination November 2025

KU3DSCSTA202 - BASIC LINEAR ALGEBRA

2024 Admission onwards

Time : 1.5 hours Maximum Marks : 50

Section A

Answer any 6 questions. Each carry 2 marks.

1. Check if $A = \begin{pmatrix} 0 & 2 & -1 \\ -2 & 0 & 3 \\ 1 & -3 & 0 \end{pmatrix}$ is skew-symmetric.
2. Test whether $A = \begin{pmatrix} 2 & i \\ -i & 2 \end{pmatrix}$ is Hermitian.
3. What is meant by a subspace of a vector space? Give one example.
4. What is the difference between a vector and a scalar?
5. Why is it not possible to solve a system of equations $AX = B$ using the inverse matrix method if $\det(A) = 0$?
6. Explain the system of linear equations in echelon form and give an example.
7. Find the rank of
$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}.$$
8. If λ is an eigenvalue of A, show that λ^2 is an eigenvalue of A^2.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Solve the system using determinants (Cramer's rule):
$$\begin{cases} x + y + z = 3 \\ 2x - y + z = 4 \\ x + 2y - z = 1 \end{cases}$$
10. Solve the system using Cramer's rule:
$$\begin{cases} 2x + 3y - z = 5 \\ x - 2y + 4z = -3 \\ 3x + y + z = 10 \end{cases}$$

11. Reduce the following matrix to row canonical form:
$$\begin{bmatrix} 1 & 2 & -1 & 1 \\ 2 & 4 & 0 & 3 \\ 3 & 6 & -1 & 4 \end{bmatrix}$$
12. Find the rank of
$$\begin{bmatrix} 1 & 2 & -1 \\ 2 & 4 & 1 \\ 3 & 6 & 0 \end{bmatrix}$$
using row reduction.
13. Verify the Cayley–Hamilton theorem for
$$A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}.$$
14. Show that the eigenvalues of a triangular matrix are its diagonal elements.

Section C

Answer any 1 questions. Each carry 14 marks.

15. Show that if $\det(A) = 0$, then A is singular. Verify with $A = \begin{pmatrix} 2 & 4 & 6 \\ 1 & 2 & 3 \\ 3 & 6 & 9 \end{pmatrix}$.
16. (a) What is meant by the basis and dimension of a space?
    (b) Find basis and dimension of span$\{(1, 2), (2, 4)\}$.
    (c) Find standard matrix of $T(x, y) = (x + y, x - y)$.