

Mid-West University
Examinations Management Office

Surkhet, Nepal

End Semester Examination-2080

Level: B.Ed./ II Semester

Time: 3.00 hrs.

FM: 60

PM: 30

Sub: Matrix Algebra (MATH 424/325)

Candidates are required to give their answers in their own words as far as practicable.

Attempt all the questions.

Group "B"

6×5 = 30

1. Define hermitian matrix. Show that matrix

$$A = \frac{1}{2} \begin{pmatrix} 1+i & 1-i \\ 1-i & 1+i \end{pmatrix} \text{ are hermitian and unitary.}$$

2. Prove that:

$$\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$$

3. If $A = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 3 & -5 \\ -1 & 2 \end{pmatrix}$ Verify that $(AB)^{-1} = B^{-1}A^{-1}$

Or

If $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 1 & 5 & 12 \end{bmatrix}$ compute $\text{adj}(A)$ and prove that $A \cdot \text{adj}(A) = \text{adj}(A) \cdot A$.

4. Find the row rank of the following matrix.

$$\begin{bmatrix} -1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & -5 & 7 \end{bmatrix}$$

5. Define linear dependence. The representation of any vector in a vector space in terms of its basis vectors is unique.

6. Let V and W be two vector spaces over the same field F and $T: V \rightarrow W$ be a linear transformation then,
I. $\text{Ker}(T)$ is a subspace of V
II. $\text{Im}(T)$ is a subspace of W

Or

Define dual space. The inverse of a linear transformation is linear.

Group "C"

2×10=20

7. Define eigen values and eigen vectors. Find the eigen values and eigen

vectors of the matrix. $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

8. Define basis with an example. Every finite dimensional non-zero vector space has an orthogonal basis.

Or

Solve the following system of equations

$$2x+3y+z = 9$$

$$x+2y+3z = 6$$

$$3x+y+2z = 8 \quad \text{Using elementary row operations.}$$

THE END

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Group "A"

$10 \times 1 = 10$

Tick (✓) the best answer.

1. A diagonal matrix is a square matrix whose ... elements are all zero.
- a. diagonal
 - b. non diagonal
 - c. triangular
 - d. non triangular

2. If A is a unit matrix then its determinant is...
- a. Unity
 - b. Trace
 - c. Hermitian
 - d. Congugate

3. A square matrix A is called idempotent if;
- a. $A^n = 0$
 - b. $A^2 = I$
 - c. $A = 0$
 - d. $A^2 = A$

4. If $A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 6 & 10 \end{bmatrix}$ Rank of A = ?
- a. 3
 - b. 2
 - c. 1
 - d. 0

5. Which one of the following condition are satisfied?
- a. $\|u\| < \text{and } \|u\| = 0 \text{ iff } u = 0$
 - b. $\|cu\| \neq |c| \|u\|, \forall u \in V \text{ \& scalar } c.$
 - c. $\|u+v\| \geq \|u\| + \|v\|$
 - d. $|\langle u, v \rangle| \leq \|u\| \|v\|$

6. The standard basis of \mathbb{R}^n is an,
- a. Orthogoal vector
 - b. Orthonormal vector
 - c. Orthogonal basis
 - d. Orthonormal basis

7. A linear transformation T is said to be:

- a. Singular
- b. Non singular
- c. Unique
- d. Symmetric

8. The square matrix A and its transpose A^T have the same...

- a. eigen values
- b. eigen vector
- c. triangular matrix
- d. diagonal element

9. The system of linear equation is inconsistent is...

- a. infinite solution
- b. unique solution
- c. no solution
- d. all of the above

10. Which one of the followings is a not property of transposed matrices?

- a. $(A^T)^T = (A)^{T^2}$
- b. $(A+B)^T = A^T + B^T$
- c. $(KA)^T = KA^T$
- d. $(AB)^T = B^T A^T$