VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

College with Potential for Excellence

Residential & Autonomous – A Gurukula Institute of Life-Training

Re-accredited (3rd Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC

[Affiliated to Madurai Kamaraj University]

B.Sc. Phy. & Chem. Degree (Semester) Examinations, April 2021

Part – III: Allied Subject: Fourth Semester: Paper – I

MATHEMATICS – II

Under CBCS – Credit 3

Time: **3** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The order of the differential equation $(\frac{dy}{dx})^4 = \frac{d^6y}{dx^6}$ is ____________.

a) 7 b) 6 c) 5 d) 4

2. The degree of the differential equation $y' = \sin x$ is_________.

a) 1 b) 2 c) 3 d) 4

3. The integrating factor of the differential equation $\frac{dy}{dx} + xy = e^{\frac{-x^2}{2}}$ is ____

a) $e^{\frac{-x^2}{2}}$ b) $e^{\frac{x^2}{2}}$ c) $-e^{\frac{-x^2}{2}}$ d) $-e^{\frac{x^2}{2}}$

4. The general form of Bernoulli's equation is ________.

a) $\frac{dy}{dx} + Qy = Py^n$ b) $\frac{dy}{dx} + Py = Qy^n$

c) $\frac{dy}{dx} = Py^n$ d) $\frac{dy}{dx} = Qy^n$

5. The general solution of $(D^2 - 4)y = 0$ is ___________.

a) $y = Ae^{2x} + Be^{-2x}$ b) $y = Ae^{4x} + Be^{-4x}$

c) $y = Ae^{3x} + Be^{x}$ d) $y = Ae^{4x} + B$

6. The Particular integral of $(D^2 + 1)y = 0$ is __________.

a) x b) x^2 c) 1 d) 0

7. In a homogeneous linear equations D represents ______.

a) $\frac{d}{dx}$ b) $\frac{d}{dy}$ c) $\frac{d}{dz}$ d) $\frac{d}{dt}$

8. In a homogeneous linear equations, $xDy =$ ______.

a) θx b) θz c) θt d) θy

9. The expansion of $d(xy) =$ ______.

a) $xy' - yx'$ b) $xx' - yy'$ c) $xy' + yx'$ d) $-xy' + yx'$

10. The value of $d(\log secx) =$ __________.

a) $cos\,x$ b) $tan\,x$ c) $sin\,x$ d) $sec\,x$

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find the order and degree of the differential equation $(y''')^3 + (y'')^4 + y = 0.$

12. Form the differential equation of $y = a\cos(nx + b)$.

13. Define Bernoulli's Equation.

14. Find the Complementary function of $(D^2 - 5D + 6)y = 0.$

15. Find the Particular integral of $(D^3 + 3D^2 + 3D + 1)y = e^{-x}.$

16. Change the differential equation $(x^2D^2 - 3xD - 5)y = \sin(\log x)$ into constant coefficient differential equation.

17. Write the working rule for the method of variation of parameters.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Solve: $\dfrac{dy}{dx} = \dfrac{x + y}{y - x}.$

[OR]

b) Verify whether $e^y dx + (xe^y + 2y)dy = 0$ is exact. If so, solve.

19. a) Solve the differential equation $y' + y\cos x = \sin 2x$ by integrating factor method.

[OR]

b) Solve the differential equation $y' + y\sec x = \tan x$ by integrating factor method.

20. a) Solve: $(D^2 - 4)y = e^{2x} + e^{-4x}.$

[OR]

b) Find the Particular Integral of $(D^2 + D + 1)y = \sin 2x.$

21. a) Find the Particular Integral of $(x^2D^2 - 3xD - 5)y = \sin(\log x).$

[OR]

b) Find the Particular Integral of $(x^2D^2 + 4xD + 2)y = x^2.$

22. a) Solve $y'' + y = \operatorname{cosec} x$ by using method of variation of parameters.

[OR]

b) Solve $y'' + 3y' + 2y = x^2$ by using method of variation of parameters.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Solve the differential equation $(1 + x^2)y' + y = \tan^{-1} x$ by integrating factor method.

24. Solve the Bernoulli's form of differential equation $xy' + y = y^2 \log x.$

25. Solve: $(D^2 - 2D + 2)y = e^x \sin x.$

26. Solve: $x^2 y'' - xy' + 4y = \cos(\log x)$.

27. Using the method of variation of parameters, solve $(D^2 + 1)y = x.$

05AT03

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B.Sc. Phy. & Chem. Degree (Semester) Examinations, April 2021

Part – III: Allied Subject: Fourth Semester: Paper – II

MATHEMATICS - III

Under CBCS – Credit 3

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. In a partial differential equations, p denotes

a) $\frac{\partial z}{\partial x}$ b) $\frac{\partial z}{\partial y}$ c) $-\frac{\partial z}{\partial x}$ d) $-\frac{\partial z}{\partial y}$

2. The partial differential equation of the given equation $az + b = a^2x + y$ is ________________

a) $-1 = pq$ b) $1 = pq$ c) $z = pq$ d) $z = -pq$

3. In a partial differential equations, the general term of Standard 1 is ____

a) $f(p,q) = 0$ b) $F(x,p,q) = 0$

c) $f_1(x,p) = f_2(y,q)$ d) $z = px + qy + f(p,q)$

4. The value of $L(t^n) =$

a) $\frac{\Gamma(n+1)}{s^{n+1}}$ b) $\frac{\Gamma(n)}{s^{n+1}}$ c) $\frac{\Gamma(n+1)}{s^n}$ d) $\frac{\Gamma(n)}{s^n}$

5. The value of $L\{e^{-at}f(t)\} =$

a) $F(s-a)$ b) $F(-(s-a))$ c) $F(-(s+a))$ d) $F(s+a)$

6. The value of $L^{-1}\left(\frac{1}{s}\right) =$

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

7. The value of $L^{-1}\{F'(s)\} =$

a) $-tL^{-1}\{F(s)\}$ b) $-tL^{-1}\{F(-s)\}$

c) $tL^{-1}\{F(s)\}$ d) $tL^{-1}\{F(-s)\}$

8. The value of $L(cosh\,7t) =$

a) $\frac{s}{s^2+49}$ b) $\frac{7}{s^2+49}$ c) $\frac{s}{s^2-49}$ d) $\frac{7}{s^2-49}$

9. Fourier series is also called as

a) Power series b) Trigonometric series

c) Exponential series d) Logarithmic series

10. The value of $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\ldots$ is

$a)\ \frac{\pi}{4}$ $b)\ \frac{\pi^2}{6}$ $c)\ \frac{\pi^2}{12}$ $d)\ \frac{\pi^2}{8}$

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define Singular integral.

12. How to find general solution of the form $f(p,q)=0$.

13. Find $L\left(xe^{-x}\cos x\right)$.

14. Define Laplace transformation.

15. Find $L^{-1}\left(\frac{1}{(s+3)^2+25}\right)$.

16. Write the inverse Laplace formula for $F(\lambda s)$ and $\frac{1}{s}F(s)$.

17. What is the difference between odd and even function.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Eliminating arbitrary functions f and g from $z=f(x+ay)+g(x-ay)$ and form a partial differential equation

[OR]

b) Solve $p\cot x+q\cot y=\cot z$.

19. a) Find the general solution of $pq+p+q=0$

[OR]

b) Solve $z=px+qy+\frac{q}{p}-p$

20. a) Find the Laplace transformation of $t^2+\cos 2t\cos t+\sin^2 2t$.

[OR]

b) Find the Laplace transformation of the followings:

i) $x^2\cosh ax$ ii) x^2e^{-ax}.

21. a) Find $L^{-1}\left(\frac{1}{s(s+1)(s+2)}\right)$.

[OR]

b) Find inverse Laplace of $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$

22. a) Determine the Fourier expansion of the function $f(x)=x$ where $-\pi\le x\le\pi$.

[OR]

b) Find the Fourier series for $f(x)=|\sin x|$ in $(-\pi,\pi)$ of periodicity 2π.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Solve the first order partial differential equation $(x+y)zp+(x-y)zq=x^2+y^2$.

24. Find the general integral of each of the following:

i) $q-p=y-x$ ii) $pe^y=qe^x$

25. Find Laplace transformation of $L\left(\frac{1-\cos x}{x}\right)$.

26. Using Laplace transformation solve $y''+4y'+13y=2e^{-x}$ given $y(0)=0$ and $y'(0)=-1$.

27. Find the Fourier series for defined in $f(x)=e^{-x}$ defined in $[-\pi,\pi]$.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Allied Subject: Fourth Semester: Paper – I

PROGRAMMING IN C++

Under CBCS – Credit 5

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Data that may be accessed by all the functions of a program is called ______________ data.
   a) Global b) Local c) Both A & B d) None of them
2. Execution of all C++ programs begins at _____________ function.
   a) #include b) main( ) c) return ( ) d) Member
3. C++ provides an additional use of _______________ for declaration of generic pointers.
   a) int b) float c) double d) void
4. Variable that are listed in function's calls are called_____________
   a) Actual parameter b) Declared parameter
   c) Passed parameter d) None of them
5. _____________ means assigning different meaning to an operation.
   a) referencing b) calling c) converting d) overloading
6. A reference variable must be initialized at the time of___________
   a) initialization b) declaration c) running d) definition
7. Which of the following is the scope resolution operator in C++.
   a) : : b) : :* c) - > * d) . *
8. In C++, the declaration of functions and variables are collectively called_____________
   a) class members b) function members
   c) object members d) member variables

9. A static member function can be called using the ______________ instead of its objects.

a) variable name b) function name

c) class name d) object name

10. A constructor has the same ___________________ as that of class.

a) variable b) object c) function d) name

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define Tokens in C++ Programme language?

12. Define Identifiers and Constants?

13. What do you meant by recursion in C++ Programme?

14. Define Constant Arguments in C++ programme?

15. Define member function in C++ programme?

16. Define Constructor in C++ programme?

17. Define Inheritance in C++ programme?

SECTION – C

Answer ALL Questions: **(5 × 5 = 25)**

18. a) Explain the structure of C++ program?

[OR]

b) Explain about Return by Reference function in C++?

19. a) Enumerate Inline Function with example program.

[OR]

b) Explain about Default arguments in C++.

20. a) How do define Member function?

[OR]

b) Explain about Static Member function?

21. a) Explain about Constructors with an example?

[OR]

b) Examine Parameterized Constructor with example?

22. a) Summarize Multiple Inheritances with example program.

[OR]

b) Explain about Multilevel Inheritance.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Explain the applications of OPPs in C++.

24. Examine different types of operators used in C++ with example.

25. Explain about Friend functions in C++?

26. Explain about Destructors with an example?

27. Explain about Inheritance and its types with diagram.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Second Semester: Paper – I

INTEGRAL CALCULUS

Under CBCS – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. $\int \sec x \tan x dx$ =_______

a) $\sec x + c$ b) $\tan x + c$ c) $\sec x \tan x + c$ d) None

2. $\int \frac{dx}{x^2 - a^2} =$ _____

a) $\frac{1}{2a}\log\left(\frac{x+a}{x-a}\right)+c$ b) $\log\left(\frac{x-a}{x+a}\right)+c$

c) $\frac{1}{2a}\log\left(\frac{x-a}{x+a}\right)+c$ d) None

3. $\int \sqrt{a^2 + x^2}dx =$ ______

a) $\frac{x}{2}\sinh^{-1}\left(\frac{x}{a}\right)+\frac{a^2}{2}\sqrt{a^2+x^2}+c$ b) $\frac{a^2}{2}\sinh^{-1}\left(\frac{x}{a}\right)+\frac{x}{2}\sqrt{a^2+x^2}+c$

c) $\frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right)+\frac{x}{2}\sqrt{a^2+x^2}+c$ d) None

4. $\int \sqrt{x^2 - a^2}dx =$ ______

a) $\frac{a^2}{2}\cosh^{-1}\left(\frac{x}{a}\right)-\frac{x}{2}\sqrt{x^2-a^2}+c$ b) $\frac{x}{2}\sqrt{x^2-a^2}-\frac{a^2}{2}\cosh^{-1}\left(\frac{x}{a}\right)+c$

c) $\frac{a^2}{2}\cosh^{-1}\left(\frac{x}{a}\right)+\frac{x}{2}\sqrt{x^2-a^2}+c$ d) None

5. If $f(x)$ is an odd function, then $\int_{-a}^{a} f(x)\,dx =$ ______

a) 0 b) $2\int_0^a f(x)\,dx$ c) $\frac{1}{2}\int_0^{-a} f(x)\,dx$ d) -1

6. The reduction formula for $I_n = \int x^n e^{ax} dx$ is

a) $a\,I_n = x^n e^{ax} - nI_{n-1}$ b) $a\,I_n = x^n e^{ax} + nI_{n-1}$

c) $a\,I_n = x^{n-1} e^{ax} - nI_{n-1}$ d) None

7. If n is even, $\int_0^{\frac{\pi}{2}} \sin^n x\,dx =$ ________

a) $\frac{n-1}{n}.\frac{n-3}{n-2}.\frac{n-5}{n-4}.....\frac{2}{3}.1$ b) $\frac{n-1}{n}.\frac{n-3}{n-2}.....\frac{1}{2}.\frac{\pi}{2}$

c) $\frac{n-1}{n}.\frac{n-3}{n-2}....\frac{2}{3}.1.\frac{\pi}{2}$ d) None

8. If $x = r\cos\theta; y = r\sin\theta$, Then $dx\,dy =$ _______

a) $dr d\theta$ b) $r\,dr d\theta$ c) $\frac{1}{r} dr d\theta$ d) None

9. The gamma integral is given by $\Gamma(n) =$ _______

a) $\int_0^\infty x^{n-1} e^{-x} dx$ b) $\int_0^\infty x^n e^x dx$ c) $\int_0^\infty x^n e^{-x} dx$ d) None

10. The Beta integral is given by $\beta(m,n) =$ ______

(a) $\int_0^1 x^m (1-x)^n dx$ b) $\int_0^1 x^{m-1}(1-x)^n dx$

c) $\int_0^1 x^{m-1}(1-x)^{n-1} dx$ d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find the value of $\int \left(x + \frac{1}{x}\right)^2 dx$

12. Find the value of $\int \tan^2 x\,dx$

13. Integrate the expression of $\frac{\tan x}{\sec x + \cos x}$

14. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$

15. Find the value of $\int \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx$

16. If $x = r\cos\theta; y = r\sin\theta; Find\ \frac{\partial(x,y)}{\partial(r,\theta)}$.

17. The Fourier expansion of f(x)=x where $-\pi < x < \pi$. Find a_0.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Evaluate: $\int \frac{e^x}{e^{x/2-1}} dx$

[OR]

b) Prove that $\int_0^{\pi/2} \log\sin x dx = \pi/2 \log 2.$

19. a) Prove that $\int_0^{\pi/4} \log(1+\tan\theta)d\theta = \pi/8 \log 2.$

[OR]

b) Establish a reduction formula for $\int \cos^n dx$. Also find $\int_0^{\pi/2} \cos^n x dx.$

20. a) Evaluate $\iint xydxdy$ taken over the quadrant of the circle $x^2 + y^2 = a^2$.

[OR]

b) Evaluate $\iint r\sqrt{a^2 - r^2}\,dr d\theta$ over the upper half of the circle $r = \cos\theta.$

21. a) Find the area of the surface of the sphere of radius r.

[OR]

b) Evaluate $\iint_R (x-y)^4 e^{x+y} dxdy$ where R is the sphere with vertices (1,0), (2,1), (1,2) and (0,1).

22. a) Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π to be valid in the interval 0 to 2π.

[OR]

b) Find the Fourier Sine series for f(x) = c in the range 0 to π.

<u>SECTION – D</u>

<u>Answer any THREE Questions</u> **(3 × 10 = 30)**

23. Evaluate: $\int \frac{2x+3}{x^2+x+1} dx$

24. Evaluate: $\int_0^{\pi/2} \frac{(\sin x)^{3/2}}{(\sin x)^{3/2} + (\cos x)^{3/2}} dx$

25. Prove that $\beta(m,n) = \frac{\Gamma m \, \Gamma n}{\Gamma(m+n)}$

26. Evaluate $\iiint xyzdxdydz$ taken through the positive octant of the sphere $x^2+y^2+z^2=a^2$

27. Show that $x^2 = \frac{\pi^2}{3} + \sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}, -\pi \le x \le \pi.$ Deduce that

i) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \ldots = \frac{\pi^2}{12}$ ii) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots = \frac{\pi^2}{6}$

iii) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$

05CT22

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Second Semester: Paper – II

ANALYTICAL GEOMETRY 3D AND VECTOR CALCULUS

Under CBCS – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. If l, m, n are the direction cosines of a line then $l^2 + m^2 + n^2 =$_______

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

2. The centroid of the triangle whose vertices are (3,1,3); (10,1,5) and (-1,1,-5) is _________________.

a) (3,1,1) b) (5,1,1) c) (4,1,1) d) (-4,1,1)

3. The image of the point (2,3,4) under the reflection in the xz- plane is

a) (2,3,-4) b) (2,-3, 4) c) (-2,3,4) d) (2,3,4)

4. The foot of the perpendicular drawn from (1,1,1) on the xz- plane is

a) (1,1,0) b) (1,0,1) c) (0,1,1) d) (1,1,1)

5. The xy –plane section of the sphere $x^2 + y^2 + z^2 = 1$ is ______

a) $y^2 + z^2 = 1, x = 0$ b) $x^2 + z^2 = 1, y = 0$

c) $x^2 + y^2 = 1, z = 0$ d) None

6. The tangent plane at (0,0,2) to the sphere $x^2 + y^2 + z^2 = 4$ is _____

a) $y - 2 = 0$ b) $x - 2 = 0$ c) $z - 2 = 0$ d) $y = -2$

7. If $\phi(x, y, z) = xyz$, then $\nabla\phi$ at (0,0,1) is ____________

a) $\vec{j} + \vec{k}$ b) $\vec{i} + \vec{k}$ c) $\vec{0}$ d) $\vec{i} + \vec{j} + \vec{k}$

8. For any vector $\vec{f}$, $div\ curl\ \vec{f} =$

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

9. The value of $\iiint_0^2 dxdydz =$______________

a) 2 b) 4 c) 8 d) 1

10. A vector $\vec{f}$ is called harmonic vector if ___________

a) $\nabla\vec{f} = 0$ b) $\nabla^2\vec{f} = 0$ c) $\nabla\vec{f} = \vec{f}$ d) $\nabla^2\vec{f} = \vec{f}$

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Describe direction cosine.

12. Write the plane equation for intercept form and normal form.

13. Write the angle between the plane $ax + by + cz + d = 0$ and the line $\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n}$.

14. Define great circle.

15. Define gradient.

16. Prove that $\nabla \bullet \vec{r} = 3$ and $\nabla \times \vec{r} = 3$.

17. State Gauss divergence theorem.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Find the direction cosine of the line joining the points (3, -5, 4) and (1, -8, -2).

[OR]

b) Find the equation of the plane through (3, 4, 5) parallel to the plane $2x + 3y - z = 0$.

19. a) Find the image of the point (1, -2, 3) in the plane $2x - 3y + 2z + 3 = 0$.

[OR]

b) Demonstrate that the lines $\frac{x+1}{-3} = \frac{y+10}{8} = \frac{z-1}{2}$; $\frac{x+3}{-4} = \frac{y+1}{7} = \frac{z-4}{1}$ are coplanar. Find the point of intersection and the plane through them.

20. a) Find the equation of the sphere which has its centre at the point (6, -1, 2) and touches the plane $2x - y + 2z - 2 = 0$.

[OR]

b) Illustrate that the plane $2x - y - 2z = 16$ touches the sphere $x^2 + y^2 + z^2 - 4x + 2y + 2z - 3 = 0$ and find the point of contact.

21. a) Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^3$ at the point (2, -1, 1) in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$.

[OR]

b) Compute the divergence and curl of the vector $\vec{F} = xyz\vec{i} + 3x^2y\vec{j} + \left(xz^2 - y^2z\right)\vec{k}$ at (1, 2, -1).

22. a) Show that $\iint_S \vec{r} \bullet \vec{n}\ dS = 3V$ where V is the volume enclose S and $\vec{r}$ is the position vector.

[OR]

b) Show that the value of the integral $\int_{(0,0)}^{(1,2)} 3x(x + 2y)\ dx + \left(3x^2 - y^3\right)dy$ is independent of the path of integration and evaluate the integral by any method.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Illustrate that the origin lies in the acute angle between the planes $x+2y+2z=0,\ 4x-3y+12z+13=0$. Find the planes bisecting the angles between them and point out which bisects the obtuse angle.

24. Find the shortest distance between the lines $\dfrac{x-3}{-1}=\dfrac{y-4}{2}=\dfrac{z+2}{1}$; $\dfrac{x-1}{1}=\dfrac{y+7}{3}=\dfrac{z+2}{2}$.

25. Find the equation of the sphere which passes through the circle $x^2+y^2+z^2-2x-4y=0;\ x+2y+3z=8$ and touches the plane $4x+3y=25$.

26. Demonstrate that $\vec{v}=r^n\vec{r}$ is irrotational. Find n when it's also solenoidal.

27. Evaluate $\iint\left(x^3\,dy\,dz+x^2y\,dz\,dx+x^2z\,dx\,dy\right)$ over the surface bounded by $z=0$, $z=c$, $x^2+y^2=a^2$.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Fourth Semester: Paper – I

SEQUENCES & SERIES

Under CBCS – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Let A = (0,1), the glb and lub of A is ______________

a) 1,0 b) 0,1 c) 0,0 d) 1,1

2. A sequence (a_n) is said to be ____________ if there exists a real number k such that $a_n \geq k$ for all n.

a) bounded above b) bounded below

c) unbounded d) both bounded

3. A sequence (a_n) is said to be ____________________ if $a_n \leq a_{n+1}$ for all n.

a) Monotonic increasing b) monotonic decreasing

c) oscillating d) bounded

4. Every bounded sequence has at least ________________ limit point.

a) one b) two c) three d) four

5. $\lim\limits_{n\to\infty}\left(\dfrac{1^3+2^3+3^3+....+n^3}{n^4}\right)=.........$

a) 1 b) $\dfrac{1}{2}$ c) $\dfrac{1}{4}$ d) 0

6. $\lim\limits_{n\to\infty}\left(1+\dfrac{1}{n}\right)^n = ...$

a) 0 b) e c) 1 d) ∞

7. __________________ is the example of Cauchy sequence.

a) $\left(\dfrac{1}{n}\right)$ b) $(-1)^n$ c) n d) none

8. The Harmonic series $\sum \frac{1}{n^p}$ is converges if _____ and diverges if _____

a) $p<1, p\geq 1$ b) $p>1, p\geq 1$ c) $p>1, p\leq 1$ d) $p<1, p\leq 1$

9. In a Geometric series if r>1 then S_n value is

a) $\frac{r-1}{r^n-1}$ b) $\frac{1-r^n}{1-r}$ c) $\frac{r^n-1}{r+1}$ d) $\frac{r^n-1}{r-1}$

10. Let $\sum a_n$ be a series of positive terms. Then $\sum a_n$ is ____________

if $\lim\limits_{n\to\infty} \frac{a_n}{a_{n+1}} < 1$.

a) convergent b) divergent c) unbounded d) not exist

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define greatest lower bound.

12. Define bounded sequence.

13. Define convergent sequence.

14. Define Cauchy sequence.

15. What you mean by oscillating sequence?

16. State Cauchy's Root test.

17. Define absolutely convergent series.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) State and prove Cauchy – Schwarz inequality.

[OR]

b) State and prove Weierstrass inequality.

19. a) Prove that $|x+y| \leq |x| + |y|$ for all $x,y \in R$.

[OR]

b) Prove that every convergent sequence is bounded.

20. a) Prove that every cauchy sequence is bounded.

[OR]

b) Prove that any convergent sequence is a cauchy sequence.

21. a) Test the convergence of the series $\sum \frac{n^2+1}{5^n}$.

[OR]

b) Test the convergence of the series $\sum \frac{x^n}{n!}$.

22. a) Prove that any absolutely convergent series is convergent.

[OR]

b) Test the convergence of the series $\sum \frac{(-1)^n}{n^p}$.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. State and prove triangle inequalities.

24. If $(a_n) \to a$ and $(b_n) \to b$ Prove that $(a_nb_n) \to ab$.

25. State and prove Cauchy first limit theorem.

26. State and prove Cauchy general principle of convergence.

27. State and prove Leibnitz test.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Fourth Semester: Paper – II

DYNAMICS

Under CBCS – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The horizontal range is maximum when the particle is projected at an angle ________________

   a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) 2π

2. Greatest height attained by a projectile

   a) $\frac{u^2 \sin^2 \alpha}{2g}$ b) $\frac{u \sin \alpha}{g}$ c) $\frac{u^2 \sin 2\alpha}{g}$ d) $\frac{2u \sin \alpha}{g}$

3. Bodies for which e = 1 are said to be_____________________

   a) perfectly inelastic b) perfectly elastic

   c) elastic d) inelastic

4. If an elastic sphere strikes a plane normally with velocity u, it will rebound in the same direction with velocity_______________________

   a) u b) eu c) -u d) e

5. The period of simple Harmonic motion is ______________________

   a) $\frac{2\pi}{\sqrt{\mu}}$ b) $\frac{\sqrt{\mu}}{2\pi}$ c) $\frac{\pi}{2\sqrt{\mu}}$ d) $\frac{2\sqrt{\mu}}{\pi}$

6. A seconds pendulum is one whose period of oscillation is _____ seconds

   a) 1 b) 2 c) 3 d) 4

7. Radial component of velocity is _______________________

   a) $r\dot{\theta}$ b) $\dot{\theta}$ c) $\ddot{\theta}^2$ d) $\dot{r}$

8. The pedal equation of the circle – pole at any point

a) $c^2 = r+a-2ap$ b) $c^2 = r^2 + a^2-2ap$ c) $r^2 = 2ap$ d) $r = 2ap$

9. M.I of the rod AB about the line through A perpendicular to AB is ______

a) $\frac{Ma^2}{3}$ b) $\frac{4Ma^2}{3}$ c) Ma^2 d) $\frac{Ma^2}{2}$

10. M.I of uniform circular ring about on axis through the centre perpendicular to its plane is ______________

a) Ma^2 b) $\frac{Ma^2}{2}$ c) Mb^2 d) Ma^3

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define angle of projection

12. State the principle of conservation of momentum for a particle

13. Find the periodic time of S.H.M

14. Define Oblique impact.

15. Define Simple Pendulum.

16. Define Areal velocity.

17. Define Moment of Inertia.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Find the Range of a projectile in an inclined plane.

[OR]

b) Find the greatest distance of the projectile from the inclined plane and show that is attained in half of the total time of flight.

19. a) A ball of mass 8 gm. moving with velocity of 10cm per sec. impinges directly on another of mass 24 gm moving at 2 cm per sec. in the same direction. If e = ½, find the velocities after impact. Also calculate the loss in kinetic energy.

[OR]

b) A smooth sphere of mass m_1 impinges directly with velocity u_1 on another smooth sphere of mass m_2 moving in the same direction with velocity u_2, if the co-efficient of restitution is e. find their velocities after impact

20. a) A particle is moving with S.H.M and while making an oscillation from one extreme position to other, its distances from the centre of oscillation at 3 consecutive seconds are x_1, x_2, x_3. Prove that the period of oscillation is $\dfrac{2\pi}{\cos^{-1}\left(\dfrac{x_1 + x_3}{2x_2}\right)}$

[OR]

b) If the displacement of a moving point at any time given by an equation of the form $x = a\cos\omega t + b\sin\omega t$, show that the motion is a simple harmonic motion. If a = 3, b = 4, $\omega = 2$ determine the period, amplitude, maximum velocity and maximum acceleration of the motion

21. a) Obtain the differential equation of central orbits in polar coordinates.

[OR]

b) Find the Pedal equation of the central orbit.

22. a) State and prove Theorem of parallel axes

[OR]

b) Find the Moment of inertia a thin uniform rod.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. Show that the path of the projectile is a parabola.

24. Find the Loss of kinetic energy due to direct impact of two smooth spheres.

25. Find the composition of two simple Harmonic Motion of the same period in two perpendicular directions.

26. Find the law of force towards the pole under which the curve $r^n = a^n \cos n\theta$ can be described.

27. Find the M.I of uniform elliptic lamina (axes 2a, 2b) about these axes

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Sixth Semester: Paper – I

LINEAR ALGEBRA

Under CBCS – Credit 5

Time: **3** Hours　　　　Max. Marks: **75**

SECTION – A

Answer ALL Questions　　　　**(10 × 1 = 10)**

1. In C let S={I,i}.Then L(S)=_________________

   a) S　　b) C　　c) R　　d) {a+bi |a,b∈ Z}

2. For the above problem rank and nullity of T are given by __________

   a) nullity T=1; rank T = n　　b) nullity T=0; rank T=n

   c) nullity T=0; rank T= $n+1$　　d) nullity T=1; rank T= $n+1$

3. If A is a 3×4 matrix and B is a 4×1 matrix then________________

   a) AB is not defined　　b) AB is a column matrix with 3 rows

   c) A+B is a 3×1 matrix　　d) A−B is a 4× 1 matrix

4. If A= $\begin{pmatrix} 1+i & 1-i \\ i & -i \end{pmatrix}$ then$A+\overline{A}$ =_________________

   a) $\begin{pmatrix} 2 & 2 \\ 0 & 0 \end{pmatrix}$　　b) $\begin{pmatrix} 1-i & 1+i \\ i & -i \end{pmatrix}$　　c) $\begin{pmatrix} 2i & 2i \\ 0 & 0 \end{pmatrix}$　　d) $\begin{pmatrix} 2i & 0 \\ -2i & 0 \end{pmatrix}$

5. Any skew Hermitian matrix with entries form real numbers is always___

   a) skew symmetric matrix　　b) singular matrix

   c) symmetric matrix　　d) non singular matrix

6. Choose the matrix for which the inverse exists_______________

   a) $\begin{pmatrix} 2 & 15 \\ 4 & 3 \end{pmatrix}$　　b) $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$　　c) $\begin{pmatrix} 3 & 3 \\ 2 & 2 \end{pmatrix}$　　d) $\begin{pmatrix} \frac{1}{10} & \frac{2}{5} \\ \frac{1}{20} & \frac{1}{5} \end{pmatrix}$

7. Any non singular square matrix of order n is equivalent to_________

   a) The identity matrix of order n　　b) A diagonal matrix of order n

   c) Scalar matrix of order n　　d) the zero matrix of order n

8. The characteristic polynomial of I_2 is__________________

a) x^2+2x+1 b) x^2-2x+1 c) $x^2-x-1=0$ d) x^2+x+1

9. If $A=\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ the sum and product of the eigen values of A are______________

a) 32,12 b) $-12,32$ c) $-12,-32$ d) 12,32

10. If the matrix of the quadratic from $q(x,y,z)$ is $\begin{pmatrix} 6 & 2 & 9 \\ 2 & 3 & 2 \\ 9 & 2 & 14 \end{pmatrix}$ then the quadratic from is_________________

a) Positive definite b) Indefinite

c) Positive and semi definite d) negative semi definite

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define vector space.

12. Describe linear transformation.

13. Prove that $\|\alpha x\|=|\alpha|\,\|x\|$.

14. Define Hermitian and skew Hermitian matrix.

15. Define characteristic matrix.

16. Define Eigen values and Eigen vectors.

17. Define symmetric bilinear form.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Prove that the intersection of two subspaces of a vector space is a subspace.

[OR]

b) Prove that any vector space of dimension n over a field is isomorphic to $V_n(F)$.

19. a) State and prove Schwartz's inequality.

[OR]

b) If W_1 and W_2 be subspaces of a finite dimensional inner product space. Then prove that $(W_1+W_2)^{\perp}=W_1^{\perp}\cap W_2^{\perp}$.

20. a) Show that a square matrix A is involutory iff $A=A^{-1}$.

[OR]

b) Find the rank of the matrix $A=\begin{pmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 7 \end{pmatrix}$.

21. a) State and prove Cayley Hamilton theorem.

[OR]

b) Find the sum and product of Eigen values of the matrix

$A=\begin{pmatrix} 3 & -4 & 4 \\ 1 & -2 & 4 \\ 1 & -1 & 3 \end{pmatrix}$ without actually finding the Eigen values.

22. a) A bilinear form f defined on V is symmetric iff its matrix (a_{ij}) w.r.t any one basis $\{v_1,v_2,\ldots\ldots,v_n\}$ is symmetric.

[OR]

b) If f be a symmetric bilinear form defined on V. Let q be the associated quadratic form $f(u,v)=\frac{1}{4}\{q(u+v)-q(u-v)\}$.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. State and prove fundamental theorem of homomorphism.

24. Prove that any finite dimension inner product space has an orthonormal basis.

25. Compute the inverse of the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$.

26. Find the Eigen values and Eigen vector of the matrix $A = \begin{pmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$.

27. Reduce the quadratic form $2x_1x_2 - x_1x_3 + x_1x_4 - x_2x_3 + x_2x_4 - 2x_3x_4$ to the diagonal form using Lagrange's method.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Core Subject: Sixth Semester: Paper – II

COMPLEX ANALYSIS

Under CBCS – Credit 5

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The equation of inversion is ________________

a) $w = \frac{1}{z}$ b) $w = -z$ c) $w = \bar{z}$ d) None

2. $w = \bar{z}$ represents reflection about ____________________

a) Origin b) Real axis c) Imaginary axis d) None

3. The fixed points of a translation are given by ____________________

a) 0 only b) ∞ only c) 0 and ∞ only d) None

4. The complex form of C) R equation is____________________

a) $f_x = f_y$ b) $f_x = - f_y$ c) $f_x = - if_y$ d) None

5. By Liouville's theorem, a bounded entire function in the complex plane becomes

a) zero b) a constant c) a variable d) None

6. By Cauchy's integral formula for higher derivatives, $f^1(z)$ is__________

a) $\frac{1}{2\pi i}\int_c \frac{f(\varsigma)}{\varsigma - z} d\varsigma$ b) $\frac{1}{2\pi i}\int_c \frac{f(\varsigma)}{z - \varsigma} d\varsigma$ c) $\frac{1}{2\pi i}\int_c \frac{f(\varsigma)}{(\varsigma - z)^2} d\varsigma$ d) None

7. The Taylor series of f(z) about the point z_0 is f(z) = ________________

a) $\sum_{n=1}^{\infty} \frac{(z-z_0)^n}{n!} f^{(n)}(z_0)$ b) $\sum_{n=0}^{\infty} \frac{(z-z_0)^n}{n!} f^{(n)}(z_0)$

c) $\sum_{n=0}^{\infty} \frac{z^n}{n!} f^{(n)}(z_0)$ d) None

8. The Maclaurin's series of f(z) is given by f(z) = ______________________

a) $\sum_{n=1}^{\infty} \frac{z^n}{n!} f^{(n)}(0)$ b) $\sum_{n=0}^{\infty} \frac{z^n}{n!} f^{(n)}(0)$ c) $\sum_{n=0}^{k} \frac{z^n}{n!} f^{(n)}(0)$ d) None

9. A pole **a** is called a simple pole, if it is of order ___________________

a) zero b) one c) infinity d) None

10. The total number of types of singularity is________________________

a) two b) three c) four d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find the fixed points of the transformation $w = \frac{1+z}{1-z}$.

12. Verify Cauchy-Riemann equations for the function $f(z) = z^3$.

13. State Liouville's theorem.

14. State Riemann's theorem.

15. Determine the singular point of $f(z) = \frac{z}{e^z - 1}$

16. Find the residue of cot z at z = 0.

17. Define Fundamental theorem of Algebra.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Find the image of the circle $|z-3i| = 3$ under the map $w = \frac{1}{z}$.

[OR]

b) Find the bilinear transformation which maps the points $z_1 = 2, z_2 = i, z_3 = -2$ onto $w_1 = 1, w_2 = i, w_3 = -1$ respectively.

19. a) If $u + v = \frac{\sin 2x}{\cosh 2y - \cos 2x}$, find the analytic function $f(z)$.

[OR]

b) State and prove Cauchy-Riemann equations.

20. a) State and prove Cauchy's Inequality.

[OR]

b) State and prove Liouville's theorem.

21. a) State and prove Weierstrass theorem for essential singularity.

[OR]

b) Expand $\frac{1}{z^2 - 3z + 2}$ in Laurent's series of $1 < |z| < 2$.

22. a) State and prove Rouche's theorem.

[OR]

b) Find the residue of $\frac{1}{(z^2 + a^2)^2}$ $at\ z = ai$.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Prove that any bilinear transformation can be expressed as a product of translation, rotation, magnification or contraction and inversion.

24. Prove that $u = 2x - x^3 + 3xy^2$ is harmonic and find its harmonic conjugate. Also find the corresponding analytic function.

25. State and prove Cauchy's Integral Formula.

26. State and prove Taylor's theorem.

27. Evaluate: $\int_0^{2\pi} \frac{d\theta}{5 + 4\sin\theta}$.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – III: Elective Subject: Sixth Semester: Paper – I

GRAPH THEORY

Under CBCS – Credit 5

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. A regular graph of degree 3 is called a _________

   a) complete graph b) bigraph c) multigraph d) cubic graph

2. A point ϑ of degree zero is called__________

   a) isolated point b) even c) odd d) end point

3. A walk is ______________ if all the lines are distinct

   a) path b) cycle c) trail d) closed walk

4. Number of lines in C_n

   a) n-1 b) n c) n+1 d) n-2

5. The graph K_3 is ____________

   a) Eulerian b) Hamiltonian c) Both a and b d) Not Eulerian

6. Every tree is _________________ graph

   a) bipartite b) complete c) not regular d) none of these

7. Number of perfect matching is $K_{n,\,n}$ is ______________

   a) n b) 2n c) n! d) (n-1)!

8. Each vertex in matching M has degree ______________

   a) one b) two c) three d) zero

9. $\aleph$ (K_p) = ______________

   a) p b) p-1 c) 1 d) 2

10. Chromatic number of any tree is _________________

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

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Prove that $\delta \le \frac{2q}{p} \le \Delta$

12. Prove that the sum of the degree of the points of a graph G is twice the number of lines.

13. Prove that the partition P = (7, 6, 5, 4, 3, 2) is not graphic.

14. Prove that every Hamiltonian graph is two connected.

15. Prove that every non-trivial tree G has at least two vertices of degree 1.

16. Prove that $K_{3,3}$ is not planar.

17. Find the chromatic number of K_p and $K_{m,n}$

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Define self-complementary graphs. Prove that any self-complementary group has 4n or 4n+1 points.

[OR]

b) Let G be a (p, q) graph. The prove that L(G) is a (q, q_L) graph when $q_L = \frac{1}{2}\left(\sum_{i=1}^{p} d_i^2\right) - q$

19. a) Prove that a graph G with p points and $\delta \ge \frac{p-1}{2}$ is connected.

[OR]

b) Prove that for any graph G, $k \le \lambda \le \delta$

20. a) Write Fleury's algorithm.

[OR]

b) Prove that every tree has a centre consisting of either one point or two adjacent points.

21. a) Find the number of perfect matching in the complete graph K_{2n}

[OR]

b) State and prove Euler's polyhedron formula.

22. a) If G is a tree with n points, n ≥ 2 then prove that $f(G, \lambda) = \lambda(\lambda - 1)^{n-1}$

[OR]

b) Prove that $\lambda^4 - 3\lambda^3 + 3\lambda^2$ cannot be the chromatic polynomial.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Prove that the maximum number of lines among all p point graph with no triangle is $\left[P^2/4\right]$

24. Prove that a graph G with at least two points is bipartite iff all its cycles are of even length

25. Show that the Petersen graph is nonhamiltonian.

26. State and prove Hall's marriage theorem.

27. Prove that $\chi'(K_n) = n$ if n is odd $(n \ne 1)$ and $\chi'(K_n) = n - 1$ if n is even

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021
Part – III: Elective Subject: Sixth Semester: Paper – II

OPERATIONS RESEARCH

Under CBCS – Credit 5

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. If small orders are placed frequently (rather than placing large orders infrequently), then total inventory cost is________________.
   a) reduced b) increased
   c) either reduced or increased d) minimized
2. If the procurement cost used in the formula to compute EOQ is half of the actual procurement cost, the EOQ so obtained will be _________.
   a) half of EOQ b) 0.707 time EOQ
   c) one third of EOQ d) one forth of EOQ
3. In a queueing system expected waiting time in the queue is denoted by __
   a) $E(m)$ b) $E(n)$ c) $E(v)$ d) $E(w)$
4. In deterministic queueing model, _______________.
   a) arrival rate is known and the service time is also certain
   b) arrival rate must not exceed the service rate
   c) the service rate and the service time are reciprocal of each other
   d) if the arrival occur according to a Poisson distribution, the inter- arrival times would
5. In critical path Analysis, the word CPM means_________.
   a) Critical Path Method b) Crash Project Management
   c) Critical Project Management d) Critical Path Management
6. Which of the following is not correct?
   a) The critical path of a project network represents the minimum time needed to complete the project
   b) Critical path is the longest path in a project network
   c) A delay in the completion of critical activities need not cause a delay in the completion of the whole project

d) The sum of the variances of the critical activity times gives the variance of the overall project completion time

7. A sequencing problem involving six jobs and three machine requires evaluation of __________ sequences.

a) $6! + 6! + 6!$ b)$(6!)^3$ c)$(6 \times 6 \times 6)$ d) $(6 + 6 + 6)$

8. Six jobs are to be processed on two machines A and B in the order AB. The timings of the jobs are known to be: (30, 80), (120, 100), (50, 90), (20, 60), (90,30) and (100,10). The optimum sequence would be:

a) $J_1 \rightarrow J_4 \rightarrow J_5 \rightarrow J_2 \rightarrow J_3 \rightarrow J_6$ b) $J_1 \rightarrow J_6 \rightarrow J_2 \rightarrow J_3 \rightarrow J_4 \rightarrow J_5$

c) $J_4 \rightarrow J_1 \rightarrow J_3 \rightarrow J_2 \rightarrow J_5 \rightarrow J_6$ d) $J_4 \rightarrow J_1 \rightarrow J_5 \rightarrow J_2 \rightarrow J_3 \rightarrow J_6$

9. When value of money changes with time, the optimum replacement policy of the equipment after 'n' periods is:

i) Do not replace the item if next periods operating cost is greater than the weighted average of previous costs

ii) Replace the item if the next periods operating cost is less than the weighted average of

a) All the Only (i) is correct b) Only (ii) is correct

c) Both (i) and (ii) are correct, d) Both (i) and (ii) are not correct

10. In a replacement problem, the total cost is denoted by ___________.

a) $e(t)$ b) $S(n)$ c) TC d) $A(n)$

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. State reason for carrying inventories.

12. Draw the EOQ graph.

13. Write any two cost associated with inventories.

14. State any two elements of a queue system.

15. Present various time estimates in PERT.

16. Give any two assumptions of a sequencing problems.

17. Declare two classification of Replacement problem.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) State the factors affecting inventory control.

[OR]

b) A manufacturing company purchase 9000 parts of a machine for its annual requirements ordering for one month usage at a time, each part costs ₹ 20. The ordering cost per order is ₹ 15 and carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchase policy for the company. What advice you offer and how much would it save the company per year?

19. a) A television repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

[OR]

b) Explain operating characteristics of a queueing system.

20. a) Construct network diagram for the following information B < E, F; C< G, L; E, G < H; L, H < I; L < M; H < N; H < J; I, J < P; P< Q. Here letters are known as activity and X < Y means X must be finished before Y can begin.

[OR]

b) A small Project is composed of the following activities

Activity		Estimate duration(weeks)		
I	j	Optimistic	Most likely	Pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

Calculate expected project completion time.

21. a) In a factory there are six jobs to be performed each of which should go through two machines A and B in the order A, B. The processing timing (in hours) for the jobs arc given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time T

Job	**J1**	**J2**	**J3**	**J4**	**J5**	**J6**
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

[OR]

b) A book binder has one printing press, one binding machine and manuscripts of a number of different books. The time required to perform the printing and binding operations on each book are shown below. Determine the order in which the books should be processed, so that the total time required to process all books is minimized.

Book:	1	2	3	4	5	6
Printing Time (hrs) :	30	120	50	20	90	100
Binding Time (hrs) :	80	100	90	60	30	10

22. a) The cost of new machine is ₹ 5000. The maintenance cost of n^{th} year is given by $C_n = 500(n-1)$, n = 1, 2, ... Suppose that the discount rate per year is 0.05. After how many years it will be economical to replace the machine by new one?

[OR]

b) Equipment A purchase cost is ₹ 10000 and using the following information estimate the optimum period for replacement.

Year	1	2	3	4	5	6	7
Operating Cost ₹	1500	1900	2300	2900	3600	4500	5500
Resale Value ₹	5000	2500	1250	600	400	400	400

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Explain the deterministic inventory problems with no shortage.

24. Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival time follows an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, one of which is reserved for shunting purposes), then calculate the probability that the yard is empty and the average queue length.

25. Draw the network and also compute Total float, critical path and Project length for the data given below:

Activity	A	B	C	D	E	F	G	H	I
Predecessor	-	-	-	A	B	C	D,E	B	H,F
Estimate Time(weeks)	3	5	4	2	3	9	8	7	9

26. Solve the following sequence problem, giving an optimal solution when passing is not allowed.

Machine	Job				
	I	II	III	IV	V
M1	10	12	8	15	16
M2	3	2	4	1	5
M3	5	6	4	7	3
M4	14	7	12	8	10

27. A Manufacturer is offered two machines A and B. Machine A is priced at ₹ 5000 and running costs are estimated at ₹ 800 for each of the first five years, increasing by ₹ 200 per year in the sixth and subsequent years. Machine B, with the same capacity as A, costs ₹ 2500, but has running cost of ₹ 1200 per year for six years, thereafter increasing by ₹ 200 per year. If money is worth 10% per year, which machine should be purchased? (Assume that the machines will eventually be sold for scrap at a negligible price).

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B.A. & B.Sc. Degree (Semester) Examinations, April 2021
Part – IV: Non-Major Elective Subject: Second Semester: Paper – I
STATISTICS AND OPERATIONS RESEARCH
Under CBCS – Credit 2

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The transportation problem deals with the transportation of __________.
   a) a single product from several sources to a destination
   b) a multi-product from several sources to several destinations
   c) a single product from several sources to several destinations
   d) a single product from a source to several destinations
2. The solution to a T.P with *m*-sources and *n*- destinations is feasible, if the number of allocations are________________.
   a) m + n b) m + n + 1 c) m + n - 1 d) m - n
3. In an assignment problem, the number of rows is __________ to number of columns.
   a) less than b) greater than c) equal d) less than or equal
4. In an assignment problem involving four workers and three jobs, total number of assignments possible are __________.
   a) 4 b) 3 c) 7 d) 12
5. The observation which occurs most frequently in a sample is the___
   a) median b) mean c) mode d) standard deviation
6. What is the median of the sample 5, 5, 11, 9, 8, 5, 8 ?
   a)5 b)8 c)11 d)9
7. The mean of ten numbers is 58. If one of the numbers is 40, what is the mean of the other nine?
   a)18 b)540 c)162 d)60

8. Given an LPP to maximize $z = -5x_2$, subject to $x_1 + x_2 \leq 1, 0.5x_1 + 5x_2 \geq 0$ and $x_1, x_2 \geq 0$. Using graphical method, we have________.

a) no feasible solution b) unbounded solution.

c) unique optimum solution d) multiple optimum solution.

9. Which of the following is not correct?

a) Graphical method of linear programming is not useful when there are only two decision variables.

b) Solution of a maximization LPP when permitted to be infinitely large is called unbounded.

c) Optimum solution to an LPP always lies at least on the two vertices of the feasible region.

d) It is possible for the objective function value of an LPP to be the same at two distinct extreme points.

10. Relation between mean median and mode.

a) 2Mean + Mode =3Median b) Mean + Mode =Median

c) Mean + 2Mode =3Median d) 3Mean +2 Mode =Median

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define Assignment problem.

12. What is the main objective of Transportations problem?

13. State any to limits of statistics.

14. Write the merits of Graphical method in linear programming.

15. Define Mean.

16. Find the Standard deviation of 1, 2, 3, 4, 5.

17. Find the Median of the given data: 2,4,6,7,8,1,2,5.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Find the Standard deviation of the given data:

Class Interval(x)	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency(f)	1	4	17	45	26	5	2

[OR]

b) Estimate the quartile deviation Q_1 and Q_3 from the following data:

X	2	4	10	14	18	28
F	3	7	12	14	9	5

19. a) Luminous lamps has three factories - F_1, F_2, and F_3 with production capacity 30, 50, and 20 units per week respectively. These units are to be shipped to four warehouses W_1, W_2, W_3, and W_4 with requirement of 20, 40, 30, and 10 units per week respectively. The transportation costs (in Rs.) per unit between factories and warehouses are given below.

Factory	**Warehouse**				**Supply**
	W_1	**W_2**	**W_3**	**W_4**	
F_1	1	2	1	4	30
F_2	3	3	2	1	50
F_3	4	2	5	9	20
Demand	20	40	30	10	

Find an initial basic feasible solution of the given transportation problem using northwest corner rule?

[OR]

b) using Least Cost method, find an initial basic feasible solution of the given transportation problem?

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

20. a) A machine tool company decides to make four subassemblies through four contractors. Each contractor is to receive only one subassembly. The cost of each subassembly is determined by the bids submitted by each contractor and is as shown in the table below (in thousands of rupees). Assign different assemblies to contractors so as to minimize the total cost.

Sub-assembly / Contractor	A	B	C	D
1	15	13	14	17
2	11	12	15	13
3	18	12	10	11
4	15	17	14	16

[OR]

b) Solve the following LPP by graphical method Minimize $z = 5x_1 + 4x_2$

Subject to constraints $4x_1 + x_2 \geq 40$; $2x_1 + 3x_2 \geq 90$ and $x_1, x_2 \geq 0$

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

21. Five jobs are to be done on five different machines. The cost of producing i[th] job on the j[th] machine is given below. Assign the job to different machine so as to minimize the total cost.

Jobs / Machines	A	B	C	D	E
1	9	3	1	13	1
2	1	17	13	20	5
3	0	14	8	11	4
4	19	3	0	5	5
5	12	8	1	6	2

22. Use Vogel's approximation method to obtain an initial basic feasible solution of the transportation problems:

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

23. State the importance of statistics in various fields.

24. Find the mean median and mode for the given informations:

Marks Obtained	0-20	20-40	40-60	60-80	80-100
Number of students	5	10	12	6	3

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021
Part – IV: Skill Based Subject: Fourth Semester: Paper – I

COMPETITIVE MATHEMATICS

Under CBCS – Credit 2

Time: **2** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Find the product: 0.069 * 10000 = ?
   a) 69 b) 609 c) 690 d) 6900
2. H.C.F. of 391 and 667 is ?
   a) 23 b) 53 c) 33 d) 43
3. The average of 5,6,7,8,9,10.
   a) 7.6 b) 7.5 c) 7.8 d) 7.7
4. Evaluate $\sqrt{6084}$ by factorization method .
   a) 78 b) 68 c) 72 d) 62
5. What percent of 2 metric tones is 40 quintals ?
   a) 100% b) 150% c) 200% d) 250%
6. Some article were bought at 6 for ₹ 5 and sold at 5 for ₹ 6. Gain percent is :
   a) 30% b) $33\frac{1}{3}$% c) 35% d)44%
7. If a : b = 5: 9 and b : c = 4: 7, find b =?
   a) 22 b) 36 c) 63 d) 54
8. Find the S.P., when C.P. = ₹ 56.25, gain = 20 %.
   a) ₹ 67.15 b) ₹ 67.20 c) ₹ 67.30 d) ₹ 67.50
9. Find the third proportional to 16 and 36?
   a) 82 b) 83 c) 81 d) 80

10. Find C.P., when S.P. = ₹ 40.60, Gain = 16%.

a) ₹ 30 b) ₹ 35 c) ₹ 40 d) ₹ 45

SECTION – B

Answer any FIVE Questions **($5 \times 2 = 10$)**

11. What value will replace the question mark in the following equations ? 5172.49 + 378.352 + ? = 9318.678

12. Find the H.C.F. of 108, 288 and 360.

13. If a * b * c = $\sqrt{(a+2)(b+3)}$ / (c + 1), find the value of 6 * 15 * 3?

14. The Average of 11 results is 60, if the average of the 1st 6 results is 58 & that of the last 6 results is 63. Find the 6th result?

15. Sixty five percent of a number is 21 less than four fifth of that number. What is the number?

16. If x: y = 5: 2, then (8x + 9y): (8x + 2y) is:

17. A retailer buys 40 pens at the marked price of 36 pens from a wholesaler. If he sells these pens giving a discount of 1%, what is the profit percent

SECTION – C

Answer ALL Questions **($3 \times 9 = 25$)**

18. a) i) Find the H.C.F. of 0.63, 1.05 and 2.1.

ii) Calculate: 5.064 + 3.98 + 0.7036 + 7.6 + 0.3 + 2.

[OR]

b) i) Difference of two numbers is 1660. If 7.5% of the number is 12.5% of the other number, find the numbers?

ii) In an examination, 80% of the students passed in English, 85% in Mathematics and 75% in both English and Mathematics. If 40 students failed in both the subjects, find the total number of students.

19. a) i) The average age of a class of 39 students is 15 years. If the age of the teacher be included, then the average increases by3 months. Find the age of the teacher.

ii) There were 35 students in a hostel. Due to the admission of 7 new students, the expenses of the mess were increased by ₹ 42 per day while the average expenditure per head diminished by ₹ 1. What was the original expenditure of the mess?

[OR]

b) i) Evaluate $\sqrt{175.2976}$. ii) Find the cube root of 9261000.

20. a) i) The salaries of A, B, C are in the ratio 2:3:5. If the increments of 15%, 10% and 20% are allowed respectively in their salaries, then what will be the new ratio of their salaries ?

ii) When a producer allows 36% commission on the the retail price of his product, he earns a profit of 8.8 %. What would be his profit percent if the commission is reduced by 24%?

[OR]

b) i) A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is ₹ 855, the total profit is?

ii) Three partners A, B, C start a business. Twice A's capital is equal to thrice B's capital and B's capital is four times C's capital. Out of a total profit of ₹ 16,500 at the end of the year, B's share is ?

SECTION – D

Answer any TWO Questions: **($2 \times 14 = 28$)**

21. i) The traffic lights at three different road crossings change after every 48 sec., 72 sec. and 108 sec. respectively. If they all change simultaneously at 8:20:00 hours, then at what time will they again change simultaneously.

ii) Express as vulgar fractions: a) $0.1\overline{7}$, b) $0.12\overline{54}$.

22. i) Simplify: $\sqrt{[(12.1)^2 - (8.1)^2] / [(0.25)^2 + (0.25)(19.95)]}$.

ii) The average weight of A, B, C is 45 Kg. The average weight of A & B be 40Kg & that of B, C be 43Kg. Find the weight of B?

iii) Find the average of first 20 multiples of 7?

23. i) The present age of a father is 3 years more than three times the age of his son. Three years hence, father's age will be 10 years more than twice the age of the son. Find the present age of the father?

ii) One year ago, the ratio of Gaurav’s and Sachin’s age was 6: 7 respectively. Four years hence, this ratio would become 7: 8. How old is Sachin?

24. i) A and B started a business with initial investments in the ratio 14 : 15 and their annual profits were in the ratio 7 : 6. If A invested the money for 10 months, for how many months did B invest his money?

ii) If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of ₹ 4650, C will receive ___________?

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021

Part – IV: Skill Based Subject: Sixth Semester: Paper – I

ADVANCED STATISTICS

Under CBCS – Credit 2

Time: **2** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The qualities characteristic of a population are called
   a) Frequency b) Attributes c) Posive d) None
2. For any three given attributes total number of positive class frequencies is
   a) 2^3 b) 3^3 c) 3^2 d) 7
3. There is no negative class frequencies of order ___________
   a) 0 b) 1 c) 2 d) 3
4. Given n attributes, the total number of class freuencies is
   a) 2^n b) 3^n c) 2^n -1 d) None
5. For any four given attributes**,** the total number of positive class frequencies is
   a) 15 b) 81 c) 17 d) 16
6. Class frequencies of type (A), (B), (ABC)… are known as _______ class frequencies.
   a) Positive b) Negative c) Contrary d) None
7. Two attributes A and B are said to be ______________ if there is same proportion of A as amongest B's
   a) Independent b) Positively associated
   c) Negatively associated d) None
8. Equivalent positive class condition for (ABC) $\geq$ 0.
   a) (ABC) $\leq$ AB b) (ABC) $\leq$ BC
   c) (ABC) $\leq$ AC d) None

9. For any four given attributes, the total number of positive class frequencies is

a) 8 b) 7 c) 3^3 d) 9

10. The following are ultimate frequencies of two attributes A and B, AB = 975, αB = 100, Aβ = 25 & $\alpha\beta$ = 950, then β is ____________

a) 975 b) 875 c) 925 d) 950

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Given A = 30, B = 25, α = 30 and $\alpha\beta$ = 20. Find (i) N (ii) β (iii) AB.

12. Define consistency.

13. Find whether the following data are consistent for A = 300, B = 400,

AB = 50 & N = 600.

14. Check whether the attributes A and B are independent for A = 30, B = 60, AB = 12 & N =150.

15. Prove that (AB) = ABC + (ABx)

16. Prove that (AB) = N – α – β + ($\alpha\beta$).

17. Define inconsistent.

SECTION – C

Answer ALL Questions **(3 × 9 = 27)**

18. a) In a class test in which 135 candidates were examined for proficiency in English and Maths. It was discovered that 75 students failed in English, 90 failed in Maths and 50 failed in both. Find how many candidates
i) have passed in Maths
ii) have passed in English & failed in Maths
iii) have passed in both.

[OR]

b) Given N = 1200, ABC = 600, ($\alpha\beta$x) = 50, γ = 270, (Aβ) = 36, (Bγ) = 204, A – α = 192 & B – β = 620. Find the remaining ultimate class frequencies.

19. a) Given that A = B = α = β = N/2. Show that (i) AB = $\alpha\beta$, (ii) Aβ = αB.

[OR]

b) Of 2000 people consulted 1854 speak Tamil, 1507 speak hindi, 572 speak English, 676 speak tamil and hindi, 286 speak tamil and English, 270 speak hindi and English, 114 speak tamil, hindi & English. Show that the information as it stands is incorrect.

20. a) Show whether A and B are independent (or) positively associated (or) negatively associated in the following cases.
i) A = 470, AB = 300, α = 530, αB = 150
ii) AB = 66, Aβ = 88, αB = 102, $\alpha\beta$ = 136.

[OR]

b) Calculate the coefficient of association between intelligence of father and son from the following data.
Intelligent fathers with intelligent sons 200
Intelligent fathers with dull sons 50
Dull fathers with intelligent sons 110
Dull fathers with dull sons 600. Comment on the result.

SECTION – D

Answer any TWO Questions **(2 × 14 = 28)**

21. The following is the statistics showing the lives in hours of four batches of electric bulbs sold in different shops. Perform an analysis of variance and state your conclution.

Batches	S1	S2	S3	S4	S5	S6	S7	S8
A	1600	1610	1650	1680	1700	1720	1800	-
B	1580	1640	1700	1750	1640	-	-	-
C	1460	1550	1600	1620	1640	1660	1740	1820
D	1510	1520	1530	1570	1600	1680	-	-

22. Given the following positive class frequencies N = 20, A = 9, B = 12, C = 8, AB = 6, BC = 4, CA = 4 & ABC = 3, Find the remaining Class frequencies.

23. In a very hartly fought battle 70% of the soldiers atleast lost an eye, 75% atleast lost an ear, 80% atleast an arm and 85% atleast lost a leg. How many atleast must have lost all the four.

24. From the following data compare the association between marks in physics and chemistry in M.K.U and M.S.U.

University	**M.K.U**	**M.S.U**
Total Number of candidates	1600	200
Pass in Physics	320	80
Pass in Chemistry	90	40
Pass in Physics & Chemsitry	30	20

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B.Sc. Mathematics Degree (Semester) Examinations, April 2021
Part – IV: Skill Based Subject: Sixth Semester: Paper – II

BOOLEAN ALGEBRA

Under CBCS – Credit 2

Time: **2** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Let A={(3,4)}and B={triangle, square, rectangle}.Define a relation ρ from A to B as aρb⇔a is the number of(edges) sides of b. then ρ is_____________
   a){(Triangle, 3)} b){(3, triangle)}
   c){(3, triangle), (3, square),(3, rectangle)}
   d){(4, square), (3, triangle), (4, rectangle)}
2. Let S be the set of all lines in the Euclidean plane R×R. Define a ρ b ⇔a is parallel to b. Then ρ is____________
   a) not reflexive b) not symmetric
   c) not transitive d) equivalence relation
3. A lattice is a poset in which any two elements have a ___________
   a) *g.l.b* b) *l.u.b.* c) *g.l.b* and *l.u.b.* d) None of these
4. A partial ordering in which any two elements are comparable is ___
   a) Total ordering b) Poset c) linear ordering d) None of these
5. The least element of all finite subset of any infinite set is _______
   a)1 b) 2 c) ϕ d) None of these
6. The lattice of normal subgroup of any group is a ______________
   a) Distributive b) Unit c) Complemented d) Modular
7. L be a lattice. Let $a, b \in L$. Then $a \vee a =$ _______________
   a) 1 b) 0 c) infinite d) a

8. Any chain is a ______________ lattice

a) Distributive b) Unit c) Complemented d) None of these

9. In a distributive lattice the compliment of any element a, if its exists, is ___________

a) Modular b) Unique c) Complemented d) Distributive

10. In any Boolean algebra, each of the identifies $a \wedge x = a$ and $a \vee x = x$ for all x implies _________________

a) $a=b$ b) $a=a'$ c) $a=0$ d) None of these

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define equivalence relation.

12. Draw a poset diagram for {1, 2, 3, 4} with the usual less than or equal.

13. Write distributive laws in lattices.

14. Define modular lattice.

15. Define Boolean algebra.

16. Define complemented lattice.

17. Prove that a Boolean algebra cannot have exactly three elements.

SECTION – C

Answer ALL Questions **(3 × 9 = 27)**

18. a) i) Demonstrate that the union of two equivalence relations need not to be an equivalence relation.

ii) If ρ and σ are equivalence relations defined on a set S, prove that $\rho \cap \sigma$ is an equivalence relation.

[OR]

b) Prove that any partition of a set S determines an equivalence relation ρ such that the members of the partition are precisely the equivalence classes defined by ρ.

19. a) Show that in any distributive lattice $(a \vee b) \wedge (b \vee c) \wedge (c \vee a) = (a \wedge b) \vee (b \wedge c) \vee (c \wedge a)$.

[OR]

b) Prove that the lattice of normal subgroups of any group is a modular lattice.

20. a) Let L be a Boolean algebra. Then prove that

i) $(a \vee b)' = a' \wedge b'$ and $(a \wedge b)' = a' \vee b'$ ii) $(a')' = a$

[OR]

b) i) In a Boolean algebra if $a \vee x = b \vee x$ and $a \vee x' = b \vee x'$ then $a = b$.

ii) Show that in a Boolean algebra $[a \vee (a' \wedge b)] \wedge [b \vee (b \wedge c)] = b$.

SECTION – D

Answer any TWO Questions **(2 × 14 = 28)**

21. If ρ be an equivalence relation defined on a set S. Then

i) $a \rho b \Leftrightarrow [a] = [b]$. ii) Any two distinct equivalence classes are disjoint.

iii) S is the union of all equivalence classes.

22. Describe the covers of following sets and draw a poset diagram, if the set of all subgroup of

i) $V_4 = \{e, a, b, c\}$ given by {e}, {e, a}, {e, b}, {e, c} and V_4.

ii) {1, 2, 3}.

23. Let L be a lattice. Let $a, b, c \in L$. Then we have

i) $L_1 : a \vee a = a$ and $L_1' : a \wedge a = a$ $(Idempotent)$

ii) $L_2 : a \vee b = b \vee a$ and $L_2' : a \wedge b = b \wedge a$

iii) $L_3 : a \wedge (a \vee b) = a$ and $L_3' : a \vee (a \wedge b) = a$

24. Explain a Boolean algebra B, the complement of any element is not itself. Also, prove that a Boolean algebra cannot have exactly three elements.