Question 1.

Suppose $\lim_{x \to 0} \frac{x(1-a\sin x) + b\sin x}{x^3} = \frac{1}{3}$, then

1. The value of constant "b" is
    a. 0
    b. Infinity
    c. -0.5
    d. 1
    e. None of mentioned

2. The value of constant "a" is
    a. 1
    b. 0
    c. 0.75
    d. 0.5
    e. None of mentioned

3. Direct substitution gives the limit of numerator, as x tends to zero
    a. $1 - a + b$
    b. $1 - a - b$
    c. 0
    d. $1 - b$
    e. None of mentioned

4. Direct substitution gives the limit of denominator, as x tends to zero
    a. Infinity
    b. 0
    c. 1
    d. 2
    e. None of mentioned

5. Which is true ?
    a. Both are positive integers
    b. Both are negative integers
    c. One positive and One negative integer
    d. Both are imaginary number
    e. None of mentioned

Question 2.

Consider the Group $G = \{1, \omega, \omega^2\}$ Where ω is the cube root of unity, If $*$ denotes the multiplication operation, the structure $(G, *)$

1. Is it a Group under the multiplication operation ?
   a. Yes
   b. No
   c. Can not be a group
   d. None

2. Inverse of ω is
   a. 1
   b. ω
   c. ω^2
   d. None

3. Inverse of ω^2 is
   a. ω
   b. 1
   c. ω^2
   d. None

4. Is it a Cyclic Group under the multiplication operation ?
   a. No
   b. Yes
   c. Can not be a Cyclic group
   d. None

5. What is its identity Element ?
   a. 1
   b. ω
   c. ω^2
   d. *None*

Question 3.

Consider $(Q,*)$ is set of rational numbers excluding 1 and $*$ is defined as

$a * b = a + b - ab$, for all a, b belongs Q

1. Identity element of Q is
    a. 0
    b. 1
    c. 2
    d. 3

2. Inverse element of 3 is
    a. 1
    b. 3/2
    c. 0
    d. -3/2

3. Inverse element of 4 is
    a. 4/3
    b. 4/5
    c. 5/4
    d. 3/4

4. Inverse element of 2 is
    a. 1
    b. 2
    c. 3
    d. 4

5. Q is
    a. Semigroup
    b. Monoid
    c. Group
    d. All of the above

Question 4.

Consider $(G,*)$ where $*$ is defined as $a * b \ = ab/4$, and G is the set of all non-zero real numbers

1. Identity element of G is
    a. 1
    b. 2
    c. 3
    d. 4

2. G is abelian or not
    a. Yes
    b. No
    c. Cannot say

3. Inverse of the 2
    a. 16
    b. 8
    c. 4
    d. 2

4. Inverse of the a
    a. a
    b. 16
    c. 16/a
    d. None

5. G is
    a. Semigroup
    b. Monoid
    c. Group
    d. All of the above

Question 5.

If $u = \operatorname{cosec}^{-1}\left(\frac{x^{\frac{1}{2}} + y^{\frac{1}{2}}}{x^{\frac{1}{3}} + y^{\frac{1}{3}}}\right)^{1/2}$

1. $\operatorname{cosec} u$ is a homogeneous function of degree
   a. $\frac{1}{11}$
   b. $-\frac{1}{12}$
   c. $-\frac{1}{11}$
   d. $\frac{1}{12}$

2. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$
   a. $-\frac{1}{12}\tan u$
   b. $\frac{1}{12}\tan u$
   c. $-\frac{1}{12}\sin u$
   d. $\frac{1}{10}\tan u$

3. $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} =$
   a. $\frac{13+sec^2u}{144}$
   b. $\frac{13+sin^2u}{144}$
   c. $\frac{13+tan^2u}{144}$
   d. None of the mentioned

4. $x\frac{\partial^2 u}{\partial x^2} + \frac{\partial u}{\partial x} + y\frac{\partial^2 u}{\partial y^2} =$
   a. $\frac{1}{12}cos^2u\frac{\partial u}{\partial x}$

b. $-\frac{1}{12}sec^2u\frac{\partial u}{\partial x}$
c. $\frac{1}{12}sec^2u\frac{\partial u}{\partial x}$
d. $-\frac{1}{12}cos^2u\frac{\partial u}{\partial x}$

5. $x\frac{\partial^2 u}{\partial y\partial x}+\frac{\partial u}{\partial y}+y\frac{\partial^2 u}{\partial y^2}=$
   a. $-\frac{1}{12}sec^2u\frac{\partial u}{\partial y}$
   b. $-\frac{1}{12}sec^2u\frac{\partial u}{\partial x}$
   c. $\frac{1}{12}cos^2u\frac{\partial u}{\partial y}$
   d. $-\frac{1}{12}cos^2u\frac{\partial u}{\partial x}$

Question 6.

Statement : If $u=\tan^{-1}\frac{x^3+y^3}{x+y}$

1. $x\frac{\partial^2 u}{\partial x^2}+\frac{\partial u}{\partial x}+y\frac{\partial^2 u}{\partial x\partial y}=$
   a. $\sin 2u\frac{\partial u}{\partial y}$
   b. $2\cos 2u\frac{\partial u}{\partial y}$
   c. $2\cos 2u\frac{\partial u}{\partial x}$
   d. $2\sin 2u\frac{\partial u}{\partial x}$

2. $x\frac{\partial^2 u}{\partial x\partial y}+y\frac{\partial^2 u}{\partial y^2}+\frac{\partial u}{\partial y}=$
   a. $\sin 2u\frac{\partial u}{\partial y}$
   b. $2\cos 2u\frac{\partial u}{\partial y}$
   c. $-2\cos 2u\frac{\partial u}{\partial y}$
   d. $2\sin 2u\frac{\partial u}{\partial x}$

3. $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=$
   a. $\tan 2u$
   b. $-\tan 2u$
   c. $\sin 2u$
   d. $\cos 2u$

4. $\tan u$ is homogeneous function of degree
   a. 1
   b. 2
   c. -1
   d. -2

5. $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} =$
   a. $\sin 4u + \sin 2u$
   b. $2\cos 3u \sin u$
   c. $2\sin 3u \cos u$
   d. $\sin 2u - \sin u$

Question 7.

For the integral $\iint_R xy(x+y)dydx$, Where R is the region bounded by $y = z^2$ and $y \ = \ z$

1. Find the limits of x if integral is taken as $\iint xy(x+y)dydx$
   a. $0 \le x \le 1$
   b. $y \le x \le \sqrt{y}$
   c. $0 \le x \le \sqrt{y}$
   d. None of these

2. Find the limits of 'y' if integral is taken as $\iint xy(x+y)dydx$
   a. $x \le y \le \sqrt{x}$
   b. $0 \le y \le 1$
   c. $\sqrt{x} \le y \le x$
   d. None of these

3. Find the limits of y if integral is taken as $\iint xy(x+y)dydx$
   a. $0 \le y \le 1$
   b. $0 \le y \le 2$
   c. $y \le y \le \sqrt{x}$
   d. None of these

4. Find the limits of 'x' if integral is taken as $\iint xy(x+y)dydx$
   a. $0 \le x \le 1$

b. $y \leq x \leq \sqrt{y}$
c. $0 \leq x \leq 2$
d. None of these

5. The value of integral is
   a. $\frac{3}{36}$
   b. $\frac{2}{21}$
   c. $\frac{1}{8}$
   d. None of these

Question 8.

For the integral $\iint_R ydydx$, Where R is the region bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$

1. Find the limits of x if integral is taken as $\iint ydydx$
   a. $0 \leq x \leq 4$
   b. $\frac{y^2}{4} \leq x \leq 2\sqrt{y}$
   c. $2\sqrt{y} \leq x \leq \frac{y^2}{4}$
   d. $0 \leq x \leq 2\sqrt{y}$

2. Find the limits of 'y' if integral is taken as $\iint ydydx$
   a. $\frac{x^2}{4} \leq y \leq 2\sqrt{x}$
   b. $0 \leq y \leq 4$
   c. $0 \leq y \leq 2\sqrt{x}$
   d. None of these

3. Find the limits of 'x' if integral is taken as $\iint ydydx$
   a. $\frac{y^2}{4} \leq x \leq 2\sqrt{y}$
   b. $0 \leq x \leq 4$
   c. $0 \leq x \leq 2\sqrt{y}$

   d. None of these

4. Find the limits of y if integral is taken as $\iint ydydx$
   a. $\frac{x^2}{4} \leq y \leq 2x$
   b. $0 \leq y \leq 4$
   c. $0 \leq y \leq 2x$
   d. None of these

5. The value of integral is
   a. $\frac{48}{5}$
   b. $\frac{24}{3}$
   c. 0
   d. None of these

Question 9.

If $p(x)$ and $q(x)$ some function of x such that

1. $p(x) = 0$ *and* $q(x) = infinity$ *as* x tends to a point "a" and let $L(x) = p(x).q(x)$, then limit of $L(x)$ *as* x tends to "a" is of the form
   a. (0/0)
   b. 1^(infinity)
   c. (0. infinity)
   d. (infinity/infinity)

2. $p(x) = 0$ *and* $q(x) = 0$ *as* x tends to a point "a" and let $L(x) = [p(x)]\^q(x)$, then limit of $L(x)$ *as* x tends to "a" is of the form
   a. (0)^(0)
   b. (0/0)
   c. (0. infinity)
   d. (infinity/infinity)

3. $p(x) = infinity$ *and* $q(x) = infinity$ *as* x tends to a point "a" and let $L(x) = p(x)/q(x)$, then limit of $L(x)$ *as* x tends to "a" is of the form
   a. (0)^(0)
   b. (0. infinity)

c. (0/0)
d. (infinity/infinity)

4. $p(x) = 1\ and\ q(x) = infinity\ as\ x$ tends to a point "a" and let $L(x) =$ $[p(x)]\hat{}q(x)$, then limit of $L(x)$ $as\ x$ tends to "a" is of the form
   a. (0)^(0)
   b. (infinity/infinity)
   c. (0/0)
   d. 1^(infinity)

5. $p(x) = 0\ and\ q(x) = 0\ as\ x$ tends to a point "a" and let $L(x) = p(x)/q(x)$, then limit of $L(x)$ $as\ x$ tends to "a" is of the form
   a. (infinity/infinity)
   b. (0/0)
   c. (0)^(0)
   d. (0. infinity)

Question 10.

Consider $Z15$, the group of integers under addition modulo 15. let $H1 = \{0,5,10\}, H2 = \{0,4,8,12\}$.

1. Is $H2$ subgroup of $Z15$
   a. No
   b. Yes
   c. Never

2. Is $Z15$ is a Group with addition Modulo operation
   a. Yes
   b. No
   c. Not Possible

3. Is $H1 \cap H2$ subgroup of $Z15$
   a. Yes
   b. No
   c. Not Possible

4. Is $H1$ subgroup of $Z15$
   a. Never
   b. Yes
   c. Not Possible

5. Is $H1$ is a Cyclic Subgroup with addition Modulo 15 operation.
   a. Yes
   b. No
   c. Not Possible

Question 11.

Find the first six terms of the expansion of the function $e^x \log(l + y)$ Taylor's series in the neighbourhood of the point $(0, 0)$.

1. Value of f_{yyy} $at\ x = 0\ and\ y = 0$ is
   a. 1
   b. -1
   c. 2
   d. -2

2. Value of f_y $at\ x = 0\ and\ y = 0$?
   a. 1
   b. 0
   c. 2
   d. 3

3. Value of f_{xy} $at\ x = 0\ and\ y = 0$?

a. 1
b. 0
c. 2
d. 3

4. Value of f_{xx} $at\ x = 0\ and\ y = 0$?
   a. 1
   b. 2
   c. -1
   d. 0

5. Value of f_{xxy} $at\ x = 0\ and\ y = 0$ is
   a. 1
   b. -1
   c. 2
   d. -2

Question 12.

Evaluate $\lim\limits_{x\to 0} \frac{\log(1+kx^2)}{1-\cos x}$.

1. To evaluate the indeterminate form, function should be
   a. Continuous
   b. Derivable
   c. Both continuous & derivable
   d. None of mentioned

2. Direct substitution gives the limit of function
   a. (infinity/infinity) indeterminate form
   b. (0/0) indeterminate form
   c. (0/infinity) indeterminate form
   d. (0. infinity) indeterminate form

3. Limit of the function
    a. does not exist
    b. can not be computed
    c. exist finitely
    d. None of mentioned

4. Limit of the function is equal to
    a. k
    b. $2k + 1$
    c. $2k$
    d. 2

5. Limit of the function
    a. depends on k
    b. does not depend on k
    c. can not be computed
    d. None of mentioned

Question 13.

If $y = \log(x^3 + y^3 + z^3 - 3xyz)$,

1. $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$
    a. 0
    b. $\frac{3}{x+y+z}$
    c. $\frac{3x^2-3yz}{x^3+y^3+z^3-3xyz}$
    d. 3

2. $\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 u =$
   a. $-9/(x+y+z)^2$
   b. $3/x+y+z$
   c. $9/(x+y+z)^2$
   d. Not mentioned

3. $\frac{\partial u}{\partial x}$
   a. $\frac{3x^2-3yz}{x^3+y^3+z^3-3xyz}$
   b. $\frac{3y^2-3zx}{x^3+y^3+z^3-3xyz}$
   c. $\frac{3z^2-3xy}{x^3+y^3+z^3-3xyz}$
   d. None

4. $\frac{\partial u}{\partial y}$
   a. $\frac{3x^2-3yz}{x^3+y^3+z^3-3xyz}$
   b. $\frac{3y^2-3zx}{x^3+y^3+z^3-3xyz}$
   c. $\frac{3z^2-3xy}{x^3+y^3+z^3-3xyz}$
   d. None

5. $\frac{\partial u}{\partial z}$
   a. $\frac{3x^2-3yz}{x^3+y^3+z^3-3xyz}$
   b. $\frac{3y^2-3zx}{x^3+y^3+z^3-3xyz}$
   c. $\frac{3z^2-3xy}{x^3+y^3+z^3-3xyz}$
   d. None

Question 14.

If $u = \tan^{-1}\frac{y^2}{x}$

1. The degree of function $\tan u$
   a. 0
   b. 1
   c. 2
   d. 3

2. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$
   a. $-\frac{1}{2}\sin 2u$
   b. $\frac{1}{2}\sin 2u$
   c. $\sin 2u$

3. $x\frac{\partial^2 u}{\partial x^2} + \frac{\partial u}{\partial x} + y\frac{\partial^2 u}{\partial x \partial y} =$
   a. $\sin 2u \frac{\partial u}{\partial x}$
   b. $-\sin 2u \frac{\partial u}{\partial x}$
   c. $\cos 2u \frac{\partial u}{\partial x}$

4. $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} =$
   a. $\sin 2u\, sin^2\, 2u$
   b. $-\sin 2u\, sin^2\, 2u$
   c. $\cos 2u\, sin^2\, 2u$
   d. $\sin 2u\, cos^2\, u$

5. $x\frac{\partial^2 u}{\partial y \partial x} + y\frac{\partial^2 u}{\partial y^2} + \frac{\partial u}{\partial y} =$
   a. $\sin 2u \frac{\partial u}{\partial y}$
   b. $-\sin 2u \frac{\partial u}{\partial y}$
   c. $\cos 2u \frac{\partial u}{\partial y}$

Question 15.

For the Integral $\iint e^{2x+3y}\, dxdy$ over the triangle bounded by

$x = 0, y = 0\ and\ x + y = 1.$

1. Find the limits of ‘x’ if integral is taken as $\iint e^{2x+3y}\, dxdy$

a. $0 \leq x \leq 1$
b. $y \leq x \leq 1 - y$
c. $0 \leq x \leq 2$
d. None of these

2. Find the limits of x if integral is taken as $\iint e^{2x+3y}\, dxdy$
   a. $0 \leq x \leq 1$
   b. $0 \leq x \leq 1 - y$
   c. $y \leq x \leq 1 - y$
   d. None of these

3. The value of integral is
   a. $\frac{1}{6}(e-1)^2(2e+1)$
   b. $\frac{1}{6}(e+1)^2(2e-1)$
   c. $\frac{1}{6}(e+1)^2(2e+1)$
   d. None of these

4. Find the limits of 'y' if integral is taken as $\iint e^{2x+3y}\, dxdy$
   a. $0 \leq y \leq 1 - x$
   b. $0 \leq y \leq 1$
   c. $1 - x \leq y \leq x$
   d. None of these

5. Find the limits of y if integral is taken as $\iint e^{2x+3y}\, dxdy$
   a. $0 \leq y \leq 1$
   b. $0 \leq y \leq 2$
   c. $0 \leq y \leq 1 - x$
   d. None of these

Question 16.

Taylor's expansion of $\tan^{-1}\frac{y}{x}$ about $(1, 1)$.

1. Value of fxy is given as
    a. 1
    b. 2
    c. 0
    d. -1

2. Value of fxx is given as
    a. 1
    b. 2
    c. ½
    d. -1

3. Value of fyy is
    a. -1/2
    b. 1
    c. ½
    d. -1

4. Value of fy is
    a. ½
    b. -1/2
    c. 1
    d. -1

5. Value of fx is
    a. ½
    b. -1/2
    c. 1
    d. -1

Question 17.

Let $x = r\cos\theta \ \ and \ y = r\sin\theta$.

1. Partial derivative of r w.r.t x
   a. 0
   b. x/r
   c. y/r
   d. $-x/r$

2. (Partial derivative of θ w.r.t x) $\times r$
   a. $-y/r^2$
   b. x/r
   c. $-y/r$
   d. y/r

3. $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2}$ is equal to
   a. 0
   b. $-1/r$
   c. $1/r$
   d. None of the mentioned

4. $\frac{\partial^2 \theta}{\partial x^2} + \frac{\partial^2 \theta}{\partial y^2}$ is equal to
   a. 1
   b. 0
   c. -1
   d. r

If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$

1. Then $x\frac{\partial u}{\partial x}$
   a. $\frac{x}{\sqrt{y^2-x^2}} - \frac{xy}{x^2+y^2}$
   b. $\frac{1}{\sqrt{y^2-x^2}} - \frac{y}{x^2+y^2}$
   c. 0
   d. -1

2. Then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$
   a. $\frac{x}{\sqrt{y^2-x^2}} - \frac{xy}{x^2+y^2}$
   b. $\frac{1}{\sqrt{y^2-x^2}} - \frac{y}{x^2+y^2}$
   c. 0
   d. -1

3. Then $y\frac{\partial u}{\partial y}$
   a. $-\frac{x}{\sqrt{y^2-x^2}} + \frac{xy}{x^2+y^2}$
   b. $\frac{1}{\sqrt{y^2-x^2}} - \frac{y}{x^2+y^2}$
   c. 0
   d. -1

4. Euler Theorem is applicable for which kind of functions ?
   a. Homogeneous functions
   b. Non-homogeneous
   c. None of the mentioned

5. Degree of the given function is
   a. 1
   b. 0
   c. -1
   d. 2

Question 19.

1. Change the order of integration of $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dxdy$
2. Change the order of integration of $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dydx$ is
3. Change the order of integration of $\int_0^a \int_{y^2/a}^{y} y\, dxdy$ is
4. Change the order of integration of $\int_0^a \int_y^a \frac{xdxdy}{x^2+y^2}$ is
5. Change the order of integration in $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2\, dydx$ is

Question 20.

1. $\lim_{x\to 0} \cot x \log\left(\frac{1+x}{1-x}\right)$
   a. 2
   b. 1
   c. -1
   d. none of the mentioned

2. $\lim_{x\to 0} \left(1+\frac{1}{x}\right)^{x}$
   a. 0
   b. 1
   c. 2
   d. none of the mentioned

3. $\lim_{x\to 0} \sin x \log(x^2)$
   a. 2
   b. 1
   c. -1
   d. 0

4. $\lim_{x\to {\pi}/{2}} (\sec x - \tan x)$
   a. -1
   b. 2
   c. 1
   d. 0

5. $\lim_{x\to 0} \left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$
   a. 1
   b. 0
   c. -1
   d. none of the mentioned

Question 21.

1. $\lim_{x \to 0} \frac{\tan x - x}{x - \sin x}$
   a. -2
   b. 0
   c. 1
   d. 2

2. $\lim_{x \to 0} \frac{x \cos x - \sin x}{x^2 \sin x}$
   a. 1
   b. 1/3
   c. -1/3
   d. -1

3. $\lim_{x \to 0} \left(cot^2 x - \frac{1}{x^2} \right)$
   a. 1
   b. 3/2
   c. 2/3
   d. -2/3

4. $\lim_{x \to 0} x^3 (\log x)^2$
   a. 1
   b. 0
   c. -1
   d. 2

5. $\lim_{x \to 0} \frac{e^x - e^{\sin x}}{x - sinx}$
   a. -1
   b. 0
   c. 1
   d. none of the mentioned

Question 22.

Evaluate the limit

1. $\lim_{x\to 0}\left(\frac{1}{x}-\frac{1}{\sin x}\right)$
    a. 1
    b. 0
    c. -1

2. $\lim_{x\to 0}(\operatorname{cosec} x)^{\frac{1}{\log x}}$
    a. 1
    b. 1/e
    c. -1/e

3. $\lim_{x\to 0} x^x$
    a. 0
    b. -1
    c. 2
    d. 1

4. $\lim_{x\to \pi/2}(\sin x)^{\tan x}$
    a. 0
    b. 1
    c. -1
    d. none of the mentioned

5. $\lim_{x\to 1}\left(\frac{x}{x-1}-\frac{1}{\log x}\right)$
    a. 0
    b. 1
    c. -1/2
    d. 1/2

Question 23.

1. Which among the following is the definition of jacobian of u and v w.r.t x and y ?
   a. $J\left(\frac{x,y}{u,v}\right)$
   b. $J\left(\frac{u,v}{x,y}\right)$
   c. $\frac{\partial(x,y)}{\partial(u,v)}$
   d. $\frac{\partial(u,x)}{\partial(v,y)}$

2. If $u = x^2 + y^2 + z^2$ be such that $xu_x + xu_x + xu_x = \lambda u$, then λ is equal to
   a. 1
   b. 2
   c. 0
   d. none of the mentioned

3. Value of $\int_0^1 \int_0^{x^2} xe^y dydx$ is equal to
   a. $\frac{e}{2}$
   b. $e - 1$
   c. $1 - e$
   d. None of these

4. Value of $\int_0^2 \int_0^{y^2} e^{\frac{x}{y}} dxdy$ is equal to
   a. $\frac{e}{2}$
   b. $e - 1$
   c. $1 - e$
   d. None of these

5. If $u = x^2 f\left(\frac{y}{x}\right)$ then:
   a. $x\frac{\partial u}{\partial x} - y\frac{\partial u}{\partial y} = 0$
   b. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$

c. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$
d. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2u$

Question 24.

1. If $u = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$ *then* $\frac{\partial^2 u}{\partial x \partial y}$ is ?
   a. $\frac{x^2+y^2}{x^2-y^2}$
   b. $\frac{x^2-y^2}{x^2+y^2}$
   c. $\frac{x^2}{x^2+y^2}$
   d. $\frac{y^2}{x^2+y^2}$

2. If $x = r\cos\varphi\sin\theta$, $y = r\sin\varphi\sin\theta$, $z = r\sin\theta$, then the value of $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)}$ is :
   a. 0
   b. r
   c. $r^2\sin\theta$
   d. $r^2\cos\theta$

3. $\int_0^1 \int_0^1 \frac{dxdy}{\sqrt{(1-x^2)(1-y^2)}}$
   a. π^2
   b. $\frac{\pi^2}{2}$
   c. $\frac{\pi^2}{4}$
   d. None of these

4. The jacobian of p, q, r w.r.t x, y, z given $p = x + y + z$, $q = y + z$, $r = z$ is_____
   a. 0
   b. 1
   c. 2
   d. -1

5. If $u = \sin^{-1}\sqrt{x-y}$ where $x = 3t,\ y = 4t^3,$ then $\frac{du}{dt}$ is :
   a. $\sqrt{1-t^2}$
   b. $\frac{3}{\sqrt[3]{1-t^2}}$
   c. $\frac{3}{\sqrt{1-t^2}}$
   d. $3\sqrt{1-t^2}$

Question 25.

1. If $u = \sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}},$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is
   a. $\frac{1}{2}\tan u$
   b. $-\frac{1}{2}\tan u$
   c. $\frac{1}{4}\tan u$
   d. $-\frac{1}{4}\tan u$

2. $\int_0^{\frac{\pi}{2}}\left(\int_0^{a\cos\theta} r\sqrt{a^2-r^2}dr\right)d\theta$
   a. $\frac{a^3}{18}(3\pi-4)$
   b. $\frac{a^2}{9}(3\pi-4)$
   c. $\frac{a^3}{18}(3-4\pi)$
   d. *None of these*

3. Value of $\int_0^a\int_0^{\sqrt{x}} 1dxdy$ is equal to
   a. 6
   b. 4
   c. 10
   d. None of these

4. Evaluate by reversing the order of integration of $\int_0^\infty\int_0^x xe^{\frac{-x^2}{y}}\,dydx$
   a. $\frac{1}{4}$
   b. $\frac{1}{2}$
   c. 0

d. None

5. Volume bounded by triple integral $x \geq 0, y \geq 0, z \geq 0$ and $x^2 + y^2 + z^2 = 1$ is
   a. $\frac{4\pi}{3}$
   b. $\frac{4\pi r}{3}$
   c. $\frac{4\pi r}{6}$
   d. None

Question 26.

1. $\int_0^1 \int_0^1 (x+2)dydx$
   a. $\frac{15}{2}$
   b. $\frac{5}{2}$
   c. $\frac{11}{2}$
   d. None of these

2. If $u = \log(x^2 + y^2 + z^2)$, then the value of $xu_x + yu_y + zu_z$ is equal to
   a. 0
   b. $2u$
   c. 2
   d. $2e^u$

3. For this $\int_0^1 \int_0^{1-x} dxdy$ by the change of integration we get
   a. $\int_0^1 \int_0^{1-x} dydx$
   b. $\int_0^1 \int_0^{1-y} dxdy$
   c. $\int_0^1 \int_0^1 dxdy$
   d. None of these

4. Value of $\int_0^2 \int_0^x (x+y)\, dxdy$ is equal to
   a. 6
   b. 4
   c. 10
   d. 5

Question 27.

Consider the Group G = {+1,-1,+I,-1} Where i is (iota).

1. Is it a Group under the multiplication operation ?
    a. Yes
    b. No
    c. Not Possible

2. If it is a Cyclic group then what is the order of its generation
    a. 1
    b. 2
    c. 3
    d. 4

3. What is its identity Element ?
    a. 1
    b. -1
    c. iota
    d. None

4. If it is a cyclic group then inverse of positive iota is
    a. positive iota only
    b. negative iota only
    c. negative iota and positive iota both
    d. None

5. If it is a cyclic group then its Generation are
   a. -1
   b. 1
   c. negative iota only
   d. negative iota and positive iota both

Question 28.

Consider the following polynomials in $P(t)$ with the inner product $(f.g) = \int_0^1 f(t)g(t)dt$: $f(t) = t + 2,$ $g(t) = 3t - 2,$ $h(t) = t^2 - 2t - 3$

1. then $< f, g >$ is
   a. -2
   b. 2
   c. 1
   d. -1
   e. 0

2. then 3 $|| f ||$ is
   a. 4.8
   b. 7.55
   c. 6.7
   d. 6
   e. 8

3. Normalization of g is
   a. $3t$
   b. $3t + 1$
   c. $3t - 2$
   d. $3t + 2$

e. $3t - 1$

4. then $< f, h >$ is
   a. -37/4
   b. 37/4
   c. 27/4
   d. -27/4
   e. None

5. then $|| g ||$ is
   a. -2
   b. 2
   c. -1
   d. 0
   e. 1

Question 29.

Consider $G = \{1,2,3,4,5,6\}$, under multiplication modulo 7.

1. What is the identity of G ?
   a. 0
   b. 1
   c. -1
   d. None

2. Inverse of 2
   a. 2
   b. 3
   c. 4
   d. 1

3. Inverse of 3
   a. 5
   b. 4
   c. 3
   d. 2

4. Is G Commutative ?
    a. Yes
    b. No
    c. Cannot say

5. G is
    a. Semigroup
    b. Monoid
    c. Group
    d. All of the above

Question 30.

Let V be a vector space over the field R

1. The dim (V) if (a, b, c) is basis of V
    a. 0
    b. 1
    c. 2
    d. 3

2. If $V = R$^3 then find the co-ordinates of vector $x = (2,6,4)$ relative to basis vectors $u = (1,1,2)$, $v = (2,2,1)$, $w = (1,2,2)$.
    a. (6,2,-11)
    b. (-2,0,4)
    c. (-2,-1,7)
    d. None of the mentioned

3. If $V = R$^3 then which of the following is a basis of V over R.
    a. {(1,2,-1),(0,3,1)}
    b. {(1,1,1),(1,2,3),(2,-1,1)}

c. {(1,3,-4),(1,4,-3),(2,3,-1)}
d. {(1,1,1),(2,0,-1),(3,-1,0),(4,1,2)}

4. If (a, b, c) is basis of V then which of the following is the another basis of V ?
   a. $\{a + b, b + c, c + a\}$
   b. $\{a + b, b + c\}$
   c. $\{a, b\}$
   d. None of the mentioned

5. The number of vectors in two different basis of a vector space are same.
   a. true
   b. false

Question 31.

Let $V = R$^3 be a vector space over the field R

1. Any vector $\{x, y, z\}$ can be expressed in terms of basis $B = (u, v, w)$ as
   a. (x,y,z)
2. If V has basis $B = (u, v, w)$. Then u, v, w are
3. The co-ordinate vector of $(-3,5,7)$ relative of $B = (u, v, w)$ is
   a. (0,2,-5)
   b. (0.2,5)
   c. (1,2,5)
   d. None of the mentioned

4. The vector $(-3,5,7)$ can be expressed in terms of basis $B = (u, v, w)$ as
   a. $0u + 2v - 5w$
   b. $0u + 2v + 5w$
   c. $0u + 2v + 5w$
   d. None of the mentioned

5. The dim (V)
    a. 0
    b. 1
    c. 2
    d. 3

Question 32.

Consider the Mapping $T: (R^\wedge 3) \rightarrow (R^\wedge 3)$, defined by $T(a,b,c) = (2b+c, a-4b, 3a)$ Corresponding to the basis $(I)B = \{(1,0,0)(0,1,0)(0,0,1)\}$ and $(II)B' = \{(1,1,1)(1,1,0)(1,0,0)\}$

1. What is the value of $T(1,1,0)$?
    a. (3,-3,3)
    b. (2,-3,3)
    c. (3,0,0)
    d. (0,1,3)

2. What is the value of $T(1,1,1)$?
    a. (3,3,3)
    b. (-3,-3,-3)
    c. (6,5,-1)

d. (-6,-6,-2)

3. The Second row of matrix relative to ordered basis $B' = \{(1,1,1)(1,1,0)(1,0,0)\}$ of T is
   a. (3,3,3)
   b. (-3,-3,-3)
   c. (6,5,-1)
   d. (-6,-6,-2)

4. The First row of matrix relative to ordered basis $B' = \{(1,1,1)(1,1,0)(1,0,0)\}$ of T is
   a. (3,3,3)
   b. (-3,-3,-3)
   c. (6,5,-1)
   d. (-6,-6,-2)

5. The Third row of matrix relative to ordered basis $B' = \{(1,1,1)(1,1,0)(1,0,0)\}$ of T is
   e. (3,3,3)
   f. (-3,-3,-3)
   g. (6,5,-1)
   h. (-6,-6,-2)

Question 33.

Consider $f(x) = 3t - 5$ and $g(t) = t^2$ in the polynomial space $P(t)$ with inner product $(f.g) = \int_0^1 f(t)g(t)dt$.

1. then || f ||^2 is
   a. 10
   b. 11
   c. 12
   d. 15
   e. 13

2. then $< f, g >$ is
   a. -10/12

b. -11/12
c. -9/12
d. -8/12
e. -13/12

3. then $|| g ||$^2 is
   a. 0.5
   b. 0.3
   c. 0.4
   d. 0.2
   e. 0.6

4. then $|| f || \; at \; t = 1$ is
   a. 5
   b. 3
   c. 4
   d. 2
   e. 1

5. then $|| g || \; at \; t = 2$ is
   a. 16
   b. 12
   c. 13
   d. 14
   e. 15

Question 34.

Let $u = (1,3,-4,2), \; v = (4,-2,2,1), \; w = (5,-1,-2,6) \; in \; R^4|$

1. then $< v, w >$ is
   a. 18
   b. 24
   c. 22
   d. 19
   e. 30

2. then $< u, w >$ is
   a. 30
   b. 19

c. 22
d. 24
e. 20

3. then $< 3u - 2v, w >$ is
   a. 22
   b. 30
   c. 24
   d. 18
   e. 19

4. then $|| u ||$ is
   a. 4.48
   b. 3.48
   c. 2.48
   d. 6.48
   e. 5.48

5. then $|| v ||$ is
   a. 5
   b. 6
   c. 0
   d. 1
   e. 4