



BRAINWARE UNIVERSITY

Term End Examination 2021 - 22

Programme – Bachelor of Technology in Electronics & Communication Engineering

Course Name – Linear Algebra and Differential Equations

Course Code - BSC(ECE)201

(Semester II)

Time allotted : 1 Hrs.25 Min.

Full Marks : 70

[The figure in the margin indicates full marks.]

Group-A

(Multiple Choice Type Question)

1 x 70=70

Choose the correct alternative from the following :

(1)

The value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega^2 & 1 & \omega \\ \omega^2 & \omega & 1 \end{vmatrix}$ is .

- | | |
|------|------|
| a) 0 | b) 1 |
| c) 2 | d) 3 |
- (2) If A is symmetric as well as skew- symmetric then A is a/an
- | | |
|--------------------|-------------------|
| a) Diagonal matrix | b) Null matrix |
| c) Identity matrix | d) None of these. |
- (3) If A is an idempotent matrix then I-A is a/an
- | | |
|-----------------------|----------------------|
| a) nilpotent matrix | b) idempotent matrix |
| c) involuntary matrix | d) none of these. |
- (4) If A is a non-null square matrix, then $A-A^T$ is a
- | | |
|---------------------|--------------------------|
| a) symmetric matrix | b) skew-symmetric matrix |
| c) null matrix | d) none of these. |
- (5) $(AB)^T =$
- | | |
|--------------|-------------------|
| a) A^T+B^T | b) $A^T B^T$ |
| c) $B^T A^T$ | d) none of these. |

(6) The co-factor of x in the determinant $\begin{vmatrix} x & 1 & 1 \\ 2 & -1 & 0 \\ 1 & 3 & 2 \end{vmatrix}$ is

- | | |
|-------|------|
| a) -2 | b) 4 |
|-------|------|

c) 2

d) 0

(7) The value of the determinant $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{vmatrix}$ is

a) 1

b) -1

c) 2

d) 0

(8) If $A = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}$, then $A^2 + 7I =$

a) O

b) 2A

c) 3A

d) 5A

(9) The rank of the matrix $A = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$ is

a) 2

b) 3

c) 4

d) none of these

(10) For what value of μ does the system of equations $x+y+z=1$; $x+2y-z=2$; $5x+7y+\mu z=4$ have a unique solution?

a) $\mu \neq 2$

b) $\mu \neq 1$

c) $\mu \neq 3$

d) $\mu \neq 4$

(11) The value of 'a' for which rank of the matrix $\begin{pmatrix} 2 & 0 & 1 \\ 5 & a & 3 \\ 0 & 3 & 1 \end{pmatrix}$ is less than 3?

a) 3/4

b) 3/5

c) 3/2

d) 1

(12) The equation $x-y=0$ has

a) no solution

b) exactly one solution

c) exactly two solutions

d) infinite number of solutions.

(13) The value of $\begin{vmatrix} 100 & 101 & 102 \\ 105 & 106 & 107 \\ 110 & 111 & 112 \end{vmatrix}$ is

a) 2

b) 0

c) 405

d) -1

(14) In $\begin{vmatrix} 3 & -2 & 5 \\ -1 & 2 & -3 \\ -5 & 6 & 9 \end{vmatrix}$, the minor and co-factor of -2 are respectively

a) -24, 24

b) 24, -24

c) -24, -24

d) none of these.

(15) If set of vectors $\{(1, 0, 0), (1, x, 1), (x, 0, 1)\}$ is linearly dependent then x is

a) 1

b) 0

c) 2

d) 3

(16) $S = \{(x, y, 0) \mid x, y \in R\}$ is a subspace of R^3 , then $\dim(S)$ is

a) 2

b) 3

c) 5

d) None of these

(17)

Let α, β, γ be three vectors in a vector space V over R , where R is the set of all real numbers. $c\alpha + d\beta + e\gamma = \theta$, where θ is the zero vector in V then the value of c, d, e are respectively.

a) 1,1,1

b) 0,0,0

c) 1,0,0

d) 0,1,1

(18)

If $\{\alpha, \beta, \gamma\}$ is a basis of a vector space V , then $\{\alpha, \beta + \gamma, \gamma\}$

a) is a basis of V

b) linearly dependent

c) linearly independent but not a basis

d) None of these

(19) Which of the following is not a subspace of R^2 ?

a) $\{(x, 0) : x \in R\}$

b) $\{(0, y) : y \in R\}$

c) $\{(x, 1) : x \in R\}$

d) $\{(x, y) : x = y, x, y \in R\}$

(20) Let $T : R^3 \rightarrow R^3$ be defined by $T(x_1, x_2, x_3) = (x_1 + 1, x_2 + 1, x_3 + 1), (x_1, x_2, x_3) \in R^3$, then T is a

a) linear mapping

b) is not a linear mapping

c) $T(\alpha + \beta) = T(\alpha) + T(\beta)$

d) None of these

(21) Let V and W be two vector spaces and $T : V \rightarrow W$ is a linear mapping and θ, θ' be the null vectors of V and W respectively, then

a) $\text{Ker } T = \{\alpha \in V \mid T(\alpha) = \theta\}$

b) $\text{Ker } T = \{\alpha \in V \mid T(\alpha) = \theta'\}$

c) $\text{Ker } T = \{\alpha \in V \mid T(\alpha) = \alpha\}$

d) None of these

(22) If S is a subspace of a vector space $(V, +, \cdot)$ over R , where R is the set of all real numbers. Then which of the following statement is false.

a) $\alpha + \beta \in S$ whenever $\alpha, \beta \in S$

b) $\alpha + 2\beta \in S$ whenever $\alpha, \beta \in S$

c) $-\alpha + \beta \in S$ whenever $\alpha, \beta \in S$

d) None of a, b, c is true.

(23) Let A and B be two subspaces of a vector space V , then

a) $A \cap B$ is a subspace of V .

b) both $A \cap B$ and $A \cup B$ are subspaces of V .

c) $A \cup B$ is a subspace of V .

d) neither $A \cap B$ nor $A \cup B$ are subspaces of V .

(24) In a vector space V over R . Let $\alpha \in V$ and $a \in R$. Then which is true?

a) $a\alpha \in V$

b) $\alpha + \alpha \in V$

c) $\alpha^2 \in V$

d) $\alpha \in V$

(25)

The value of the linear combination $2 \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & -1 \\ -1 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ in the vector space

$M_{3 \times 1}(R)$ is?

a) a scalar

b) a vector

c) neither a scalar nor a vector

d) both scalar and vector

(26) Which of the following is not linear transformation?

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a) $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2 : T(x, y) = (3x - y, 2x)$

b) $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2 : T(x, y, z) = (3x + 1, y - z)$

c) $T: \mathbb{R} \rightarrow \mathbb{R}^2 : T(x) = (5x, 2x)$

d) $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2 : T(x, y, z) = (x, 0, z)$

(27) Let I be the identity transformation of the finite dimensional vector space V , then the nullity of I is

a) $\dim(V)$

b) 0

c) 1

d) $\dim(V) - 1$

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(28) A linear mapping $T: V \rightarrow W$ is injective if and only if

a) T is surjective

b)

$\text{Ker } T = \{\theta\}$

c)

$\text{Im } T = \{\theta\}$

d)

$\text{Ker } T \neq \{\theta\}$

(29) Let $T: \mathbb{R}^n \rightarrow \mathbb{R}^n$ be a linear transformation. Which one of the following statement implies that T is bijective?

a) $\text{nullity}(T) = n$

b) $\text{rank}(T) = \text{nullity}(T) = n$

c) $\text{rank}(T) + \text{nullity}(T) = n$

d) $\text{rank}(T) - \text{nullity}(T) = n$

(30)

Which of the following is the linear transformation from \mathbb{R}^2 to \mathbb{R}^2 ?

(i) $f \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 4 \\ x + y \end{pmatrix}$

(ii) $g \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} xy \\ x - y \end{pmatrix}$

(iii) $h \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} z - x \\ x + y \end{pmatrix}$

a) only f

b) only g

c) only h

d) all the transformations f, g, h

(31)

Which of the following subsets of \mathbb{R}^4 ?

$B_1 = \{(1, 0, 0, 0), (1, 1, 0, 0), (1, 1, 1, 0), (1, 1, 1, 1)\}$

$B_2 = \{(1, 0, 0, 0), (1, 2, 0, 0), (1, 2, 3, 0), (1, 2, 3, 4)\}$

$B_3 = \{(1, 2, 0, 0), (0, 0, 1, 1), (2, 1, 0, 0), (-5, 5, 0, 0)\}$

a)

B_1 and B_2 but not B_3

b)

B_1, B_2 and B_3

c)

B_1 and B_3 but not B_2

d)

only B_1

(32)

If $A^2 = A$, then its Eigen values are either

a) 0 or 2

b) 1 or 2

c) 0 or 1

d) Only 0

(33)

If $\lambda \neq 0$ is an Eigen value of a matrix A then the matrix A^{-1} has an Eigen value

a) λ

b) $-\lambda$

c) $\frac{1}{\lambda}$

d) Can Not be determined

Q.11
Q.12

- (34) If A is an orthogonal Matrix then what can we say about the matrix A
- a) Singular Matrix
 - b) Non-Singular Matrix
 - c) Symmetric Matrix
 - d) Skew-Symmetric matrix
- (35) If A is a skew-symmetric matrix then which of the following be an possible Eigen value of A

- a) 1
- b) -1
- c) 0
- d) None of -1,0,1

- (36) If 0 is an Eigen value of a matrix A then which of the following is false

- a) 0 is an Eigen value of A^{-1}
- b) 0 is an Eigen value of A'
- c) A has no inverse matrix
- d) A can't be orthogonal

- (37) If A is an orthogonal matrix then which of the following is not a possible Eigen value of A

- a) -1
- b) 0
- c) 1
- d) $\sqrt{-1}$

- (38) If A is similar to the matrix B then A^{-1} is similar to the matrix

- a) A
- b) B
- c) B^{-1}
- d) A'

- (39) If η is an Eigen value of A and A similar to B then B always has an Eigen value

- a) η^3
- b) η^2
- c) η
- d) $\frac{1}{\eta}$

- (40) If α is an Eigen value and v is the corresponding Eigen vector of a matrix A then which of the following is false

- a) $Av = \alpha v$
- b) $Av = \alpha v$
- c) $A^{-1}v = \frac{1}{\alpha}v$
- d) One of a, b, c is false

- (41) If $V = R^3$ be equipped with inner product $(x, y) = x_1y_1 + 2x_2y_2 + 3x_3y_3$, In this inner

product space $(V, (\cdot, \cdot))$ then the value of the inner product of $u = \begin{bmatrix} 1 \\ 1 \\ \sqrt{3} \end{bmatrix}, v = \begin{bmatrix} 0 \\ 1 \\ \frac{1}{\sqrt{3}} \end{bmatrix}$

- a) $\frac{2}{\sqrt{2}}$
- b) $2\sqrt{2}$
- c) 2
- d) $\frac{\sqrt{3}}{2}$

- (42) If $V = R^3$ be equipped with inner product $(x, y) = x_1y_1 + x_2y_2 + x_3y_3$, In this inner product space $(V, (\cdot, \cdot))$ which of the following pairs of vectors is orthonormal?

- a)
- b)

$$u = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, v = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$u = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, v = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$$

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c)
$$u = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, v = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$$

d)
$$u = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}, v = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

- (43) Any set of linearly independent vectors can be orthonormalized by the:
- a) Cramer's rule
 - b) Sobolev Method
 - c) Gram-Schmidt procedure
 - d) Pound-Smith procedure
- (44) The diagonalizing matrix is also known as:
- a) Eigen Matrix
 - b) Constant Matrix
 - c) Modal Matrix
 - d) State Matrix
- (45) If $V = R^3$ be equipped with inner product $(x, y) = x_1y_1 - x_2y_2 + x_3y_3$. Then which of the following set of vectors are linearly independent.
- a) $\{(0, 1, 0), (0, 0, 1), (-1, 0, 1)\}$
 - b) $\{(0, 1, 0), (0, -1, 0), (0, 0, 1)\}$
 - c) $\{(0, 1, 0), (0, 0, 1), (-1, 0, 1)\}$
 - d) $\{(1, 0, 1), (0, 1, 0), (-1, 0, 1)\}$
- (46) If α and β be two orthogonal vectors in a Euclidean space $(R^n, \|\cdot\|)$, then which of the following relation holds.
- a) $\|\alpha + \beta\|^2 = \|\alpha\|^2 - \|\beta\|^2$
 - b) $\|\alpha + \beta\|^2 = \|\alpha\|^2 + \|\beta\|^2$
 - c) $\|\alpha + \beta\|^2 = 2(\|\alpha\|^2 - \|\beta\|^2)$
 - d) $\|\alpha + \beta\|^2 = 2(\|\alpha\|^2 + \|\beta\|^2)$
- (47) Let A be a 3×3 matrix of real numbers and A is diagonalizable then which of the following statement is true.
- a) A has 3 l.d Eigen vectors
 - b) A has 3 l.i Eigen vectors
 - c) A has 3 distinct Eigen values
 - d) Two of a, b and c is true
- (48) If λ is an Eigen value of an orthogonal matrix A the which of the following statement is false
- a) $\det(A - \lambda I) = 0$
 - b) $\det(A - \frac{1}{\lambda} I) = 0$
 - c) $\det(A^{-1} - \lambda I) = 0$
 - d) One of a, b and c is false
- (49) If λ is the only Eigen value (real or complex) of an $n \times n$ matrix A then $\det A =$
- a) λ
 - b) λ^n
 - c) $n\lambda$
 - d) $n\lambda^{n-1}$
- (50) The differential equation $(a_1x - b_1y)dx + (a_2x - b_2y)dy = 0$ is exact if
- a) $a_1 = b_2$
 - b) $b_1 = b_2$
 - c) $a_1 = -b_2$
 - d) $a_2 = -b_1$
- (51) If $x^m y^n$ be the IF of the equation $(2ydx + 3xdy) + 2xy(3ydx + 4xdy) = 0$ then the value of m and n are respectively
- a) 1, 3
 - b) 2, 1
 - c) 2, 2
 - d) 1, 2
- (52) The integrating factor of $ydx - xdy + 4x^2y^2e^x dx = 0$ is

a) $\frac{1}{y}$

b) y^2

c) xy^2

d) $\frac{1}{y^2}$

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(53) The general form of a first order linear equation in x is $\frac{dx}{dy} + Px = Q$ where

a) P and Q are both functions of x

b) P and Q are both functions of y

c) P and Q are the functions of x and y , respectively

d) P and Q are the functions of y and x , respectively

(54) $\frac{1}{(D^2 - 2D + 2)} \cos x =$

a) $\frac{1}{5}(-2 \sin x + \cos x)$

b) $\frac{1}{10} \cos x$

c) $\frac{1}{5}(2 \sin x + \cos x)$

d) None of these

(55) The CF of the equation $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} = 3x$ is

a) $c_1x + c_2e^{3x}$

b) $c_1e^x + c_2e^{3x}$

c) $c_1 + c_2e^{3x}$

d) None of these

(56) The integrating factor of $\cos x \frac{dy}{dx} + y \sin x = 1$ is

a) $\tan x$

b) $\cos x$

c) $\sec x$

d) $\sin x$

(57) A particular solution of $\frac{d^2y}{dx^2} + y = 0$ when $x=0, y=4; x = \frac{\pi}{2}, y=0$ is

a) $y = A \cos x$

b) $y = 5 \cos x$

c) $y = 4 \cos x + 2 \sin x$

d) $y = 4 \cos x$

(58) $\frac{1}{(D-2)(D-3)} e^{2x} =$

a) $-e^{2x}$

b) xe^{2x}

c) $-xe^{3x}$

d) $-xe^{2x}$

(59) $\frac{1}{D^2 + 2} x^2 e^{3x} =$

a) $\frac{1}{11} \left(x^2 - \frac{12x}{11} \right)$

b) $\frac{1}{11} \left(x^2 - \frac{12x}{11} + \frac{60}{121} \right)$

c) $\frac{1}{11} \left(x^2 - \frac{12x}{11} + \frac{50}{121} \right)$

d) None of these

(60) The Wronskian for the differential equation $\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 2y = 9e^x$ is

a) e^{2x}

b) e^x

c) e^{3x}

d) None of these

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- (61) The C.F of the equation $x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} = 3x$ is
- a) $c_1 x + c_2 e^{3x}$
 - b) $c_1 e^x + c_2 e^{3x}$
 - c) $c_1 + c_2 e^{3x}$
 - d) None of these
- (62) The solution of the system $Dx = y', D_1 y' = x \left(D \equiv \frac{d}{dt} \right)$ is
- a) $x = Ae^t + Be^{-t}, y' = Ae^t + 2Be^{-t}$
 - b) $y' = Ae^t + Be^{-t}, x = Ae^t - Be^{-t}$
 - c) $x = Ae^t + Be^{-t}, y' = -Ae^t - Be^{-t}$
 - d) None of these
- (63) For the simultaneous equation $\frac{dx}{dt} + y = \sin t, \frac{dy}{dt} + x = \cos t$, which of the following is true?
- a) $x = c_1 \cos t + c_2 \sin t$
 - b) $x = c_1 e^t + c_2 e^{-t}$
 - c) $x = (c_1 + c_2 t) e^t$
 - d) None of these
- (64) $\frac{1}{D^2 - 2D + 5} (10 \sin x) =$
- a) $\sin x + \cos x$
 - b) $3 \sin x - \cos x$
 - c) $2 \sin x + \cos x$
 - d) $4 \sin x$
- (65) The solution of $\frac{dy}{dx} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0$ is
- a) $y \sin x + (\sin y + y) x = C$
 - b) $y \sin x + (\sin x + x) = C$
 - c) $y = \sin x + y \cos y + C$
 - d) None of these
- (66) If y^a is an integrating factor of the differential equation $2xy dx - (3x^2 - y^2) dy = 0$, then the value of a is
- a) -4
 - b) 4
 - c) -1
 - d) 1
- (67) If $y = 3e^{2x} + e^{-2x} - \alpha x$ is the solution of the initial value problem $\frac{d^2 y}{dx^2} + \beta y = 4 \alpha x$, $y = 4$ and $\frac{dy}{dx} = 1$ at $x = 0$, where $\alpha, \beta \in \mathbb{R}$, then
- a) $\alpha = 3$ and $\beta = 4$
 - b) $\alpha = 1$ and $\beta = 2$
 - c) $\alpha = 3$ and $\beta = -4$
 - d) $\alpha = 1$ and $\beta = -2$
- (68) The integrating factor of $\frac{dy}{dx} = \frac{2xy^2 + y}{x - 2y^3}$ is
- a) $\frac{1}{y}$
 - b) $\frac{1}{y^2}$
 - c) y
 - d) y^2
- (69) Eliminating arbitrary constants a and b from $z = (x^2 + a)(y^2 + b)$, the PDE is
- a) $p + q = xyz$
 - b) $pq = xyz$

c) $pq = 4xyz$

d) $pq = -4x^2y^2z^2$

70) The general integral of $zxp - yzq = y^2 - x^2$ for an arbitrary function ϕ is

a) $x^2 + y^2 + z^2 = \phi(xy)$

b) $x^2 - y^2 - z^2 = \phi(xy)$

c) $x^2 + y^2 + z^2 = \phi(xyz)$

d) $x^2 - y^2 - z^2 = \phi(yz)$

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