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Maximum Weight : 10

Section II

ME 010 102—MCQ—LINEAR ALGEBRA

[TO BE ATTACHED TO THE MAIN ANSWER-BOOK]

M.Sc. DEGREE (C.S.S.) PRIVATE EXAMINATION, MAY 2026

DO NOT WRITE YOUR REGISTER NUMBER OR NAME ANYWHERE IN SECTION II OF THE QUESTION PAPER

Answer all questions.

All questions carry equal weight.

Put a tick mark [✓] in the column against the correct answer.

1. If the dimensions of subspaces V_1 and V_2 of a vector space V are 8 and 10 respectively and $\dim(V_1 + V_2) = 4$, then $\dim(V_1 \cap V_2)$ is :

(A) 10.

☐

(B) 14.

☐

(C) 22.

☐

(D) 8.

☐

2. Which of the following is not a property of a vector space V over the field F where $\alpha, \beta \in V$ and $a, b \in F$:

(A) $(a + b)\alpha = a\alpha + b\alpha$.

☐

(B) $a(b\alpha) = (ab)\alpha$.

☐

(C) $\alpha\beta = \beta\alpha$.

☐

(D) $\alpha + \beta \in V$.

☐

3. Which of the following subsets are subspace of the vector space of all $n \times n$ matrices over R :

(A) Set of all matrices whose diagonal elements are all 0.

☐

(B) Set of all matrices whose diagonal elements are all 1.

☐

(C) Set of all matrices whose determinant is 1.

☐

(D) Set of all matrices whose trace is 0.

☐

4. Consider the vector space R^2 over R and let $S = (4, 0)$. then $\text{span}(S)$ is :

(A) S .

☐

(B) $\{(x, 0) | x \in R\}$.

☐

(C) $\{(0, y) | y \in R\}$.

☐

(D) R^2 .

☐

Turn over





26151743

5. Which of the following is correct for a vector space V and a linear transformation T :

(A) $\text{Rank}(V) + \text{Nullity}(V) = \dim(T)$. ☐

(B) $\text{Rank}(T) + \text{Nullity}(T) = \dim(V)$. ☐

(C) $\text{Rank}(V) + \text{Nullity}(T) = \dim(T)$. ☐

(D) $\text{Rank}(T) + \text{Nullity}(V) = \dim(T)$. ☐

6. The sum of dimensions of a subspace and its annihilator is :

(A) Dimension of the full space. ☐

(B) 0. ☐

(C) < 0 . ☐

(D) > 0 . ☐

7. Rank of a linear functional is :

(A) 0. ☐

(B) 1. ☐

(C) Can take any value. ☐

(D) None. ☐

8. If A is an $m \times n$ matrix, then the null space of A :

(A) A subspace of $\mathbb{R}^n$. ☐

(B) A subspace of $\mathbb{R}^m$. ☐

(C) A subspace of $\mathbb{R}^{mn}$. ☐

(D) A subspace of $\mathbb{R}^{\min(m,n)}$. ☐

9. For a matrix A , the row space of A^T is same as :

(A) Row space of A . ☐

(B) Column space of A . ☐

(C) Column space of A^T . ☐

(D) Null space of A . ☐

10. If A is an $n \times n$ matrix with real entries and rows of A are linearly independent, then :

(A) $\det A = 0$. ☐

(B) $\det A \neq 0$. ☐

(C) $\det A < 0$. ☐

(D) $\det A > 0$. ☐





26151743

11. The determinant function on the set of $n \times n$ matrices over the field F is not :
 (A) One-one. ☐ (B) Onto. ☐
 (C) n -linear. ☐ (D) Alternating. ☐
12. If A is an nn matrix over a field R with $\det A = 30$, then the determinant of the matrix obtained by interchanging two columns of A is :
 (A) -30 . ☐ (B) $1/30$. ☐
 (C) $3 \cdot 30$. ☐ (D) 0 . ☐
13. If $A^2 - A + I = 0$, then $A^{-1} = ?$
 (A) A^2 . ☐ (B) $A + I$. ☐
 (C) $A - I$. ☐ (D) $I - A$. ☐
14. Let σ and τ be the permutations of degree 4 defined by $\sigma 1 = 2, \sigma 2 = 3, \sigma 3 = 4, \sigma 4 = 1, \tau 1 = 3, \tau 2 = 1, \tau 3 = 2, \tau 4 = 4$. Then :
 (A) Both σ and τ are odd permutations. ☐
 (B) Both σ and τ are even permutations. ☐
 (C) σ is odd and τ is even permutation. ☐
 (D) σ is even and τ is odd permutation. ☐
15. If D is an alternating function on the set of $n \times n$ matrices over a field F and A' is the matrix obtained by interchanging any two rows of A , then $D(A')$ is :
 (A) $D(A)$. ☐ (B) 0 . ☐
 (C) $-D(A)$. ☐ (D) 1 . ☐
16. Which of the following is the characteristic polynomial of an $n \times n$ matrix A ?
 (A) $f(x) = \det (xI - A)$. ☐ (B) $f(x) = \det (xI - A^2)$. ☐
 (C) $f(x) = \det (xI + A)$. ☐ (D) $f(x) = \det (I - xA)$. ☐

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26151743

17. Choose the correct statement :

- (A) Characteristic polynomial divides the minimal polynomial. ☐
- (B) Characteristic polynomial and minimal polynomial has the same degree. ☐
- (C) Minimal polynomial divides the characteristic polynomial. ☐
- (D) The sum of minimal and characteristic polynomial is the zero polynomial. ☐

18. Let T be a linear operator on a vector space V . A subspace W is invariant under T if :

- (A) $T(W) = \phi$. ☐ (B) $T(W) = W$. ☐
- (C) $T(W) \subset W$. ☐ (D) $T(W) \cup W = \{0\}$. ☐

19. Suppose that E is a projection on a vector space V . Let R be the range of E and let N be the null space of E . Then :

- (A) $V = R \cup N$. ☐ (B) $V = R \cap N$. ☐
- (C) $R \oplus N = \phi$. ☐ (D) $V = R \oplus N$. ☐

20. Find the matrix with two distinct characteristic values :

- (A) $A = \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$. ☐ (B) $A = \begin{bmatrix} -1 & 0 \\ 2 & -1 \end{bmatrix}$. ☐
- (C) $A = \begin{bmatrix} 2 & -2 \\ 0 & 2 \end{bmatrix}$. ☐ (D) $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$. ☐

No. of MCQ's attempted

Weight Scored

(To be entered by the examiner)

No. of MCQ's not attempted

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