MGU-BSc - BCS - 202 -[Computer Science]-[Complimentary - III]-Second Semester-Mathematics-II

Unit-1-Linear Algebra: Vector Spaces-MCQs

1. Addition of vectors is given by the rule
   (A) $(a_1, b_1) + (a_2, b_2) = (a_1 + a_2, b_1 + b_2)$
   (B) $(a_1, b_1) + (a_2, b_2) = (a_1 + b_1, a_2 + b_2)$
   (C) $(a_1, b_1) + (a_2, b_2) = (a_1 + b_2, b_1 + a_2)$
   (D) $(a_1, b_1) + (a_2, b_2) = (a_1 + a_2 + b_1 + b_2)$

2. If V is said to form a vector space over F for all x, y $\in$ V and α, β $\in$ F, which of the equation is correct:
   (A) $(\alpha + \beta)\, x = \alpha x \,.\, \beta x$
   (B) $\alpha\,(x + y) = \alpha x + \alpha y$
   (C) $(\alpha + \beta)\, x = \alpha x \cup \beta x$
   (D) $(\alpha + \beta)\, x = \alpha x \cap \beta x$

3. In any vector space V (F), which of the following results is correct?
   (A) $0 \,.\, x = x$
   (B) $\alpha \,.\, 0 = \alpha$
   (C) $(-\alpha)x = -(\alpha x) = \alpha(-x)$
   (D) None of the above

4. If α, β $\in$F and x, y $\in$ W, a non empty subset W of a vector space V(F) is a subspace of V if –
   (A) $\alpha x + \beta y \in W$
   (B) $\alpha x - \beta y \in W$
   (C) $\alpha x \,.\, \beta y \in W$
   (D) $\alpha x / \beta y \in W$

5. If L, M, N are three subspaces of a vector space V, such that $M \subseteq L$ then
   (A) $L \cap (M + N) = (L \cap M) \,.\, (L \cap N)$
   (B) $L \cap (M + N) = (L + M) \cap (L + N)$
   (C) $L \cap (M + N) = (L \cap M) + (L \cap N)$
   (D) $L \cap (M + N) = (L \cap M \cap N)$

6. Under a homomorphism $T : V \to U$, which of the following is true?
   (A) $T(0) = 1$
   (B) $T(-x) = -T(x)$
   (C) $T(0) = \infty$
   (D) None of the above

7. If A and B are two subspaces of a vector space V(F), then

(A) $\frac{A+B}{A} \cong \frac{B}{A \cap B}$.

(B) $\frac{B+A}{B} \cong \frac{A}{B \cap A}$

(C) A + B = A ∩ B

(D) Both (A) and (B)

Ans: (A) $\frac{A+B}{A} \cong \frac{B}{A \cap B}$.

8. If V = R^4(R) and S = {(2, 0, 0, 1), (– 1, 0, 1, 0)}, then L(S)

(A) {(2α + β, 0, β, α) | α, β ∈ R}

(B) {(2αβ+β, 0, β, α) | α, β ∈ R}

(C) {(2αβ – β, 0, β, α) | α, β ∈ R}

(D) {(2α – β, 0, β, α) | α, β ∈ R}

9. If V is said to form a *vector space* over F for all x, y ∈ V and α, β ∈ F, which of the equation is correct:

(A) (αβ) *x* = α (β*x*)

(B) (α + β) x = αx . βx

(C) (α + β) x = αx ∪ βx

(D) (α + β) x = αx ∩ βx

10. If V is an inner product space, then

(A) (0, v) = 0 for all v ∈ V

(B) (0, v) = 1 for all v ∈ V

(C) (0, v) = ∞ for all v ∈ V

(D) None of the above

11. If V be an inner product space, then

(A) || x - y || ≤ || x || + || y || for all x, y ∈ V

(B) || x + y || ≤ || x || + || y || for all x, y ∈ V

(C) || x + y || ≥ || x || + || y || for all x, y ∈ V

(D) || x - y || ≥ || x || + || y || for all x, y ∈ V

12. If V be an inner product space, then

(A) $\|x + y\|^2 + \|x – y\|^2 = 2 (\|x\|^2 - \|y\|^2)$

(B) $\|x + y\|^2 + \|x – y\|^2 = 2 (\|x\| + \|y\|)^2$

(C) $\| x + y \|^2 + \| x - y \|^2 = 2 (\| x \|^2 + \| y \|^2)$
(D) $\| x + y \|^2 + \| x - y \|^2 = 2 (\| x + y \|)^2$

13. In Cauchy-Schwarz inequality, the absolute value of cosine of an angle is at most
    (A) 1
    (B) 2
    (C) 3
    (D) 4

14. If A and B are two subspaces of a FDVS V then, dim (A + B) is equal to
    (A) dim A + dim B + dim $(A \cap B)$
    (B) dim A – dim B – dim $(A \cap B)$
    (C) dim A + dim B – (dim A $\cap$ dim B)
    (D) dim A + dim B – dim $(A \cap B)$

15. If A and B are two subspaces of a FDVS V and $A \cap B = (0)$ then
    (A) dim (A + B) = dim A $\cup$ dim B
    (B) dim (A + B) = dim A + dim B
    (C) dim (A + B) = dim A $\cap$ dim B
    (D) dim (A + B) = dim (A + B)

16. If V be an inner product space and $x, y \in V$ such that $x \perp y$, then
    (A) $\| x + y \|^2 = \| x \|^2 + \| y \|^2$
    (B) $\| x + y \|^2 = \| x \|^2 . \| y \|^2$
    (C) $\| x + y \|^2 = \| x \|^2 \cup \| y \|^2$
    (D) $\| x + y \|^2 = \| x \|^2 \cap \| y \|^2$

17. If V be a finite dimensional space and $W_1, \ldots, W_m$ be subspaces of V such that, $V = W_1 + \ldots + W_m$ and dim V = dim W_1 + ... + dim W_m, then
    (A) V = 0
    (B) $V = \dim W_1 \oplus \ldots \oplus W_m$
    (C) $V = \infty$
    (D) $V = W_1 \oplus W_2 + \ldots + \oplus W_m$

18. If V is a finite dimensional inner product space and W is a subspace of V, then
    (A) $V = W . W^{\perp}$
    (B) $V = W + W^{\perp}$
    (C) $V = W \oplus W^{\perp}$
    (D) $V = W \cap W^{\perp}$

19. If W is a subspace of a finite dimensional inner product space V, then
    (A) $(W^{\perp})^{\perp} = W$
    (B) $(W^{\perp})^{\perp} \neq W$
    (C) $(W^{\perp})^{\perp} \leq W$
    (D) $(W^{\perp})^{\perp} \geq W$

20. If W_1 and W_2 be two subspaces of a vector space V(F) then
   (A) $W_1 + W_2 = \{w_1 + w_2 \mid w_1 \in W_1, w_2 \in W_2\}$
   (B) $W_1 + W_2 = \{w_1 . w_2 \mid w_1 \in W_1, w_2 \in W_2\}$
   (C) $W_1 + W_2 = \{w_1 \cap w_2 \mid w_1 \in W_1, w_2 \in W_2\}$
   (D) $W_1 + W_2 = \{w_1 \cup w_2 \mid w_1 \in W_1, w_2 \in W_2\}$

21. If {w1,..., wm} is an orthonormal set in V, then for all $v \in V$ $\sum_{i=1}^{m} |(w_i, v)|^2$ is
   (A) Greater than or equal to $\| v \|^2$
   (B) Less than or equal to $\| v \|^2$
   (C) Greater than $\| v \|^2$
   (D) Less than $\| v \|^2$

22. If W is a subspace of V and $v \in V$ satisfies $(v, w) + (w, v) \leq (w, w)$ for all $w \in W$ where V is an inner product, then
   (A) $(v, w) = \infty$
   (B) $(v, w) = 1$
   (C) $(v, w) = 2$
   (D) $(v, w) = 0$

23. If S_1 and S_2 are subsets of V, then:
   (A) $L(L(S_1)) = L(S_1)$
   (B) $L(L(S_1)) = L(S_2)$
   (C) $L(L(S_1)) = L(V)$
   (D) $L(L(S_1)) = L(S_1.S_2)$

24. If V be an inner product space and two vectors $u, v \in V$ are said to be orthogonal if
   (A) $(u, v) = 1 \Leftrightarrow (v, u) = 1$
   (B) $(u, v) \neq 0 \Leftrightarrow (v, u) \neq 0$
   (C) $(u, v) = 0 \Leftrightarrow (v, u) = 0$
   (D) $(u, v) = \infty \Leftrightarrow (v, u) = \infty$

25. A set $\{u_i\}_i$ of vectors in an inner product space V is said to be orthogonal if
   (A) $(u_i, u_j) = 0$ for $i \neq j$
   (B) $(u_i, u_j) = 1$ for $i \neq j$
   (C) $(u_i, u_j) = \infty$ for $i \neq j$
   (D) $(u_i, u_j) = 2$ for $i \neq j$

26. If V and U be two vector spaces over the same field F where $x, y \in V$; $\alpha, \beta \in F$, then a mapping $T : V \rightarrow U$ is called a homomorphism or a linear transformation if
   (A) $T(\alpha x + \beta y) = \alpha T(x) . \beta T(y)$
   (B) $T(\alpha x + \beta y) = \alpha T(x) + \beta T(y)$
   (C) $T(\alpha x + \beta y) = \alpha T(x) - \beta T(y)$

(D) $T(\alpha x + \beta y) = \alpha T(y) + \beta T(x)$

27. In any vector space V (F), which of the following results is correct?
    (A) $0 . x = 0$
    (B) $\alpha . 0 = 0$
    (C) $(\alpha - \beta)x = \alpha x - \beta x$, $\alpha, \beta \in F$, $x \in V$
    (D) All of the above

28. If V is said to form a vector space over F for all $x, y \in V$ and $\alpha, \beta \in F$, which of the equation is correct:
    (A) $(\alpha + \beta) x = \alpha x + \beta x$
    (B) $(\alpha + \beta) x = \alpha x . \beta x$
    (C) $(\alpha + \beta) x = \alpha x \cup \beta x$
    (D) $(\alpha + \beta) x = \alpha x \cap \beta x$

29. The sum of two continuous functions is ________________.
    (A) Non continuous
    (B) Continuous
    (C) Both continuous and non continuous
    (D) None of the above

30. A non empty subset W of a vector space V(F) is said to form a subspace of ___ if W forms a vector space under the operations of V.
    (A) V
    (B) F
    (C) W
    (D) None of the above

31. If S_1 and S_2 are subsets of V, then:
    (A) $L(S_1 \cup S_2) = L(S_1) + L(S_2)$
    (B) $L(S_1 \cup S_2) = L(S_1) . L(S_2)$
    (C) $L(S_1 \cup S_2) = L(S_1) \oplus L(S_2)$
    (D) $L(S_1 \cup S_2) = L(S_1) \cap L(S_2)$

32. To be a subspace for a non empty subset W of a vector space V (F), the necessary and sufficient condition is that W is closed under __________________.
    (A) Subtraction and scalar multiplication
    (B) Addition and scalar division
    (C) Addition and scalar multiplication
    (D) Subtraction and scalar division

33. If $V = F_2^2$, where $F_2 = \{0, 1\}$ mod 2 and if $W_1 = \{(0, 0), (1, 0)\}$, $W_2 = \{(0, 0), (0, 1)\}$, $W_3 = \{(0, 0), (1, 1)\}$ then $W_1 \cup W_2 \cup W_3$ is equal to
    (A) $\{(0, 0), (1, 0), (0, 1), (1, 1)\}$

(B) {(1, 0), (1, 0), (1, 1), (1, 1)}
(C) {(0, 1), (1, 1), (0, 1), (1, 1)}
(D) {(0, 0), (1, 1), (1, 1), (1, 0)}

34. If the space V (F) = F^2 (F) where F is a field and if W_1 = {(a, 0) | a ∈ F}, W_2 = {(0, b) | *b* ∈ F}then V is equal to
(A) $W_1 + W_2$
(B) $W_1 \oplus W_2$
(C) $W_1 . W_2$
(D) None of the above

35. If V be the vector space of all functions from **R** → **R** and V_e = {f ∈ V | f is even}, V_o = {f ∈ V | f is odd}. Then V_e and V_o are subspaces of V and V is equal to
(A) $V_e . V_o$
(B) $V_e + V_o$
(C) $V_e \cup V_o$
(D) $V_e \oplus V_o$

36. L(S) is the smallest subspace of V, containing _________.
(A) V
(B) S
(C) 0
(D) None of the above

37. If S_1 and S_2 are subsets of V, then
(A) $S_1 \subseteq S_2 \Rightarrow L(S_1) \subseteq L(S_2)$
(B) $S_1 \subseteq S_2 \Rightarrow L(S_1) \cap L(S_2)$
(C) $S_1 \subseteq S_2 \Rightarrow L(S_1) \cup L(S_2)$
(D) $S_1 \subseteq S_2 \Rightarrow L(S_1) \oplus L(S_2)$

38. If W is a subspace of V, then which of the following is correct?
(A) L(W) = W
(B) L(W) = W^3
(C) L(W) = W^2
(D) L(W) = W^4

39. If S = {(1, 4), (0, 3)} be a subset of R2(R), then
(A) (2, 1) ∈ L(S)
(B) (2, 0) ∈ L(S)
(C) (2, 3) ∈ L(S)
(D) (3, 4) ∈ L(S)

40. If V = R4(R) and S = {(2, 0, 0, 1), (– 1, 0, 1, 0)}, then

(A) L(S) = {(2α + β, 0, β, α) | α, β ∈ R}

(B) L(S) = {(2α ⊕ β, 0, β, α) | α, β ∈ R}

(C) L(S) = {(2αβ, 0, β, α) | α, β ∈ R}

(D) L(S) = {(2α – β, 0, β, α) | α, β ∈ R}

41. In dot or scalar product of two vectors which of the following is correct?

(A) $\vec{v} . \vec{w} = \vec{w} . \vec{v}$

(B) $\vec{v} . \vec{w} = 0$

(C) $\vec{v} . \vec{w} = 1$

(D) None of the above

Ans: (A) $\vec{v} . \vec{w} = \vec{w} . \vec{v}$

42. If $\vec{u}, \vec{v}, \vec{w}$ are vectors and α, β real numbers, then which of the following is correct?

(A) $\vec{u} . (\alpha\vec{v} + \beta\vec{w}) = \alpha(\vec{u} . \vec{v}) + \beta(\vec{u} . \vec{w})$

(B) $\vec{u} . (\alpha\vec{v} + \beta\vec{w}) = \alpha\beta$

(C) $\vec{u} . (\alpha\vec{v} + \beta\vec{w}) = 1$

(D) $\vec{u} . (\alpha\vec{v} + \beta\vec{w}) = 0$

Ans: (A) $\vec{u} . (\alpha\vec{v} + \beta\vec{w}) = \alpha(\vec{u} . \vec{v}) + \beta(\vec{u} . \vec{w})$

43. If V is an inner product space, then

(A) (u, v) = 1 for all v ∈ V ⇒ $u = 0$

(B) (u, v) = 0 for all v ∈ V ⇒ $u = 0$

(C) (u, v) = ∞ for all v ∈ V ⇒ $u = 0$

(D) None of the above

44. If V be an inner product space and v $\in$ V, then norm of v (or length of v) is denoted by
    (A) $\| v \|$
    (B) $\vec{v}$
    (C) $|v|$
    (D) None of the above

45. If V be an inner product space, then for all u, $v \in$ V
    (A) $|(u, v)| = \| u \| \| v \|$
    (B) $|(u, v)| \geq \| u \| \| v \|$
    (C) $|(u, v)| \leq \| u \| \| v \|$
    (D) $|(u, v)| \neq \| u \| \| v \|$

46. If two vectors are L.D. then one of them is a scalar ______ of the other.
    (A) Union
    (B) Subtraction
    (C) Addition
    (D) Multiple

47. If $v_1, v_2, v_3 \in$ V(F) such that v_1 + v2 + v_3 = 0 then which of the following is correct?
    (A) $L(\{v_1, v_2\}) = L(\{v_1, v_3\})$
    (B) $L(\{v_1, v_2\}) = L(\{v_2, v_2\})$
    (C) $L(\{v_1, v_2\}) = L(\{v_2, v_3\})$
    (D) $L(\{v_1, v_2\}) = L(\{v_1, v_1\})$

48. The set $S = \{(1, 2, 1), (2, 1, 0), (1, -1, 2)\}$ forms a basis of
    (A) R^3 (R)
    (B) R^2 (R)
    (C) R (R)
    (D) None of the above

49. If V is a FDVS and S and T are two finite subsets of V such that S spans V and T is L.I. then
    (A) 0 (T) = 0 (S)
    (B) 0 (T) $\leq$ 0 (S)
    (C) 0 (T) $\geq$ 0 (S)
    (D) None of the above

50. If dim V = n and S = {v1, v2,...,vn} is L.I. subset of V then
    (A) V $\supseteq$ L(S)
    (B) V $\subseteq$ L(S)
    (C) V $\subset$ L(S)
    (D) V $\supset$ L(S)

Unit-2-Linear Transformation-MCQs

1. Which of the following equation is correct in terms of linear transformation where $T : V \rightarrow W$ and $x, y \in V$, $\alpha, \beta \in F$ and V and where W are vector spaces over the field F.
(A) $T(\alpha x + \beta y) = \alpha T(x) + \beta T(y)$
(B) $T(\alpha x + \beta y) = \beta T(x) + \alpha T(y)$
(C) $T(\alpha x + \beta y) = \alpha T(y) + \beta T(x)$
(D) $T(\alpha x + \beta y) = \alpha T(x) . \beta T(y)$

2. If $T : V \rightarrow W$ be a L.T, then which of the following is correct
(A) Rank of T = w(T)
(B) Rank of T = v(T)
(C) Rank of T = r(T)
(D) None of the above

3. If T, T_1, T_2 be linear operators on V, and $I : V \rightarrow V$ be the identity map I(v) = v for all v (which is clearly a L.T.) then
(A) $\alpha(T_1T_2) = (\alpha T_1)T_2 = T_1(\alpha T_2)$ where $\alpha \in F$
(B) $\alpha(T_1T_2) = \alpha T_2 = \alpha T_1$ where $\alpha \in F$
(C) $\alpha(T_1T_2) = \alpha T_1 = (\alpha T_2)$ where $\alpha \in F$
(D) $\alpha(T_1T_2) = \alpha(T_1+T_2) = T_2(\alpha T_1)$ where $\alpha \in F$

4. If T, T_1, T_2 be linear operators on V, and $I : V \rightarrow V$ be the identity map I(v) = v for all v (which is clearly a L.T.) then
(A) $T_1(T_2T_3) = (T_1T_3)T_2$
(B) $T_1(T_2T_3) = (T_2T_3)T_1$
(C) $T_1(T_2T_3) = (T_1T_2)T_3$
(D) $T_1(T_2T_3) = (T_1T_2)$

5. If $T : V \rightarrow W$ be a L.T, then which of the following is correct
(A) Nullity of T= w(T)
(B) Nullity of T = v(T)
(C) Nullity of T = r(T)
(D) None of the above

6. If $T : V \rightarrow W$ be a L.T, then which of the following is correct
(A) Rank T + Nullity T = dim V
(B) Rank T . Nullity T = dim V
(C) Rank T - Nullity T = dim V
(D) Rank T / Nullity T = dim V

7. If $T : V \rightarrow W$ be a L.T, then which of the following is correct
(A) Range T $\cap$ Ker T = {1}

(B) Range T $\cap$ Ker T = {2}
(C) Range T $\cap$ Ker T = {3}
(D) Range T $\cap$ Ker T = {0}

8. If T : V $\rightarrow$ W be a L.T and if T(T(v)) = 0, then
   (A) T(v) = 1, v $\in$ V
   (B) T(v) = ∞, v $\in$ V
   (C) T(v) = 2, v $\in$ V
   (D) T(v) = 0, v $\in$ V

9. If V and W be two vector spaces over the same field F and T : V $\rightarrow$ W and S : V $\rightarrow$ W be two linear transformations then
   (A) (T + S)v = T(v) + S(v), v $\in$ V
   (B) (T + S) v = T(v) . S(v), v $\in$ V
   (C) (T + S)v = T(v) $\oplus$ S(v), v $\in$ V
   (D) None of the above

10. If V, W, Z be three vector spaces over a field F and T : V $\rightarrow$ W, S : W $\rightarrow$ Z be L.T then we can define ST : V $\rightarrow$ Z as
   (A) (ST)v = ((ST)v)
   (B) (ST)v = S(T(v))
   (C) (ST)v = ((ST)v)
   (D) (ST)v = (S(Tv))

11. If T, T_1, T_2 be linear operators on V, and I : V $\rightarrow$ V be the identity map I(v) = v for all v (which is clearly a L.T.) then
   (A) IT = T_1
   (B) IT = T_2
   (C) IT = V
   (D) IT = T

12. If T, T_1, T_2 be linear operators on V, and I : V $\rightarrow$ V be the identity map I(v) = v for all v (which is clearly a L.T.) then
   (A) $T(T_1 + T_2) = TT_1 + TT_2$
   (B) $T(T_1 + T_2) = T_1 + T_2$
   (C) $T(T_1 + T_2) = T(TT_1 + TT_2)$
   (D) $T(T_1 + T_2) = TT_1T_2$

13. If V and W be two vector spaces (over F) of dim m and n respectively, then
   (A) dim Hom (V, W) = mn
   (B) dim Hom (V, W) = m+n
   (C) dim Hom (V, W) = m$\oplus$n
   (D) None of the above

14. If T, T_1, T_2 be linear transformations from V → W, S, S_1, S_2 from W → U and K, K_1, K_2 from U → Z where V, W, U, Z are vector spaces over a field F then
(A) K(ST) = KST
(B) K(ST) = (KS)T
(C) K(ST) = KS
(D) K(ST) = ST

15. If $T_1, T_2 \in$ Hom (V, W) then
(A) $r(\alpha T_1) = r(T_1)$ for all $\alpha \in F, \alpha \neq 0$
(B) $r(\alpha T_1) = r\alpha$ for all $\alpha \in F, \alpha \neq 0$
(C) $r(\alpha T_1) = T_1$ for all $\alpha \in F, \alpha \neq 0$
(D) None of the above

16. If $T_1, T_2 \in$ Hom (V, W) and r(T) means rank of T then
(A) $| r(T_1) - r(T_2) | = r(T_1 + T_2) = r(T_1) + r(T_2)$
(B) $| r(T_1) - r(T_2) | \geq r(T_1 + T_2) \geq r(T_1) + r(T_2)$
(C) $| r(T1) - r(T_2) | \leq r(T_1 + T_2) \leq r(T_1) + r(T_2)$
(D) $| r(T_1) - r(T_2) | < r(T_1 + T_2) < r(T_1) + r(T_2)$

17. Let T : V → W and S : W → U be two linear transformations. Then
(A) $(ST)^{-1} = T^{-1}\ T^{-1}$
(B) $(ST)^{-1} = T^{-1}T$
(C) $(ST)^{-1} = T^{-1}\ S^{-1}$
(D) None of the above

18. T be a linear operator on V and let Rank T^2 = Rank T then
(A) Range T ∩ Ker T = {0}
(B) Range T ∩ Ker T = {1}
(C) Range T ∩ Ker T = {2}
(D) Range T ∩ Ker T = {3}

19. A L.T. T : V → W is called non-singular if
(A) Ker T = ∞
(B) Ker T = {0}
(C) Ker T = {1}
(D) Ker T = {2}

20. If T be a linear operator on R^3, defined by T(x1, x2, x3) = (3x1, x1– x2, 2x1 + x2 + x3) and (z1, z2, z3) be any element of R^3 then
(A) T^{-1} (z1, z2, z3) = 0
(B) T^{-1} (z1, z2, z3) = ∞

(C) T^{-1} (z1, z2, z3) = 1
(D)

$$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{3}, \frac{z_1}{3} - z_2, z_3 - z_1 + z_2\right)$$

$$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{3}, \frac{z_1}{3} - z_2, z_3 - z_1 + z_2\right)$$

Ans: (D)

21. If T : V → V is a L.T., such that T is not onto, and that there exists some 0 ≠ v in V such that, T(v) = 0, then
(A) Ker T = {0}
(B) Ker T = ∞
(C) Ker T = {1}
(D) None of the above

22. If T : V → W and S : W → U be two linear transformations and if ST is one-one onto then
(A) $(ST)^{-1} = 0$
(B) $(ST)^{-1} = T^{-1} S^{-1}$
(C) $(ST)^{-1} = 1$
(D) None of the above

23. If T be a linear operator on FDVS V and suppose there is a linear operator U on V such that TU = I then
(A) $T^{-1} = U$
(B) $T^{-1} = I$
(C) $T^{-1} = V$
(D) None of the above

24. If V_1 and V_2 be vector spaces over F then $V_1 \times V_2$ is FDVS if and only if
(A) V_1 and V_2 are not FDVS
(B) V_1 is FDVS
(C) V_2 is FDVS
(D) V_1 and V_2 are FDVS

25. If T, T_1, T_2 be linear transformations from V → W, S, S_1, S_2 from W → U and K, K_1, K_2 from U → Z where V, W, U, Z are vector spaces over a field F then
(A) $(\alpha S)T = \alpha(S+T) = S(\alpha+T)$ where $\alpha \in F$
(B) $(\alpha S)T = \alpha(ST) = S(\alpha T)$ where $\alpha \in F$
(C) $(\alpha S)T = \alpha(S-T) = S(\alpha-T)$ where $\alpha \in F$
(D) $(\alpha S)T = ST = \alpha T$ where $\alpha \in F$

26. If W_1 and W_2 be subspaces of V such that $\frac{V}{W_1}$ and $\frac{V}{W_2}$ are FDVS then

(A) $\frac{V}{W_1 \cap W_2}$ are in FDVS

(B) $\frac{V}{W_1 \cap W_2}$ are not in FDVS

(C) $V(W_1 \cap W_2)$ are in FDVS

(D) None of the above

Ans: (A) $\frac{V}{W_1 \cap W_2}$ are in FDVS

27. If U(F), V(F) be vector spaces of dimension n and m, respectively, then

(A) Hom (U, V) > $M_{m\times n}(F)$

(B) Hom (U, V) = $M_{m\times n}(F)$

(C) Hom (U, V) ≅ $M_{m\times n}(F)$

(D) Hom (U, V) < $M_{m\times n}(F)$

28. If U(F), V(F) be vector spaces of dimension n and m, respectively, then

(A) dim Hom (U, V) = mn

(B) dim Hom (U, V) > mn

(C) dim Hom (U, V) < mn

(D) dim Hom (U, V) ≅ mn

29. If S, T be two linear transformations from V (F) into V (F) and β be an ordered basis of V, then

(A) $[ST]_\beta = [S]_\beta[T]_\beta$

(B) $[ST]_\beta = [S+T]_\beta$

(C) $[ST]_\beta = ST$

(D) None of the above

30. If T : V(F) → V(F) be a linear transformation and $\beta = \{u_1, ..., u_n\}$, $\beta' = \{v_1, ..., v_n\}$ be two ordered basis of V. Then $\exists$ a non singular matrix P over F such as

(A) $[T]_{\beta'} = P^{-1}P$

(B) $[T]_{\beta'} = P^{-1}[T]_\beta P$

(C) $[T]_{\beta'} = P^{-1}[T]_{\beta} + P$
(D) $[T]_{\beta'} = P^{-1}[T]_{\beta}$

31. If T be a linear operator on C2 defined by T(x1, x2) = (x1, 0) and β = {∈1 = (1, 0), ∈2 = (0, 1)}, β' = { α 1 = (1, i), α 2 = (–i, 2)} be ordered basis for C2 then

(A) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 1 \\ -i & 0 \end{bmatrix}$

(B) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 2 \\ -i & 0 \end{bmatrix}$

(C) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 0 \\ -i & 0 \end{bmatrix}$

(D) None of the above

Ans: (C) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 0 \\ -i & 0 \end{bmatrix}$

32. If T be the linear operator on R2 defined by T(x1, x2) = (–x2, x1) and if β is any ordered basis for R2 and [T]β = A, then
(A) $a_{12}a_{21} > 0$, where $A = (a_{ij})$
(B) $a_{12}a_{21} \neq 0$, where $A = (a_{ij})$
(C) $a_{12}a_{21} < 0$, where $A = (a_{ij})$
(D) $a_{12}a_{21} = 0$, where $A = (a_{ij})$

33. Let T be a linear operator on F^n and A be the matrix of T in the standard ordered basis for F^n. W be the subspace of Fn spanned by the column vectors of A then

(A) Rank of T = dim W
(B) Rank of T = dim W + dim T
(C) Rank of T = dim W - dim T
(D) None of the above

34. If V be the space of all polynomial functions from R into R of the form $f(x) = c_o + c_1x + c_2x^2 + c_2x^3$ and $\beta = \{1, x, x^2, x^3\}$ be an ordered basis of V. If D be the differential operator on V then

(A) $$[D]_\beta = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(B) $$[D]_\beta = \begin{bmatrix} 0 & 1 & 3 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \\ 0 & 2 & 0 & 0 \end{bmatrix}$$

(C) $$[D]_\beta = \begin{bmatrix} 0 & 0 & 3 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \\ 0 & 3 & 0 & 0 \end{bmatrix}$$

(D) $$[D]_\beta = \begin{bmatrix} 0 & 3 & 3 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \end{bmatrix}$$

Ans: (A) $$[D]_\beta = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

35. If T, T_1, T_2 be linear transformations from V → W, S, S_1, S_2 from W → U and K, K_1, K_2 from U → Z where V, W, U, Z are vector spaces over a field F then
(A) $S(T_1 + T_2) = (ST_1)(ST_2)$
(B) $S(T_1 + T_2) = ST_1$
(C) $S(T_1 + T_2) = ST_1 - ST_2$
(D) $S(T_1 + T_2) = ST_1 + ST_2$

36. If T, T_1, T_2 be linear transformations from V → W, S, S_1, S_2 from W → U and K, K_1, K_2 from U → Z where V, W, U, Z are vector spaces over a field F then
(A) $(S_1 + S_2)T = S_1S_2$

(B) $(S_1 + S_2)T = S_1T + S_2T$
(C) $(S_1 + S_2)T = (S_1 - S_2)T$
(D) $(S_1 + S_2)T = S_1T \,.\, S_2T$

37. $T : R^3 \rightarrow R^2$, $S : R^2 \rightarrow R^2$ be linear transformations then
(A) ST is not invertible
(B) ST is invertible
(C) ST is zero
(D) None of the above

38. If the L.T. $T : \mathbf{R}^7 \rightarrow \mathbf{R}^3$ has a four dimensional Kernel, then the range of T has dimension
(A) One
(B) Two
(C) Three
(D) Four

39. If T be a L.T. from R^7 onto a 3-dimensional subspace of R^5 then
(A) dim Ker T = 1
(B) dim Ker T = 2
(C) dim Ker T = 3
(D) dim Ker T = 4

40. Let $T : V \rightarrow W$ and $S : W \rightarrow U$ be two linear transformations. Then ST is one-one onto if
(A) S and T are one-one onto
(B) S and T is onto
(C) Both (A) and (B)
(D) None of the above

41. Let V be a two dimensional vector spacer over the field *F* and β be an ordered basis for *V*.

$$[T]_\beta = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

If T is a linear operator on V and then
(A) $T^2 - (a + b)T + (ad - bc)I = 0$
(B) $T^2 - (a + b)T + (ad - bc)I = 1$
(C) $T^2 - (a + b)T + (ad - bc)I = 2$
(D) $T^2 - (a + b)T + (ad - bc)I = 3$

42. If A be $n \times n$ matrix over F, then A is invertible if and only if
(A) Rows of A are linearly dependent over F
(B) Columns of A are linearly dependent over F
(C) Columns of A are linearly independent over F
(D) None of the above

43. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a 2 × 2 matrix over F, then A is invertible if and only

(A) {(a, b), (c, d)} is a basis of F

(B) {(a, b), (c, d)} is a basis of F^2

(C) {(a, b), (c, d)} is a basis of F^3

(D) None of the above

44. If dim V = 2 and T be a linear operator on V. Suppose matrix of T with respect to all bases of V is same then

(A) T = αV for some α ∈F

(B) T = αT for some α ∈F

(C) T = αI for some α ∈F

(D) None of the above

45. If T be a linear operator on C^2 defined by $T(x_1, x_2) = (x_1, 0)$ and β = {$\in_1$ = (1, 0), $\in_2$ = (0, 1)}, β′ = {α1 = (1, i), α_2 = (–i, 2)} be ordered basis for C^2 then the matrix of T relative to the pair β, β′ is

(A) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 0 \\ -i & 0 \end{bmatrix}$

(B) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 1 \\ -i & 0 \end{bmatrix}$

(C) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & -i \\ -i & 0 \end{bmatrix}$

(D) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & -i \\ -i & 2 \end{bmatrix}$

Ans: (A) $[T]_{\beta\,\beta'} = \begin{bmatrix} 2 & 0 \\ -i & 0 \end{bmatrix}$

46. Let T : V → W and S : W → U be two linear transformations. Then T is one-one if

(A) ST is one-one

(B) ST is onto

(C) Both (A) and (B)

(D) None of the above

47. Let T : V → W and S : W → U be two linear transformations. Then S is onto if

(A) ST is one-one

(B) ST is onto

(C) Both (A) and (B)
(D) None of the above

48. If T be a linear operator on R_3, defined by $T(x_1, x_2, x_3) = (3x_1, x_1 - x_2, 2x_1 + x_2 + x_3)$ and if (z_1, z_2, z_3) be any element of R3 then

(A) $$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{2}, \frac{z_1}{2} - z_2, z_3 - z_1 + z_2\right)$$

(B) $$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{2}, \frac{z_1}{2} - z_2, z_3 - z_1 - z_2\right)$$

(C) $$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{3}, \frac{z_1}{2} - z_2, z_3 - z_1 - z_2\right)$$

(D) $$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{3}, \frac{z_1}{3} - z_2, z_3 - z_1 + z_2\right)$$

Ans: (D) $$T^{-1}(z_1, z_2, z_3) = \left(\frac{z_1}{3}, \frac{z_1}{3} - z_2, z_3 - z_1 + z_2\right)$$

49. If T : V → W be a L.T. where V and W are two FDVS with same dimension, then which of the following is correct?
(A) T is invertible.
(B) T is non singular
(C) T is onto
(D) All of the above

50. A L.T. T : V → V is one-one iff T is
(A) Onto
(B) Not onto
(C) Both (A) and (B)
(D) None of the above

Unit-3-Matrix-MCQs

1. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 0 & 1 & 2 \end{pmatrix}$, then a_{33} is
   (A) 3
   (B) 9
   (C) 2
   (D) 6

2. A row matrix is one which has
   (A) One row
   (B) One column
   (C) One row and the element of row is zero
   (D) One column and the element of column is zero

3. A matrix in which the number of rows is equal to the number of columns is called a
   (A) Row Matrix
   (B) Column Matrix
   (C) Zero Matrix
   (D) Square Matrix

4. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ is an example of
   (A) Zero Matrix
   (B) Column Matrix
   (C) Scalar Matrix
   (D) Diagonal Matrix

5. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$. is an example of

   (A) Zero Matrix
   (B) Column Matrix
   (C) Scalar Matrix
   (D) Diagonal Matrix

6. A diagonal matrix whose diagonal elements are all equal to 1 (unity) is called
(A) Identity Matrix
(B) Diagonal Matrix
(C) Triangular Matrix
(D) None of the above

7. A diagonal matrix whose diagonal elements are equal, is called
(A) Scalar Matrix
(B) Identity Matrix
(C) Triangular Matrix
(D) Unit Matrix

8. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ is an example of
(A) Identity Matrix
(B) Diagonal Matrix
(C) Triangular Matrix
(D) None of the above

9. A square matrix (aij), whose elements aij = 0 when i < j is called
(A) a upper triangular matrix
(B) a triangular matrix
(C) a lower triangular matrix
(D) None of the above

10. $\begin{pmatrix} 1 & 2 \\ 0 & 3 \end{pmatrix}$ is an example of
(A) a upper triangular matrix
(B) a triangular matrix
(C) a lower triangular matrix
(D) None of the above

11. Two matrices A and B are said to be equal if
(A) A and B are of same order
(B) Corresponding elements in A and B are same
(C) Both (A) and (B)
(D) None of the above

12. Which of the following matrix are equal

(A) $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$

(B) $\begin{pmatrix} 3 & 4 & 9 \\ 16 & 25 & 64 \end{pmatrix} \quad \begin{pmatrix} 3 & 4 & 9 \\ 16 & 25 & 64 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 5 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 5 \end{pmatrix}$

(D) All of the above

$$\begin{pmatrix} 3 & 4 & 9 \\ 16 & 25 & 64 \end{pmatrix} \quad \begin{pmatrix} 3 & 4 & 9 \\ 16 & 25 & 64 \end{pmatrix}$$

Ans: (B)

13. If A and B are two matrices such as $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}, B = \begin{pmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \end{pmatrix}$, then A + B is

(A) $\begin{pmatrix} 3 & 5 & 7 \\ 9 & 11 & 13 \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$

(C) $\begin{pmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \end{pmatrix}$

(D) None of the above

Ans: (A) $\begin{pmatrix} 3 & 5 & 7 \\ 9 & 11 & 13 \end{pmatrix}$

14. If A and B be two matrices then which of the following is correct?

(A) A + B = B – A

(B) A + B = AB

(C) A + B = B + A

(D) None of the above

15. If A and B be two matrices then which of the following is correct?

(A) A + (B + C) = A . (B + C)

(B) A + (B + C) = (A + B) + C

(C) A + (B + C) = AB + BC + CA

(D) A + (B + C) = A + (BC + CA)

16. If $A = \begin{pmatrix} 2 & -1 \\ 0 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 7 & 0 \\ -2 & -3 \end{pmatrix}$ then AB is

(A) $\begin{pmatrix} 16 & 7 \\ -6 & 16 \end{pmatrix}$

(B) $\begin{pmatrix} 16 & 3 \\ -6 & -9 \end{pmatrix}$

(C) $\begin{pmatrix} 14 & 0 \\ 0 & 16 \end{pmatrix}$

(D) $\begin{pmatrix} 7 & 2 \\ 0 & 16 \end{pmatrix}$

Ans: (B) $\begin{pmatrix} 16 & 3 \\ -6 & -9 \end{pmatrix}$

17. If $A = \begin{pmatrix} -1 & 0 \\ 7 & -2 \end{pmatrix}$, $B = \begin{pmatrix} -1 & 5 \\ 7 & 0 \end{pmatrix}$, $C = \begin{pmatrix} -1 & -1 \\ 2 & 0 \end{pmatrix}$ then A(BC) is

(A) $\begin{pmatrix} -11 & -1 \\ 91 & 21 \end{pmatrix}$

(B) $\begin{pmatrix} -11 & 35 \\ 91 & 21 \end{pmatrix}$

(C) $\begin{pmatrix} -11 & 35 \\ 91 & 91 \end{pmatrix}$

(D) $\begin{pmatrix} -11 & 35 \\ -21 & 91 \end{pmatrix}$

Ans: (A) $\begin{pmatrix} -11 & -1 \\ 91 & 21 \end{pmatrix}$

18. If A and B be two matrices then which of the following is correct?

(A) A(B + C) = BC + AC

(B) A(B + C) = AC + BC

(C) A(B + C) = AB + AC

(D) A(B + C) = BC + AB

19. If A and B be two matrices then which of the following is correct?

(A) (A + B)C = AB + BC

(B) (A + B)C = AC + BC

(C) (A + B)C = AB + AC

(D) (A + B)C = AB + AC

20. If A is square matrix such as $A = \begin{pmatrix} 1 & 0 \\ 3 & 4 \end{pmatrix}$ the A^2 is

(A) $\begin{pmatrix} 1 & 0 \\ 15 & 16 \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 0 \\ 15 & 12 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 0 \\ 10 & 12 \end{pmatrix}$

(D) $\begin{pmatrix} 1 & 4 \\ 10 & 12 \end{pmatrix}$

Ans: (A) $\begin{pmatrix} 1 & 0 \\ 15 & 16 \end{pmatrix}$

21. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$ and k = 2 then kA is

(A) $\begin{pmatrix} 2 & 5 & 6 \\ 8 & 10 & 12 \end{pmatrix}$

(B) $\begin{pmatrix} 2 & 6 & 6 \\ 8 & 10 & 12 \end{pmatrix}$

(C) $\begin{pmatrix} 2 & 6 & 6 \\ 4 & 10 & 12 \end{pmatrix}$

(D) $\begin{pmatrix} 2 & 4 & 6 \\ 8 & 10 & 12 \end{pmatrix}$

Ans: (D) $\begin{pmatrix} 2 & 4 & 6 \\ 8 & 10 & 12 \end{pmatrix}$

22. If k is any complex number and A is matrix then

(A) k(A + B) = kA + kB

(B) k(A + B) = A + B

(C) k(A + B) = kAB

(D) None of the above

23. If k is any complex number and A is matrix then

(A) $(k_1k_2)A = A$

(B) $(k_1k_2)A = k_1k_2$

(C) $(k_1k_2)A = k_1(k_2A)$

(D) $(k_1k_2)A = (k_1+k_{2)}A$

24. If $A = \begin{pmatrix} 0 & 1 & 2 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{pmatrix}$ and $k_1 = i$, $k_2 = 2$, then

(A) $(k_1 + k_2)\ A = k_1A\ .\ k_2A$

(B) $(k_1 + k_2)\ A = k_1A + k_2A$

(C) $(k_1 + k_2)\ A = k_1A$

(D) $(k_1 + k_2)\ A = k_2A$

25. If $A = \begin{pmatrix} 0 & 2 & 3 \\ 2 & 1 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 7 & 6 & 3 \\ 1 & 4 & 5 \end{pmatrix}$, then the value of 2A + 3B is

(A) $\begin{pmatrix} 21 & 22 & 15 \\ 7 & 14 & 23 \end{pmatrix}$

(B) $\begin{pmatrix} 21 & 18 & 15 \\ 7 & 14 & 23 \end{pmatrix}$

(C) $\begin{pmatrix} 21 & 18 & 15 \\ 21 & 14 & 23 \end{pmatrix}$

(D) $\begin{pmatrix} 21 & 23 & 15 \\ 21 & 14 & 23 \end{pmatrix}$

Ans: (A) $\begin{pmatrix} 21 & 22 & 15 \\ 7 & 14 & 23 \end{pmatrix}$

26. If $A = \begin{pmatrix} 1 & 2 \\ -3 & 0 \end{pmatrix}$ and I is unit matrix of order 2 then $A^2 + 3A + 5I$ is

(A) $\begin{pmatrix} -9 & 8 \\ -12 & -1 \end{pmatrix}$

(B) $\begin{pmatrix} -9 & -1 \\ -12 & -1 \end{pmatrix}$

(C) $\begin{pmatrix} -9 & -1 \\ -12 & -6 \end{pmatrix}$

(D) $\begin{pmatrix} 3 & 8 \\ -12 & -1 \end{pmatrix}$

Ans: (D) $\begin{pmatrix} 3 & 8 \\ -12 & -1 \end{pmatrix}$

27. If $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, B = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$ then AB is equal to

(A) $\begin{pmatrix} 0 & -i \\ 0 & -i \end{pmatrix}$

(B) $\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}$

(C) $\begin{pmatrix} i & i \\ 0 & -i \end{pmatrix}$

(D) $\begin{pmatrix} i & -i \\ 0 & -i \end{pmatrix}$

Ans: (B) $\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}$

28. If A_1, A_2, A_3, B_1, B_2 and B_3 are row matrix such as A_1 = (3 4 5 6 0), A_2 = (3 4 5 0 0), A_3 = (3 4 5 0 0), B_1 = (3 4 5 0 2), B_2 = (3 4 5 0 2), B_3 = (3 4 5 0 2) then $(A_1 + A_2 + A_3) + (B_1 + B_2 + B_3)$ is

(A) (18 24 30 6 6)

(B) (24 24 30 6 6)

(C) (18 24 34 6 6)

(D) (18 24 30 18 6)

29. If $A = \begin{pmatrix} 10 & 20 \\ 30 & 40 \end{pmatrix}$ then 5A is equal to

(A) $\begin{pmatrix} 200 & 100 \\ 150 & 200 \end{pmatrix}$

(B) $\begin{pmatrix} 200 & 100 \\ 100 & 200 \end{pmatrix}$

(C) $\begin{pmatrix} 200 & 200 \\ 100 & 200 \end{pmatrix}$

(D) $\begin{pmatrix} 50 & 100 \\ 150 & 200 \end{pmatrix}$

Ans: (D) $\begin{pmatrix} 50 & 100 \\ 150 & 200 \end{pmatrix}$

30. If matrix $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{pmatrix}$ represents the results of the examination of B. Com. Class where the rows represent the three sections of the class and the first three columns represent the number of students securing 1st, 2nd, 3rd divisions respectively in that order and fourth column represents the number of students who failed in the examination. Then the number of students passed in three sections respectively are

(A) 6, 18, 30
(B) 18, 6, 30
(C) 30, 6, 18
(D) 18, 30, 6

31. If matrix $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{pmatrix}$ represents the results of the examination of B. Com. Class where the rows represent the three sections of the class and the first three columns represent the number of students securing 1st, 2nd, 3rd divisions respectively in that order and fourth column represents the number of students who failed in the examination. Then the no of students failed in three sections respectively are
(A) 12, 8, 4
(B) 12, 8, 4
(C) 4, 8, 12
(D) 8, 4, 12

32. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}, \quad B = \begin{pmatrix} 2 & 3 & 4 \\ 1 & 8 & 6 \end{pmatrix}$ then $(A+B)'$ is

(A) $\begin{pmatrix} 3 & 5 \\ 5 & 13 \\ 7 & 12 \end{pmatrix}$

(B) $\begin{pmatrix} 3 & 8 \\ 5 & 13 \\ 7 & 12 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 5 \\ 5 & 13 \\ 7 & 12 \end{pmatrix}$

(D) $\begin{pmatrix} 6 & 5 \\ 5 & 13 \\ 7 & 12 \end{pmatrix}$

Ans: (A) $\begin{pmatrix} 3 & 5 \\ 5 & 13 \\ 7 & 12 \end{pmatrix}$

33. If $a_{ij} = a_{ji}$ for all i and j in a square matrix A = $[a_{ij}]$ then it is called

(A) Symmetric Matrix
(B) Skew-Symmetric Matrix
(C) Scalar Matrix
(D) Identity Matrix

34. If $a_{ij} = - a_{ji}$ for all i and j in a square matrix A = $[a_{ij}]$ then it is called
(A) Symmetric Matrix
(B) Skew-Symmetric Matrix
(C) Scalar Matrix
(D) Identity Matrix

35. A square matrix $A = [a_{ij}]_{n\times n}$ is said to be Hermitian if
(A) $a_{ij} = - a_{ji}$
(B) $a_{ij} = -\overline{a}_{ji}$
(C) $a_{ij} = \overline{a}_{ji}$
(D) $a_{ij} = a_{ji}$

Ans: (C) $a_{ij} = \overline{a}_{ji}$

36. A square matrix A is said to be orthogonal if
(A) A′A = I.
(B) A′A = 1.
(C) A′A = 0.

(D) None of the above.

37. Every square matrix can be uniquely expressed as the sum of
   (A) Hermitian and Skew- Hermitian Matrices
   (B) Symmetric and Hermitian Matrices
   (C) Hermitian and Skew- Symmetric Matrices
   (D) Symmetric and Skew- Symmetric Matrices

38. If A and B are Hermitian matrices then
   (A) AB + BA is Symmetric and AB – BA is Skew-Hermitian matrix
   (B) AB + BA is Skew-Hermitian and AB – BA is Hermitian matrix
   (C) AB + BA is Symmetric and AB – BA is Skew- Symmetric matrix
   (D) AB + BA is Hermitian and AB – BA is Skew-Hermitian matrix

39. If A is an orthogonal matrix then
   (A) $|A| = 0$
   (B) $|A| = \pm 1$
   (C) $|A| = |A|^2$
   (D) $|A| = 1$

40. If A= $\frac{1}{\sqrt{3}}\begin{pmatrix} 1 & 1-i \\ 1+i & -1 \end{pmatrix}$ then A*A is

   (A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
   (B) $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$
   (C) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$
   (D) None of the above

Ans: (A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

41. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then AA' is

(A) $\begin{bmatrix} 20 & 20 \\ 14 & 20 \end{bmatrix}$

(B) $\begin{bmatrix} 5 & 11 \\ 11 & 25 \end{bmatrix}$

(C) $\begin{bmatrix} 10 & 14 \\ 14 & 20 \end{bmatrix}$

(D) $\begin{bmatrix} 14 & 11 \\ 11 & 25 \end{bmatrix}$

Ans: (B) $\begin{bmatrix} 5 & 11 \\ 11 & 25 \end{bmatrix}$

42. If A and B are both symmetric then AB is also symmetric if and only if

(A) AB = $(AB)'$

(B) AB = $A'B'$

(C) AB = BA

(D) AB = $B'A$

43. If $A = \begin{bmatrix} 1 & 2 & 6 \\ 3 & 5 & 8 \\ 4 & 9 & 7 \end{bmatrix}$ then $\frac{1}{2}(A + A')$ is

(A) $\begin{bmatrix} 1 & \frac{5}{2} & 5 \\ \frac{5}{2} & 5 & \frac{17}{2} \\ 5 & \frac{17}{2} & 7 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & -\frac{1}{2} & 1 \\ \frac{1}{2} & 0 & -\frac{1}{2} \\ -1 & \frac{1}{2} & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & \frac{5}{2} & 5 \\ \frac{5}{2} & \frac{17}{2} & \frac{17}{2} \\ 5 & \frac{17}{2} & 7 \end{bmatrix}$

(D) None of the above

Ans: (A) $\begin{bmatrix} 1 & \frac{5}{2} & 5 \\ \frac{5}{2} & 5 & \frac{17}{2} \\ 5 & \frac{17}{2} & 7 \end{bmatrix}$

44. If $A = \begin{bmatrix} 1 & -2 & 3 \\ 0 & 2 & 1 \\ -4 & 5 & 2 \end{bmatrix}$ then $Adj\ A$ is

(A) $\begin{bmatrix} -1 & 12 & -8 \\ -4 & 12 & -1 \\ 8 & 3 & 2 \end{bmatrix}$

(B) $\begin{bmatrix} -1 & 14 & -8 \\ -4 & 19 & -1 \\ 8 & 3 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & 19 & -8 \\ -4 & 14 & -1 \\ 8 & 3 & 2 \end{bmatrix}$

(D) None of the above

Ans: (C) $\begin{bmatrix} -1 & 19 & -8 \\ -4 & 14 & -1 \\ 8 & 3 & 2 \end{bmatrix}$

45. The inverse of the matrix $\begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$ is

(A) $\begin{pmatrix} 7 & -3 & -3 \\ -1 & 0 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

(B) $\begin{pmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 3 & 3 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

(D) None of the above

Ans: (B) $\begin{pmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

46. The rank of matrix $A = \begin{pmatrix} 1 & -3 & 2 \\ -3 & 9 & -6 \\ 2 & -6 & 4 \end{pmatrix}$ is
   (A) 1
   (B) 2
   (C) 3
   (D) 4

47. The sum of the squares of the eigenvalues of $\begin{bmatrix} 3 & 0 & 0 \\ 8 & 4 & 0 \\ 6 & 2 & 5 \end{bmatrix}$ is
   (A) 30
   (B) 17
   (C) 13
   (D) 50

48. If 3 and 15 are the two eigenvalues of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ then the value of the determinant

(A) 0
(B) 1
(C) 2
(D) 3

49. If $P^{-1}AP = D$ where $A = \begin{pmatrix} 3 & 1 & 4 \\ 2 & 2 & 4 \\ 4 & 1 & 3 \end{pmatrix}$ and D is a diagonal matrix whose non-zero elements are the eigenvalues of A then the matrix P is

(A) $\begin{pmatrix} -4 & 1 & 1 \\ -4 & -6 & 1 \\ 5 & 1 & 1 \end{pmatrix}$

(B) $\begin{pmatrix} -4 & 1 & 1 \\ -4 & -6 & 1 \\ 8 & 1 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} -4 & -6 & 1 \\ -4 & -6 & 1 \\ 8 & 1 & 1 \end{pmatrix}$

(D) None of the above

Ans: (A) $\begin{pmatrix} -4 & 1 & 1 \\ -4 & -6 & 1 \\ 5 & 1 & 1 \end{pmatrix}$

50. If matrix A= $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ then A^4 is

(A) $\begin{bmatrix} 0 & 0 & -13 \\ 0 & 16 & 14 \\ -40 & 0 & 41 \end{bmatrix}$

(B) $\begin{bmatrix} 41 & 0 & -13 \\ 0 & 16 & 14 \\ -40 & 0 & 41 \end{bmatrix}$

(C) $\begin{bmatrix} 41 & 0 & -40 \\ 0 & 16 & 14 \\ -40 & 0 & 41 \end{bmatrix}$

(D) $\begin{bmatrix} 41 & 0 & -40 \\ 0 & 16 & 0 \\ -40 & 0 & 41 \end{bmatrix}$

Ans: (D) $\begin{bmatrix} 41 & 0 & -40 \\ 0 & 16 & 0 \\ -40 & 0 & 41 \end{bmatrix}$

Unit-4-Graph Theory-MCQs

1. A vertex with degree zero is called

    (A) isolated vertex

    (B) pendant vertex

    (C) adjacent vertices

    (D) None of the above

2. A pair of vertices that determine an edge is called

    (A) isolated vertex

    (B) pendant vertex

    (C) adjacent vertices

    (D) None of the above

3. A graph with no self loops and parallel edges is called a

    (A) Multigraph

    (B) Simple Graph

    (C) Pseudograph

    (D) None of the above

4. A graph with self loops and parallel edges is called

    (A) Multigraph

    (B) Simple Graph

    (C) Pseudograph

    (D) None of the above

5. If G be a simple graph with n vertices then

    (A) $E(G) \leq \frac{(n-1)}{2n}$.

(B) $E(G) \leq \frac{(n-1)^2}{2}$

(C) $E(G) \leq \frac{(n-1)}{2}$

(D) $E(G) \leq \frac{n(n-1)}{2}$

Ans: (D) $E(G) \leq \frac{n(n-1)}{2}$

6. If G be a graph with n vertices and e edges. Then

(A) $\sum_{i=1}^{n} d(v_i) = 2e.$

(B) $\sum_{i=1}^{n} d(v_i) = e.$

(C) $\sum_{i=1}^{n} d(v_i) = e^2$

(D) None of the above

$\sum_{i=1}^{n} d(v_i) = 2e.$

Ans: (A)

7. The minimum degrees of G are

(A) $\delta(G) = \min \{d(v)^3; v \in V(G)\}$

(B) $\delta(G) = \min \{d(v)^2; v \in V(G)\}$

(C) $\delta(G) = \min \{d(v); v \in V(G)\}$

(D) None of the above

8. A simple graph in which each pair of distinct vertices is joined by an edge is called

(A) Multigraph

(B) Simple Graph

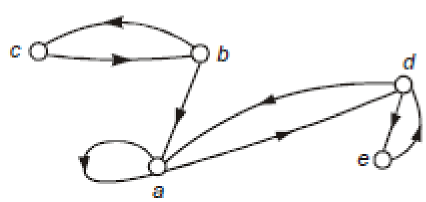
(C) Pseudograph

(D) Complete Graph

9. In a graph with directed edges the in-degree of a vertex *v* denoted by

(A) $d^+(v)$
(B) $d^-(v)$
(C) $d(v)$
(D) None of the above

10. The out-degree of the following graphs is



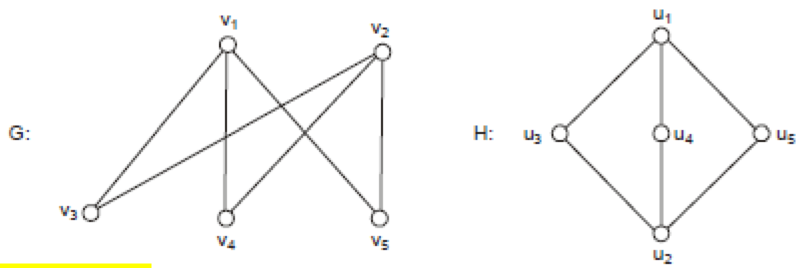
(A) 1
(B) 2
(C) 3
(D) 4

11. A graph H = (V(H), E(H)) is called a subgraph of a graph G = (V(G), E(G)) if
(A) $V(H) \supset V(G)$
(B) $V(H) \supseteq V(G)$
(C) $V(H) \subset V(G)$
(D) $V(H) \subseteq V(G)$

12. If in a simple graph, its vertex set V can be partitioned into two disjoint non-empty sets V1 and V2 such that every edge in the graph connects a vertex in V1 and a vertex in V2, then the graph is called

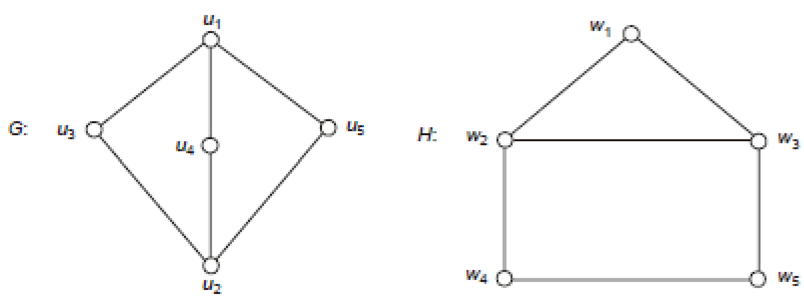
(A) Multigraph
(B) Subgraph
(C) Bipartite Graph
(D) Complete Bipartite Graph

13. The following graph G and H is



(A) Isomorphic
(B) Non-isomorphic
(C) Complete Bipartite Graph
(D) None of the above

14. The following graph G and H is

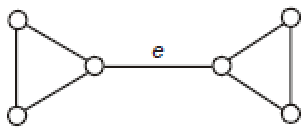


(A) Isomorphic
(B) Non-isomorphic
(C) Complete Bipartite Graph
(D) None of the above

15. A vertex v in a graph ,G where ω(G) is the component of G and component is a maximal connected subgraph of G, is said to be a cut-vertex if
(A) $\omega(G - v) < \omega(G)$
(B) $\omega(G - v) = \omega(G)$
(C) $\omega(G - v) \neq \omega(G)$
(D) $\omega(G - v) > \omega(G)$

16. An edge e in a graph G is said to be a Cut-edge, if
    (A) (G – e) is disconnected
    (B) (G – e) is connected
    (C) (G – e) is continuous
    (D) None of the above

17. The following graph contains



    (A) No Cut-edge
    (B) One Cut-edge
    (C) Two Cut-edge
    (D) Three Cut-edge

18. A directed graph is __________connected if there is a path from u to v and v to u, whenever u and v are vertices
    (A) Strongly
    (B) Weakly
    (C) Unilaterally
    (D) None of the above

19. A directed graph is __________ connected if there is a path between any two vertices in the underlying undirected graph
    (A) Strongly
    (B) Weakly
    (C) Unilaterally
    (D) None of the above

20. A directed graph is said to be __________ connected if in the two vertices u and v, there exists a directed path either from u to v or from v to u.
    (A) Strongly
    (B) Weakly
    (C) Unilaterally
    (D) None of the above

21. A subset S of the edge set of a connected graph G is called an edge cutest or cut-set of G if G – S is
    (A) Disconnected
    (B) Connected
    (C) Continuous
    (D) None of the above

22. A subset u of the vertex set of G is called a vertex cut-set if G – u is
    (A) Disconnected

(B) Connected
(C) Continuous
(D) None of the above

23. For every graph G,
(A) $K(G) \geq \lambda(G)$
(B) $K(G) = \lambda(G)$
(C) $K(G) \leq \lambda(G)$
(D) None of the above

24. For every graph G,
(A) $K(G) \leq \delta(G)$
(B) $K(G) \geq \delta(G)$
(C) $K(G) = \delta(G)$
(D) None of the above

25. The union of two simple graphs G1 = (V1, E1) and G2 = (V2, E2) is the simple graph with vertex set $V1 \cup V2$ and edge set $E1 \cup E2$ and is denoted by
(A) $G1 \cup G2$
(B) $G1 \cap G2$
(C) $G1 \oplus G2$
(D) None of the above

26. The intersection of two simple graphs G1 = (V1, E1) and G2 = (V2, E2) is the simple graph with vertex set $V1 \cap V2$ and edge set $E1 \cap E2$ and is denoted by
(A) $G1 \cup G2$
(B) $G1 \cap G2$
(C) $G1 \oplus G2$
(D) None of the above

27. The ring sum of two graphs G1 and G2 is a graph consisting of the vertex set $V1 \cup V2$ and of edges that are either in G1 or in G2, but not in both and is denoted by
(A) $G1 \cup G2$
(B) $G1 \cap G2$
(C) $G1 \oplus G2$
(D) None of the above

28. The ring sum of two graphs G1 and G2 is a graph consisting of the vertex set $V1 \cup V2$ and of edges that are either in G1 or in G2, but not in both and Δ is the symmetric difference then
(A) $E1 \Delta E2 = (E1 - E2) \cap (E2 - E1)$
(B) $E1 \Delta E2 = (E1 - E2) \cup (E2 - E1)$
(C) $E1 \Delta E2 = (E1 - E2) \subset (E2 - E1)$
(D) None of the above

29. Adjacency matrix uses __________
(A) Arrays
(B) Linked lists
(C) Both arrays and linked lists
(D) None of the above

30. Adjacency matrix is a
(A) Directed graphs
(B) Undirected graph
(C) Both (A) and (B)
(D) None of the above

31. In adjacency matrix, if there is an edge from vertex v_i to v_j in G, then the element a_{ij} in A is marked as
(A) Zero
(B) One
(C) Two
(D) None of the above

32. For a graph with 'n' vertices, an adjacency matrix requires ______ elements to represent it.
(A) n^2
(B) n^3
(C) n
(D) 2n

33. The adjacency matrix describes the relationships between the
(A) Adjacent vertices
(B) Adjacent nodes
(C) Distant nodes
(D) Distant vertices

34. An Euler tour is a tour which traverses each edge exactly _______
(A) Once
(B) Twice
(C) Thrice
(D) None of the above

35. A connected graph is Eulerian iff it has _____ vertices of odd degree.
(A) One
(B) Two
(C) Three
(D) No

36. A connected graph G has an Eulerian trail iff G has exactly _____ odd vertices
    (A) One
    (B) Two
    (C) Three
    (D) No

37. If D be a connected directed graph. D is Eulerian iff $d+(v) = d-(v)$, $\forall\ v \in G$, then G is called
    (A) Balanced digraph
    (B) Unbalanced digraph
    (C) Eulerian Digraphs
    (D) None of the above

38. If G be a n-vertex graph and if G_1 and G_2 are two graphs obtained from G by recursively joining pairs of non-adjacent vertices whose degree sum is atleast n. Then,
    (A) $G_1 \geq G_2$
    (B) $G_1 \neq G_2$
    (C) $G_1 = G_2$
    (D) None of the above

39. If G be a graph with at least 3 vertices, then G is Hamiltonian if
    (A) $C(G) = k_n, (n \geq 3)$
    (B) $C(G) \cong k_n, (n \geq 3)$
    (C) $C(G) \neq k_n, (n \geq 3)$
    (D) None of the above

40. If G be a graph with at least 3 vertices, then G is Hamiltonian for all pairs u and v of non-adjacent vertices of G iff
    (A) $d(u) + d(v) \geq n (n \geq 3)$
    (B) $d(u) + d(v) \leq n (n \geq 3)$
    (C) $d(u) + d(v) = n (n \geq 3)$
    (D) None of the above

41. If G is Hamiltonian then, for every non-empty proper subset S of V, then
    (A) $w(G - S) = |S|$
    (B) $w(G - S) \geq |S|$
    (C) $w(G - S) \leq |S|$
    (D) None of the above

42. A simple graph is connected if there exists at least ____ spanning tree.

    (A) One

    (B) Two

    (C) Three

(D) Four

43. The spanning tree of a connected graph can be made using

(A) Depth-First Search (DFS)

(B) Breadth-First Search (BFS)

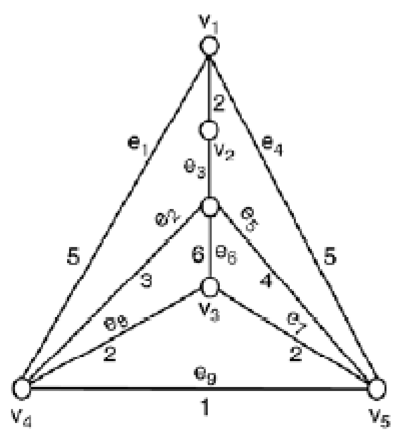
(C) Both (A) and (B)

(D) None of the above

44. Weight of a tree is the sum of weights of the edges in a tree and is denoted by
(A) wt
(B) wt(T)
(C) wt(T^2)
(D) None of the above

45. The optimal spanning tree can be found by
(A) Kruskal's algorithm
(B) Prim's algorithm
(C) Boruvka's algorithm
(D) All of the above

46. Weight of the optimal spanning tree of the following graph is



(A) 6
(B) 8
(C) 10
(D) 12

47. Boruvka's algorithm finds a minimum spanning tree in
(A) Weighted graph
(B) Directed graph

(C) Undirected graph
(D) None of the above

48. A vertex with degree zero is
(A) Pendent vertex
(B) Adjacent vertex
(C) Isolated vertex
(D) None of the above

49. A vertex with degree one is
(A) Pendent vertex
(B) Adjacent vertex
(C) Isolated vertex
(D) None of the above

50. In a graph, if movement from one vertex to another follows a direction, then it is
(A) Directed graph
(B) Undirected graph
(C) Complete graph
(D) Pseudo graph