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^TB^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+ μz=4 have a uni que solution?

a) μ≠2 b) μ≠1

c) μ≠3 d) μ≠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 $T : R^3 \to R^3$ 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 $T : V \to W$ is a linear mapping and θ, θ^1 be the null vectors of V and W respectively, then

a) $Ker\ T = \{\alpha \in V \mid T(\alpha) = \theta\}$
b) $Ker\ T = \{\alpha \in V \mid T(\alpha) = \theta^1\}$
c) $Ker\ T = \{\alpha \in V \mid T(\alpha) = \alpha\}$
d) None of these

(22) If S is a subspace of a vector space $(V, +, .)$ 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) $a + \alpha \in V$
c) $\alpha^2 \in V$
d) $a \in V$

(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 $M_{3\times3}(R)$ 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?

a) $T: R^2 \to R^2 : T(x,y) = (3x-y, 2x)$

b) $T: R^3 \to R^2 : T(x,y,z) = (3x+1, y-z)$

c) $T: R \to R^2 : T(x) = (5x, 2x)$

d) $T: R^3 \to R^2 : T(x,y,z) = (x, 0, z)$

(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

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

a) T is surjective

b) $Ker\ T = \{\theta\}$

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

d) $Ker\ T \neq \{\theta\}$

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

a) nullity(T) = n

b) rank(T) = nullity(T) = n

c) rank(T) + nullity(T) = n

d) rank(T) – nullity(T) = n

(30)

Which of the following is the linear transformation from R^3 to 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 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^T has an Eigen value

a) λ

b) $-\lambda$

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

d) Can Not be determined

(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 an 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^T
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^T

(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) $Av = \alpha I$
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 $(V, (.,.))$ then the value of the inner product of $u = \begin{bmatrix} 1 \\ 1 \\ \frac{1}{\sqrt{3}} \end{bmatrix}, v = \begin{bmatrix} 0 \\ \frac{1}{2} \\ \frac{1}{\sqrt{3}} \end{bmatrix}$

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 $(V, (.,.))$ which of the following pairs of vectors is orthonormal?

a)
b)

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

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

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 $(R^n, \|.\|, .\|)$, 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^my^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 $ydx-xdy+4x^3y^2e^{x^4}dx=0$ is

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

b) y^2

c) xy^2

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

(53) The general form of a first order linear equation in x is $\frac{dy}{dx}+Px=Q$ 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) $\frac{1}{D^2+2}x^2e^{3x}=$

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

(61) The C.F 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

(62) The solution of the system $Dx=y,\ Dy=x\left(D\equiv\frac{d}{dt}\right)$ 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) $x=c_1e^t+c_2e^{-t}$

c) $x=(c_1+c_2t)e^t$

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 $2xydx-(3x^2-y^2)dy=0$, 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 $\frac{d^2y}{dx^2}+\beta y=4\alpha x$
$y=4$ 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) $x^2 - y^2 - z^2 = \phi(yz)$