BRAINWARE UNIVERSITY

Term End Examination 2020 - 21

Programme – Bachelor of Science (Honours) in Computer Science

Course Name – Mathematics-III

Course Code - GEBS302

Semester / Year - Semester III

Time allotted : 75 Minutes Full Marks : 60

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 60=60

1. *(Answer any Sixty)*

(i)

The degree of the polynomial $ax+b$ is 1 if and only if

a) $a=0$

b) $a\neq 0$

c) $b=0$

d) $b\neq 0$

(ii)

If $f(x),\ g(x)$ are polynomials of degree m and n respectively. Then the degree of $f(x)+g(x)$ is

a) mn

b) m+n

c) No conclusion

d) undefined

(iii)

Which of the following is not a factor of $f(x) = x^3 + 3x^2 + 3x + 1$?

a) x+1

b) $(x+1)^2$

c) $(x+1)^3$

d) $(x+1)^4$

(iv)

If $p(x) = ax^2 + bx + c$ is a polynomial of degree 2, then $\frac{c}{a}$ is equal to

a) 0

b) 1

c) Sum of zeroes

d) Product of zeroes

(v)

The zeroes of the polynomial $f(x) = 4x^2 - 12x + 9$ are:

a) 3/2, -3/2

b) 3/2, 3/2

c) 2/3, 3/2

d) -3/2, 2/3

(vi)

The value of k, if (x – 1) is a factor of $4x^3 + 3x^2 - 4x + k$, is

a) 1

b) 2

c) -3

d) 3

(vii)

A quadratic polynomial equation whose one root is 6 and sum of the roots is 0, is

a)

$x^2 - 12x + 36=0$

b)

$x^2 - 36=0$

c)

$x^2 - 36=0$

d)

$x^2 - 6x=0$

(viii)

Every algebraic equation of degree ‘n’ has exactly

a)

n roots

b)

n-1 roots

c)

n+1 roots

d)

None of these

(ix)

A bicubic equation is of degree

a) 4

b) 6

c) 9

d)

Degree not assigned

(x)

Maximum number of negative roots of the equation $x^3 + x - 3 = 0$ is

a) 0 b) 1

c) 2 d) 3

(xi)

Maximum number of complex roots of a cubic equation is

a) 0

b) 1

c) 2

d) 3

(xii)

The equation whose roots are double of those of the equation $x^3 + 2x - 3 = 0$ is

a) $x^3 + 8x - 3 = 0$

b) $x^3 + 4x - 12 = 0$

c) $x^3 + 8x - 24 = 0$

d) None of these

(xiii)

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

a) 2 b) 3

c) 5 d) None of these

(xiv)

Let α, β, γ be three linearly independent vectors in a vector space V over R, where R is the set of all real numbers. If $c\alpha + d\beta + e\gamma = \theta$, 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

(xv)

$S = \left\{ \begin{pmatrix} x_1 & 0 \\ 0 & x_2 \end{pmatrix} \mid x_1, x_2 \in R \right\}$, then dim(S) is

a) 2

b) 3

c) 5

d) None of these

(xvi)

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

(xvii)

Let V and W be two vector spaces and $T : V \to W$ is a linear mapping, then T is injective if and only if

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

b) $\text{Ker } T=\{0\}$

c) $\text{Ker } T=V$

d) None

(xviii)

Let $T: R^3 \to R^2$ be a linear transformation defined by $T(x,y,z)=(x-y,x-z)$, then the dimension of the nullspace of T is

a) 0

b) 1

c) 2

d) 3

(xix)

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.

(xx)

A vector space V is finite dimensional if it has

a) finite basis

b) finite elements

c)

d) None of these

no basis

(xxi)

Which of the following is not linear transformation?

a)

$T: R^2 \to R^2:$

$\mathrm{T(x, y)} = (3x - y, 2x)$

b)

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

c)

$T: \mathrm{R} \to R^2: \mathrm{T(x)} = (5x, 2x)$

d)

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

(xxii)

A liner mapping $T: \mathrm{V} \to W$ is injective if and only if

a)

T is surjective

b)

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

c)

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

d)

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

(xxiii)

Let $T: \mathrm{V} \to W$ be a liner transformation and rank(T)=m, then

a)

dim(V) = m

b)

dim(Ker T) = m

c)

d)

dim(Im T) = m

dim(W) = m

(xxiv)

Consider the mapping

$$M_1 : T : R^3 \to R^2, T(x, y, z) = (y-1, x+z)$$

$$M_2 : T : R^2 \to R, T(x, y) = 2xy$$

$$M_3 : T : R^3 \to R^2, T(x, y, z) = (|y|, 0)$$

Which of the above is a linear transformation?

a) only M_2 and M_3

b) only M_3

c) all M_1, M_2 and M_3

d) None of these

(xxv)

The number of vectors present in the basis of the vector space $\left\{ \begin{bmatrix} x & 0 \\ x & y \end{bmatrix} : x, y \in R \right\}$ is

a) 1

b) 2

c) 3

d) 0

(xxvi)

Suppose u and v belong to a vector space V. Then simplified form of

$E=5(2u-3v)+4(7v+8)$ is

a)

$10u-13v+32$

b)

$42u+13v$

c)

$u+v$

d)

None of these

(xxvii)

Let $V=M_{2,2}$. The coordinate vector [A] of $A=\begin{bmatrix} 3 & -5 \\ 6 & 7 \end{bmatrix}$ relative to S where

$$S=\left\{\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix},\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix},\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix},\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}\right\}$$ is

a)

[7,-1,-13,10]

b)

[7,1,13,10]

c)

[-7,1,13,-10]

d)

Both [7,-1,-13,10] and [-7,1,13,-10]

(xxviii)

Define $T:\mathbb{R}^2 \to \mathbb{R}^2$ by $T(a_1,a_2)=(a_1,-a_2)$. Then

a)

T is called the reflection about the y -axis

b)

T is called the reflection about the x -axis

c) d)

T is called the projection on the x -axis

T is called the projection on the y -axis

(xxix)

Let V and W be vector spaces, and let $T : \mathrm{V} \to \mathrm{W}$ be linear. If $\mathrm{N(T)} = \{0\}$ then

a) T is injective

b) T is surjective

c) T is bijective

d) Can not be decided

(xxx)

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

(xxxi)

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)

d) Can Not be determined

$$\frac{1}{\lambda}$$

(xxxii)

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) $\frac{\sqrt{3}}{2}$

(xxxiii)

What is the value of k so that the vectors (1,-2,-3) and (2,k,4) are orthogonal

a) -5

b) 5

c) -10

d) 10

(xxxiv)

If λ is the only Eigen value (real or complex) of an $n \times n$ matrix A then det A=

a)

b)

λ

c)

$n\lambda$

λ^n

d)

$n\lambda^{n-1}$

(xxxv)

An orthogonal matrix A has eigen values of 1, 2 and 4. The trace of the matrix A^T is

a) 7/4

b) 1/7

c) 7

d) 4/7

(xxxvi)

The eigen values of $\begin{pmatrix} 2 & -1 \\ -4 & 5 \end{pmatrix}$ are

a)

-1 and 1

b)

1 and 6

c)

2 and 5

d)

4 and -1

(xxxvii)

If V denotes the vector space of $n \times n$ real skew symmetric matrices, then dim V=

a)

$n^2 - n$

b)

$n - 1$

c)

$\frac{n(n+1)}{2}$

d)

$\frac{n(n-1)}{2}$

(xxxviii)

The direction cosines of a line which makes equal angles with the coordinates axes are

a) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

b) $-\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$

c) Both of these

d) None of these

(xxxix)

If a line has the direction ratios – 18, 12, -4, then what are its direction cosines?

a) $\frac{9}{11}, \frac{6}{11}, \frac{2}{11}$

b) $-\frac{9}{11}, -\frac{6}{11}, -\frac{2}{11}$

c) $-\frac{9}{11}, \frac{6}{11}, -\frac{2}{11}$

d) None of these

(xl)

The points (2, 3, 4), (-1, -2, 1), (5, 8, 7)

a) makes an equilateral triangle

b) are collinear

c) makes an right angular triangle

d) None of these

(xli)

Equation of the straight line passing through x_1, y_1, z_1 whose direction cosines are l, m, n is

a)

$$\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$$

b)

$$\frac{x-l}{x_1}=\frac{y-m}{y_1}=\frac{z-n}{z_1}$$

c)

$$\frac{x}{l}=\frac{y}{m}=\frac{z}{n}$$

d)

$$\frac{x}{x_1}=\frac{y}{y_1}=\frac{z}{z_1}$$

(xlii)

The angle between the pair of lines $\frac{x+3}{3}=\frac{y-1}{5}=\frac{z+3}{4}$ and $\frac{x+1}{1}=\frac{y-4}{1}=\frac{z-5}{2}$ is

a)

$$\cos^{-1}\left(\frac{8}{5}\right)$$

b)

$$\cos^{-1}\left(\frac{8\sqrt{3}}{15}\right)$$

c)

$$\cos^{-1}\left(\frac{8\sqrt{3}}{5}\right)$$

d)

None of these are false

(xliii)

The shortest distance between the lines $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$ and $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$ is

a)

b)

$\sqrt{29}$

$-\sqrt{29}$

c)

d)

$2\sqrt{29}$

$-2\sqrt{29}$

(xliv)

The equation of the plane which makes intercepts a, b, c on x, y and z axes, respectively is

a)

b)

$ax+by+cz=1$

$\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

c)

d)

$x+y+z=abc$

$ax+by+cz=0$

(xlv)

The equation of the plane with intercepts 2, 3 and 4 on the x, y and z-axis respectively is

a)

b)

$\frac{x}{2}+\frac{y}{3}+\frac{z}{4}+1=0$

$\frac{x}{2}+\frac{y}{3}+\frac{z}{4}=0$

c)

d)

$\frac{x}{2}+\frac{y}{3}+\frac{z}{4}=1$

none of these

(xlvi)

The lines $\frac{x+3}{-3}=\frac{y-1}{1}=\frac{z-5}{5}$ and $\frac{x+1}{-1}=\frac{y-2}{2}=\frac{z-5}{5}$ are

a) parallel

b) perpendicular

c) collinear

d) coplanar

(xlvii)

The two planes $a_1x+b_1y+c_1z+d_1=0$ and $a_2x+b_2y+c_2z+d_2=0$ are parallel if

a) $\frac{a_1}{a_2}+\frac{b_1}{b_2}+\frac{c_1}{c_2}=0$

b) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

c) $a_1a_2+b_1b_2+c_1c_2=0$

d) $a_1a_2=b_1b_2=c_1c_2$

(xlviii)

The direction cosines of the normal to the plane z=2 are

a) 1,0,0

b) 0,1,0

c) 0,0,1

d) 1,1,0

(xlix)

The general solution of $xp + yq = z$ for an arbitrary function ϕ is

a) $\phi\left(\frac{x}{y}, xy\right) = 0$

b) $\phi(x+y, xz) = 0$

c) $\phi\left(\frac{x}{y}, \frac{x}{z}\right) = 0$

d) $\phi(xy, z) = 0$

(l)

The particular integral of $\left(D^2 + 3DD' + 2D'^2\right)z = x + y$ is

a) $\frac{(x+y)^2}{9}$

b) $\frac{(x+y)^3}{36}$

c) $\frac{(x+y)^3}{125}$

d) $\frac{(x+y)^3}{6}$

(li)

The general solution of $\left(D^2 + 2DD' + D'^2\right)z = e^{2x+3y}$ is

a) $z = \phi_1(y-x) + x\phi_2(y-x) + \frac{1}{5}e^{2x+3y}$

b) $z = \phi_1(y-x) + x\phi_2(y-x) + \frac{1}{15}e^{2x+3y}$

c)

$$z=\phi_1(y-x)+(1+x)\phi_2(y-x)+\frac{1}{25}e^{2x+3y}$$

d)

$$z=\phi_1(y-x)+x\phi_2(y-x)+\frac{1}{25}e^{2x+3y}$$

(lii)

The PDE $2y^2u_{xx}-4x^2yu_{xy}+2x^4u_{yy}-2u_x+4u_y=x^2yz^3$ can be classified as

a)

Parabola

b)

Ellipse

c)

Hyperbola

d)

Circle

(liii)

The PDE $x\frac{\partial^2 z}{\partial x^2}+y\frac{\partial^2 z}{\partial y^2}=0$ is

a)

hyperbolic for $x>0, y<0$

b)

elliptic for $x>0,\ y<0$

c)

hyperbolic for $x>0, y>0$

d)

none of these

(liv)

When solving a 1-dimensional wave equation using variable separation method, we get the solution if

a)

b)

k is positive

c)

k is 0

k is negative

d)

k can be anything

(lv)

The PDE $r^2 + 2s - t^2 = 0$ is of order

a)

1

b)

2

c)

3

d)

None of these

(lvi)

A partial differential equation has

a)

one independent variable

b)

two or more independent variables

c)

more than one dependent variables

d)

equal number of dependent and independent variables

(lvii)

If $f(x,y) = \sin(xy) + x^2 \ln(y)$ find f_{yx} at $(0, \frac{\pi}{2})$

a)

33

b)

0

c)

d)

3 1

(lviii)

If $f(x,y) = \frac{x+y}{y}$, then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} =$

a)

0

b)

1

c)

2

d)

3

(lix)

The differential equation $x^3yz^3\frac{\partial z}{\partial x} + xy^3z^2\frac{\partial z}{\partial y} = \sin(xy+z)$ is

a)

a linear PDE of order one

b)

a quasi-linear PDE of order one

c)

a semi-linear PDE of order one

d)

a semi-linear PDE of order two

(lx)

The differential equation $x\left(\frac{\partial z}{\partial x}\right)^2 + y\frac{\partial z}{\partial x}\frac{\partial z}{\partial y} = xyz$ is

a)

a linear PDE of order one

b)

a non-linear PDE of order one

c)

d)

a linear PDE of order two

a non-linear PDE of order two