VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

(Autonomous & Residential)

[Affiliated to Madurai Kamaraj University]

B.Sc. (Phy. / Chem.) Degree (Semester) Examinations, April 2019

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

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 $\left[1+\frac{dy}{dx}\right]^{\frac{3}{2}} = a\frac{d^2y}{dx^2}$ is ______

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

2. The degree of the differential equation $y'' + y = x^{\frac{7}{3}}$ is

   a) 3 b) 4 c) 5 d) 2

3. The general form of the linear differential equation is _________

   a) $\frac{dy}{dx} + Py = Q$ b) $\frac{dy}{dx} + Qy = P$ c) $\frac{dy}{dx} = Q$ d) $\frac{dy}{dx} = P$

4. The integrating factor of Bernoulli's equation $(x+1)\frac{dy}{dx} + 1 = 2e^{-y}$ is ___________

   a) x b) $x+2$ c) $x-1$ d) $x+1$

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 roots of the differential equation $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4y = 0$ is _______

   a) 1, 4 b) -1, -4 c) -1, 4 d) 1, -4

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. The Auxiliary equation of the differential equation $y'' + y = 0$ is ____________________

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

9. The general term of the Simultaneous differential equations of first order and first degree is ____________________

a) $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ b) $Pdx = Qdy = Rdz$

c) $\frac{dx}{1} = \frac{dy}{2} = \frac{dz}{4}$ d) $\frac{dx}{3} = \frac{dy}{4} = \frac{dz}{7}$

10. The general term of the total differential equation is ______________

a) $Pdx = Qdy = Rdz$ b) $Pdx + Qdy + Rdz = 0$

c) $Pdx = Qdy = 0$ d) $Pdx = Rdz = 1$

SECTION – B

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

11. Find the order and degree of the differential equation

$$y''' + xy'' + 2y\left(y'\right)^2 + xy = 0.$$

12. Define: Homogeneous function.

13. State the necessary and sufficient condition for a differential equation to be exact.

14. Solve : $\left(D^2 - 5D + 6\right)y = 0.$

15. Find the particular integral of the differential equation $\left(D^2 - 4\right)y = e^{2x}.$

16. Transform the given differential equation into a differential equation with constant coefficients $x^2 y'' + 4xy' + 2y = \log x.$

17. When a function is said to be integrable?

SECTION – C

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

18. a) Form the differential equation for which $y = c_1 \cos x + c_2 \sin xy$ is a solution.

(OR)

b) Solve : $\frac{dy}{dx} = \frac{6x - 4y + 3}{3x - 2y + 1}.$

19. a) Verify whether $e^y dx + \left(xe^y + 2y\right)dy = 0$ is exact, if so solve.

(OR)

b) Solve : $y' - y\tan x = e^x \sec x$

20. a) Solve : $\left(D^2 + D + 1\right)y = \sin 2x$

(OR)

b) Solve : $\left(D^2 - 4\right)y = x^2.$

21. a) Solve : $x^2 y'' + 4xy' + 2y = \log x$

(OR)

b) Find the complementary function of the given differential equation

$$(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x.$$

22. a) Solve the simultaneous equation $\frac{dx}{yz} = \frac{dy}{zx} = \frac{dz}{xy}.$

(OR)

b) Solve : $z^2 dx + \left(z^2 - 2yz\right)dy + \left(2y^2 - yz - xz\right)dz = 0.$

SECTION – D

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

23. Solve : $x\dfrac{dy}{dx}+\dfrac{y^2}{x}=y.$

24. Solve : $y\left(xy+2x^2y^2\right)dx+x\left(xy-x^2y^2\right)dy=0.$

25. Solve : $\left(D^2+4\right)y=e^{-3x}+\cos 4x.$

26. Using the method of variation of parameter, solve $\dfrac{d^2y}{dx^2}+4y=\tan 2x.$

27. Solve the following system of equations, where $D=\dfrac{d}{dt}.$

$$\frac{d^2x}{dt^2}-3x-y=e^t$$

$$\frac{dy}{dt}-2x=0.$$

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B.Sc. (Phy. / Chem.) Degree (Semester) Examinations, April 2019

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

MATHEMATICS – III

Under CBCS – Credit 3

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

SECTION – A

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

1. The solution containing as many arbitrary constants as there are independent variables is called ____________________

   a) Complete integral b) Singular integral

   c) Particular integral d) General integral

2. The partial differential equation of the given equation $z = x + y + f(xy)$ is ______________

   a) $px + qy = x + y$ b) $px - qy = x + y$

   c) $px + qy = x - y$ d) $px - qy = x - y$

3. In an equation $z = ax + by + a$, $q =$

   a) a b) $-a$ c) b d) $-b$

4. The value of $L(\cosh at) =$

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

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

   a) $(-1)^n \frac{d^n}{ds^n} F(s)$ b) $(-1)^{n-1} \frac{d^n}{ds^n} F(s)$

   c) $(-1)^{n+1} \frac{d^n}{ds^n} F(s)$ d) $(-1)^{n-2} \frac{d^n}{ds^n} F(s)$

6. The value of $L^{-1}\left(\frac{s-4}{(s-4)^2+25}\right) =$

a) $e^{-4t}\cosh 5t$ b) $e^{-4t}\cos 5t$ c) $e^{4t}\cos 5t$ d) $e^{4t}\cosh 5t$

7. The value of $L(e^{5t}) =$

a) $\frac{1}{s-5}$ b) $\frac{1}{-(s-5)}$ c) $\frac{1}{s+5}$ d) $\frac{1}{-(s+5)}$

8. The value of $L(\sin 2t) =$

a) $\frac{s}{s^2+4}$ b) $\frac{2}{s^2+4}$ c) $\frac{s}{s^2-4}$ d) $\frac{2}{s^2-4}$

9. In the Odd function, the Fourier coefficient a_0&a_n is

a) 0 b) 1 c) 2 d) π

10. The function $\sin x$ is a ________ function

a) even b) odd c) both d) neither even nor odd

SECTION – B

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

11. Write the types of formation of partial differential equations.
12. Define Lagcange's linear equation.
13. Write the complete integral for the equation of the form $z = px + qy + f(p,q)$.
14. Define Laplace Transform.
15. Write the formula for $L(\sinh ax)$.
16. Evaluate $L^{-1}\left[\frac{1}{(s-a)^2}.\right]$
17. Define Half range Sine and Cosine series.

SECTION – C

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

18. a) Eliminate the arbitrary constants a, b and c from $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ and form a partial differential equation.

(OR)

b) Form a partial differential equation by eliminating the arbitrary function ϕ from $\phi\left(x+y+z,\ x^2+y^2-z^2\right)=0.$

19. a) Solve : $pq+p+q=0.$

(OR)

b) Solve : $p^3+q^3=27z.$

20. a) Find the Laplace transforms of $x^2\cosh ax.$

(OR)

b) Prove that $L\left(e^{ax}\right)=\frac{1}{s-a}$ if $s-a>0.$

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

(OR)

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

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

(OR)

b) Find the Fourier Cosine series for the function $f(x)=\pi-x$ in the interval $(0,\pi)$.

SECTION – D

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

23. Find the general solution of $x\left(y^2-z^2\right)p+y\left(z^2-x^2\right)q=z\left(x^2-y^2\right)$.

24. Solve $q-p=y-x$.

25. i) Evaluate $L\left(\dfrac{1-\cos 2x}{x}\right)$ and ii) $L\left(xe^{-x}\cos x\right)$.

26. Find $L^{-1}\left[\dfrac{s^2-s+2}{s(s-3)(s+2)}\right]$.

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

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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

PROGRAMMING IN C++

Under CBCS – Credit 4

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

SECTION – A

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

1. The wrapping up of data and functions into a single unit is called ____.
   a) inheritance b) polymorphism c) encapsulation d) data hiding
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) void d) double
4. Default values for a function are specified when ________________.
   a) function is defined b) function is declared
   c) Both a and b d) None of these
5. The binding of data and functions together into a single class-type variable is referred to as __________________________.
   a) encapsulation b) data hiding c) data abstraction d) data binding
6. 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
7. State whether the following statements about the constructor are True or False.
   i) constructors should be declared in the private section.
   ii) constructors are invoked automatically when the objects are created.
   a) True, True b) True, False c) False, True d) False, False

8. We can overload almost all the C++ operators except the following.

i) Class member operator (.,.*)   ii) Assignment operator (=)

iii) Scope resolution operator (::)   iv) Conditional operator (?:)

a) i, ii and iii only   b) ii, iii and iv only

c) i, iii and iv only   d) All i, ii, iii and iv

9. Which among the following best describes the Inheritance?

a) Copying the code already written

b) Using the code already written once

c) Using already defined functions in programming language

d) Using the data and functions into derived segment

10. Which symbol is used to create multiple inheritance?

a) Dot   b) Comma   c) Dollar   d) None of the mentioned

SECTION – B

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

11. Mention any two Object Oriented Programming Languages other than C++.
12. Write any two applications of OOPs.
13. What do you mean by call by reference?
14. Define Class.
15. What do you mean by Operator Overloading?
16. Define Inheritance.
17. Denote Virtual Base Class.

SECTION – C

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

18. a) List out the Benefits of Object Oriented Programming.

(OR)

b) Elucidate briefly about Object Oriented Programming Paradigm.

19. a) Translate briefly about Inline Functions with example.

(OR)

b) Point out Return by Reference with example.

20. a) Clarify briefly about Classes and Objects in C++.

(OR)

b) Write Short notes on : Static Member Functions.

21. a) What is a Parameterized Constructor? Illustrate with example.

(OR)

b) Analyze with example Copy Constructor.

22. a) Explicate Single Inheritance with example.

(OR)

b) Clear Up Multilevel Inheritance with example.

SECTION – D

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

23. Rephrase the different types of Operators used in C++ with example.
24. Demonstrate Function Overloading with examples.
25. Discuss Friend Function with example.
26. Summarize Operator Overloading in C++ with example.
27. Examine Hierarchical Inheritance with example.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. $\int e^{-mx}dx =$ ____________

   a) $-e^{-mx}+c$ b) $\frac{-e^{-me}}{-m}+c$ c) $\frac{e^{-me}}{-m}+c$ d) none

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

   a) $\sin^{-1}\left(\frac{x}{a}\right)+c$ b) $\cos^{-1}\left(\frac{x}{a}\right)+c$ c) $\frac{1}{2a}\log\left(\frac{a+x}{a-x}\right)+c$ d) none

3. $f(x)$ is an even function if

   a) $f(0)=0$ b) $f(-x)=f(x)$ c) $f(-x)=-f(x)$ d) none

4. The reduction formula for $I_n = \int \sin^n x\, dx$ is

   a) $nI_n = \sin^{n-1}x\cos x + (n-1)I_{n-2}$

   b) $nI_n = -\sin^{n-1}x\cos x + (n-1)I_{n-2}$

   c) $nI_n = \sin^{n-1}x\cos x - (n-1)I_{n-2}$

   d) none

5. The Cartesian limits for the integration over the positive quadrant of the circle $x^2+y^2=a^2$ are

   a) $0 \le x \le a,\ 0 \le y \le \sqrt{a^2-x^2}$

   b) $-a \le x \le a, 0 \le y \le \sqrt{a^2-x^2}$

   c) $0 \le x \le a,\ -\sqrt{a^2-x^2} \le y \le \sqrt{a^2-x^2}$

   d) none

6. $\Gamma(n+1)$ = ________

a) $(n+1)\Gamma(n)$ b) $(n)\Gamma(n)$ c) $(n)\Gamma(n-1)$ d) none

7. The area of the circle $x^2+y^2=a^2$ is

a) $a\sqrt{\pi}$ b) πa^2 c) $2\pi a$ d) none

8. If $x+y+z=u, y+z=uv, z=uvw, then dxdydz$ = _____ $dudvdw$

a) uv b) u^2v c) uv^2 d) none

9. The Fourier coefficient a_n in the Fourier expansion for $f(x)$ in $[-\pi,\pi]$ is given by

a) $\frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos nx dx$ b) 0 c) $\frac{2}{\pi}\int_{0}^{\pi} f(x)\cos x dx$ d) none

10. The Fourier coefficient a_0 in the half range Fourier cosine series for $f(x)$ in $[0,\pi]$ is

a) 0 b) $\frac{2}{\pi}\int_{0}^{\pi} f(x) dx$ c) $\frac{2}{\pi}\int_{0}^{\pi} f(x)\cos nx dx$ d) none

SECTION – B

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

11. Evaluate $\int_{0}^{\pi/6} \cos^2\frac{x}{2} dx.$

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

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

14. Evaluate $\int_{0}^{\pi/6} \sin^6 x\, dx.$

15. Prove that $\Gamma(n+1)=n!$

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 $\int\frac{x^2dx}{(a+bx)^3}.$

(OR)

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

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

(OR)

b) Integrate $\frac{x+\sin x}{1+\cos x}.$

20. a) Evaluate $\iint xy dx dy$ taken over the positive 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 $r=a\cos\theta.$

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* $2\pi.$

(OR)

b) Find a Fourier series with period 3 to represent $f(x) = 2x - x^3$ in the range $(0,3)$.

SECTION – D

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

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

ii) $\int \frac{2dx}{(1-x)(1+x^2)}.$

24. Establish the reduction formula for $I_a = \int \sec^n x dx$ and also find $\int \sec^6 x dx.$

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

26. Find the volume and the position of the centre of gravity of the tetrahedron bounded by the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ and the coordinate planes.

27. Show that $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}$ in the interval $(-\pi \le x \le \pi)$

Deduce that

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

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

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

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. The direction cosines of the z- axis are ____________.
   a) 1,0,0 b) 0,1,1 c) 1,1,0 d) 0,0,1
2. The direction ratios of the line joining of the points O(0,0,0) and P(1,2,3) are
   a) 1,1,1 b) 2,2,2 c) 0,0,0 d)1,2,3
3. The point of the line $x-1=y-2=z-3$ is ___________
   a) (1,2,3) b) (1,1,1) c) (2,3,4) d) (1,-2,3)
4. The mirror reflection of the point (1,1,1) in the xz- plane is _________
   a) (1,1,-1) b) (1,-1,1) c) (-1,1,1) d) (1,1,1)
5. The radius of the sphere $x^2+y^2+z^2=9$ is _________
   a) 3 b) 1 c) 4 d) 0
6. The xy –plane section of the sphere $x^2+y^2+z^2=4$ is _______
   a) $y^2+z^2=4, x=0$ b) $x^2+z^2=4, y=0$
   c) $x^2+y^2=4, z=0$ d) none
7. If $\vec{r}=x\vec{i}+y\vec{j}$ then $\nabla.\vec{r}=$ ________
   a) 1 b) 2 c) 3 d) 0
8. For any two vectors $\vec{a}$ and $\vec{b}$, $\vec{a}\times\vec{b}=$_______
   a) ab b) $abcos\theta$ c) $absin\theta$ d) $absin\theta\,\vec{n}$

9. The value of $\iint dxdy$ over the region bounded by x=0, x=2, y=0, y=2, is __________

a) 2 b) 4 c) 0 d) 3

10. The value of $\iiint_0^2 x^2 ydzdydx =$ ____________

a) 32 b) $\frac{64}{5}$ c) $\frac{32}{3}$ d) $\frac{64}{7}$

SECTION – B

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

11. Calculate the direction cosines of the line joining the points $(3,-5,4)$ *and* $(1,-8,-2)$.
12. Find the angle between the planes $2x-y+z=6;\ x+y+2z=3.$
13. Find the equation of the straight line joining the points $(2,3,7)$ *and* $(2,-5,8)$.
14. Find the co-ordinates of the centre and radius of the sphere $2x^2+2y^2+2z^2-2x+4y+2z-15=0.$
15. Calculate the equation of the sphere which has its centre at the point $(6,-1,2)$ and touches the plane $2x-y+2z-2=0.$
16. Define gradient.
17. State Stokes Theorem.

SECTION – C

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

18. a) Find the direction cosines of the bisectors of the angles between the lines whose direction cosines are (l_1,m_1,n_1) *and* (l_2,m_2,n_2).

(OR)

b) Find the equation of the plane which passes through the point $(-1,3,2)$ and perpendicular to the two planes $x+2y+2z=5$, $3x+3y+2z=8.$

19. a) Show that the perpendicular distance from $P(3,9,-1)$ to the line $\frac{x+8}{-8}=\frac{y-31}{1}=\frac{z-3}{5}$ is 21 units.

(OR)

b) Show that the shortest distance between the lines $\frac{x+8}{-8}=\frac{y-4}{2}=\frac{z+2}{1};\ \frac{x-1}{1}=\frac{y+7}{3}=\frac{z+2}{2}$ in $\sqrt{35}$.

20. a) A sphere of constant radius k passes through the origin and meets the axes in A, B, C Prove that the centroid of the triangle ABC lies on the sphere $9(x^2+y^2+z^2)=4k^2$.

(OR)

b) Show 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 $i+2j+2k$.

(OR)

b) Show that $v=r^n r$ is irrotational.

22. a) Find the workdone by the force field $F(x,y)=(x^2-xy)i+(y^2-2xy)j$ moving a particle from the point $(1,1)$ *to* $(2,4)$ along the parabola $y=x^2$.

(OR)

b) Evaluate $\iint \left(x^3 dydz + x^2 ydzdx + x^2 zdxdy \right)$ over the surface bounded by $z = 0,\ z = c,\ x^2 + y^2 = a^2.$

SECTION – D

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

23. Show that the straight lines whose direction cosines are given by $al + bm + cn = 0,\ \ fmn + gnl + hlm = 0$ are perpendicular $if\ \frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$ and parallel $if\ \sqrt{af} + \sqrt{hg} + \sqrt{ch} = 0.$

24. Solve 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 also their point of intersection and the plane through them.

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. Apply $\phi(x, y, z, t) = 2x^2 y + yz^2 t - \cos(xt)$ and find the rate of change of temperature with respect to time encountered by a particles passing through the point $(3, -2, 1)$ with velocity $v = 2i - j + k$ at time $t = 0.$

27. Evaluate $\int_C \left(x^2 + y^2 + z^2 \right) ds$ where C is the arc of the circular helix $x = 3\cos t,\ \ y = 3\sin t,\ \ z = 4t$ from $A(3,0,0)\ to\ B(3,0,8\pi).$

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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

SEQUENCE AND SERIES

Under CBCS – Credit 4

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

SECTION – A

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

1. $(a,b] = \{x / x \in R, a < x \le b\}$ is called __________ interval.

   a) open –closed b) closed – open c) closed d) open

2. The function $f(n) = \left\{ \frac{n}{n+1} \right.$ determines the sequence ____________

   a) $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ...$ b) $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, ...$ c) $1, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, ...$ d) 0,1,1,2,2,3,3,…

3. A sequence (a_n) is said to be monotonic increasing if ____________

   a) $a_n \ge a_{n+1}$ b) $a_n < a_{n+1}$ c) $a_n \le a_{n+1}$ d) $a_n > a_{n+1}$

4. Read the following statement

   (a) Any convergent sequence is a bounded sequence

   (b) Any bounded sequence is a convergent sequence

   The correct statement is ____________________

   a) (a) and (b) are true b) Only (a) is true

   c) only (b) is true d) (a) and (b) are true

5. If $(a_n) \to l$ then $\left(\frac{a_1 + a_2 + ... + a_n}{n} \right) \to l$ this result is known as ____

   a) Cauchy's first limit theorem b) Cauchy's second limit theorem

   c) ceasaro's theorem d) Cauchy's general principle of convergent

6. The incorrect statement is ___________________

   a) $(a_n) \to 0$ and (b_n) is bounded $\Rightarrow (a_n b_n) \to 0$

   b) (a_n) is a monotonic increasing with the $u\ l\ b$ say k then $(a_n) \to k$

   c) (a_n) is a monotonic decreasing with the $g\ l\ b$ say k then $(a_n) \to m$

   d) A monotonic sequence neither converges nor diverges

7. Read the following statements.

   (a) $1, \frac{1}{2}, \frac{1}{3}, ..., \frac{1}{n}, ...$ is a convergent sequence convergent to 0

   (b) $1 + \frac{1}{2} + \frac{1}{3} + ... + \frac{1}{n} + ...$ is a divergent series divergent to ∞

   (c) $1, \frac{1}{1!}, \frac{1}{2!}, \frac{1}{3!}, ..., \frac{1}{n!}, ...$ is a convergent sequence

   (d) $1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + ... + \frac{1}{n!} + ...$ is convergent to e

   The correct statement is ___________________

   a) (a), (b), (c) and (d) are true　　b) Only (a), (b), (c) are true

   c) Only (a), (b) are true　　d) Only (a), (b), (d) are true

8. The following statement are true except ___________________

   a) $1 - 1 + 1 - 1 + ...$ is an oscillating finitely

   b) $1 + 1 + 1 + 1 + ...$ is a divergent to ∞

   c) $1 + 2 + 2^2 + 2^3 + ...$ divergent to ∞

   d) $1 + \frac{1}{2} + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + ...$ convergent to $\frac{1}{2}$

9. The series $\sum \frac{(-1)^n n}{2n-1}$ is ___________________

   a) Converges　　b) diverges　　c) oscillates　　d) none

10. If $a_n = \frac{n!}{n^n}$ Then $\lim_{n\to\infty} \frac{a_n}{a_{n+1}} =$ ______________

    a) e　　b) 1　　c) 0　　d) $\frac{1}{e}$

SECTION – B

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

11. Define greatest lower bound.
12. Show that the sequence $\left\langle \frac{1}{n} \right\rangle$ has the limit 0.
13. What do you mean by Oscillatory sequence?
14. Define Cauchy sequence.
15. Is the series $1 + \frac{2}{3} + \left(\frac{2}{3}\right)^2 + \left(\frac{2}{3}\right)^3 + ...$ convergent?
16. State Cauchy's Root Test.
17. Define absolutely convergent series.

SECTION – C

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

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

    (OR)

    b) Find the supremum and infimum of the singleton $\{2\} \subset R$.

19. a) Prove that every convergent sequence is bounded.

    (OR)

    b) Let $\langle s_n \rangle$ be a sequence defined as follows:

    $s_1 = \frac{3}{2}; s_{n+1} = 2 - \frac{1}{3n}, n \ge 1$　　Show that $\langle s_n \rangle$ is monotonic.

20. a) State and prove Cesaro's theorem.

(OR)

b) Show that the series $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+......$ does not converge.

21. a) Test the convergence of the series $\sum_{n=1}^{\infty}\frac{\sqrt{n}}{n^2+1}$.

(OR)

b) Test the convergence of the series $\sum_{n=1}^{\infty}\frac{x^n}{n!}$.

22. a) Show that the series $1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+......$ is absolutely convergent.

(OR)

b) Is the power series $\sum_{n=0}^{\infty}2^{-n}(x-1)^n$ convergent?

SECTION – D

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

23. State and Prove Cauchy-Schwarz inequality.

24. Show that $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$ exists and lies between 2 and 3.

25. State and prove Cauchy first limit theorem.

26. Test for convergence $1+\frac{2x}{2!}+\frac{3^2x^2}{3!}+\frac{4^3x^3}{4!}+......$

27. State and prove Dirichlet test.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. In projectiles, the ______________ component of the velocity will be subjected to a retardation

   a) vertical b) horizontal c) incline d) None of these

2. Horizontal range is equal to _________ where U and V are the initial horizontal and vertical velocities

   a) $\frac{UV}{g}$ b) $\frac{2UV}{g}$ c) $\frac{U}{V}$ d) $\frac{g}{UV}$

3. Two bodies are said to ______________ if the direction of motion of either body is not along the common normal

   a) Impinge obliquely b) Impinge directly

   c) Direct motion d) Indirect motion

4. Impact of a smooth sphere an a fixed smooth plane velocity after impact v= __________________

   a) $u\sqrt{\sin^2\alpha + e^2\cos^2\alpha}$ b) $u\sqrt{\sin^2\alpha + e^2 sm^2\alpha}$

   c) $\vartheta\sqrt{\sin^2\alpha + e\cos^2\alpha}$ d) $u\sqrt{\sin^2\alpha + e\cos^2\alpha}$

5. Frequency of S.H.M

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

6. The length of the seconds pendulum ___________.

a) $\frac{\pi}{g}$ b) $\frac{g}{\pi}$ c) $\frac{g}{\pi^2}$ d) $\frac{l}{g}$

7. Let φ be the angle made by the tangent at P with OP. Then

a) $\tan\varphi = \frac{dr}{dt}$ b) $\tan\varphi = r\frac{d\theta}{dt}$ c) $\tan\varphi = \theta\frac{dr}{dt}$ d) None

8. Polar equation of ellipse pole at focus

a) $\frac{b^2}{p^2} = \frac{2a}{r} - 1$ b) $\frac{b^2}{p^2} = \frac{2a}{r} + 1$ c) $\frac{b^2}{p^2} = \frac{2a}{r}$ d) $\frac{p^2}{b^2} = \frac{2a}{r} - 1$

9. M.I of a rectangular lamina about a line through C.G and parallel to the side 2a is ______________

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

10. M.I of the ellipse about an axis through the centre is ______

a) $\frac{Ma^2}{4}$ b) $\frac{Mb^4}{4}$ c) $\frac{M\left(a^2+b^2\right)}{4}$ d) $\frac{Ma^2}{3}$

SECTION – B

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

11. Define the horizontal range.
12. State the principle of conservation of momentum for a particle.
13. What is meant by a Simple Harmonic Motion?
14. What is meant by Central Orbit?
15. Define an areal velocity.
16. Define moment of inertia.
17. Write the formula for Routh's Rule.

SECTION – C

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

18. a) A particle is thrown over a triangle from one end of its horizontal base to graze the vertex and fall at the other end of the base. *If* A *and* B are the base angles and α the angle of projection, then prove that $\tan\alpha = \tan A + \tan B$.

(OR)

b) Find the range of a projectile in an inclined plane.

19. a) State the Laws of Impact.

(OR)

b) A ball of mass 8 gm moving with a velocity of 10 cm per sec. impinges directly on another of mass 24gm, moving at 2cm per sec. in the same direction. *If* $= 1/2$, find the velocities after impact, and also calculate the loss of Kinetic Energy.

20. a) If the displacement of a moving point at any time be 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.

(OR)

b) Find the period of Oscillation of the Simple Pendulum.

21. a) Derive the pedal equation of a central orbit.

(OR)

b) Prove that $\frac{b^2}{p^2} = \frac{2a}{r} - 1$ is the pedal equation of ellipse.

22. a) State and Prove the Parallel axes Theorem.

(OR)

b) Find the moment of inertia about I for the Rectangular Lamina.

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. Write down the equation of Simple Harmonic Motion and solve it completely.
26. Derive the Differential Equation of Central Orbits.
27. State and Prove the Perpendicular axes theorem for moment of Inertia.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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

LINEAR ALGEBRA

Under CBCS – Credit 4

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

SECTION – A

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

1. In $V_2(R)$ let S = {(4,0)} Then L(S) = ______________.

   a) S b) $\{(x,0) \mid x \in R\}$ c) $\{(0,y) \mid y \in R\}$ d) $V_2(R)$

2. Let V be the set of all polynomial of degree ≤ n in R[x]. A basis for V is _________________.

   a) $\{0, x, x^2, x^3, \dots\dots\dots.., x^n\}$ b) $\{1, x, x^2, x^3, \dots\dots\dots.., x^n\}$

   c) $\{1, x, x^2, x^3, \dots\dots\dots.., x^{n+1}\}$ d) $\{1, x, x^2, x^3, \dots\dots\dots.., x^{n-1}\}$

3. The norm of the vector (1,2,3) in $V_3(R)$ with standard inner product is ___________.

   a) 6 b) 14 c) $\sqrt{14}$ d) 1

4. The value of x satisfying the equation $\begin{pmatrix} x & 1 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} x \\ 2 \end{pmatrix} = 0$ are _____________.

   a) 1,2 b) $-1,2$ c) $-1,-2$ d) none

5. An example of a upper triangle matrix is _______________.

   a) $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} 4 & 0 & 1 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 2 \\ 0 & 0 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ 0 & 2 & 3 \end{pmatrix}$

6. A square matrix A is said to be idempotent if _____________.

   a) $A^2 = 0$ b) $A^2 = A$ c) $A^2 = I$ d) $A^2 = A^{-1}$

7. For the above problem $A^{-1} =$ ________________.

a) $\begin{pmatrix} -2 & 1 \\ \frac{3}{2} & \frac{-1}{2} \end{pmatrix}$ b) $\begin{pmatrix} 2 & 4 \\ -\frac{3}{2} & \frac{1}{2} \end{pmatrix}$ c) $\begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix}$ d) $\begin{pmatrix} \frac{1}{2} & 1 \\ 2 & -\frac{3}{2} \end{pmatrix}$

8. The rank of the matrix $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$ is __________.

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

9. If the eigen values of $A = \begin{pmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{pmatrix}$ are 2,2,3 then eigen values of A^{-1} are _________ and the eigen values of A^2 *are* ……

a) $\frac{1}{2},\frac{1}{2},\frac{1}{3};2^2,2^2,3^2$ b) $-2,-2,-3;2^2,2^2,3^2$

c) $\frac{1}{2},\frac{1}{2},\frac{1}{3};-2^2,-2^2,-3^2$ d) $4,4,9;\frac{1}{2},\frac{1}{2},\frac{1}{3}$

10. If the eigen values of A are $-1,2,5$ the eigen values of $(A^2)^{-1}$ are …..

a) $1,\frac{1}{4},\frac{1}{25}$ b) – 4, 14, 50 c) 1,4,25 d) $-\frac{1}{5},\frac{1}{10},\frac{1}{25}$

SECTION – B

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

11. Prove that in R^3, $W = \left\{\left(ka,kb,kc \big/ k \in R\right)\right\}$ is a subspace of R^3.

12. Define finite dimensional.

13. What is orthogonal set?

14. Define unitary matrix with example.

15. Define consistent and inconsistent.

16. What is characteristic equation of the matrix?

17. Define symmetric bilinear form.

SECTION – C

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

18. a) Verify in $V^3(R)$ the vectors $(1,4,-2)$, $(-2,1,3)$ *and* $(-4,11,5)$ are linearly dependent.

(OR)

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

19. a) *Let* V be the vector space of polynomials with inner product given by $\langle f,g\rangle = \int f(t)g(t)$. *Let* $f(t) = t+2$ *and* $g(t)t^2-2t-3$. Find i) $\langle f,g\rangle$ ii) $\|f\|$

(OR)

b) *Let* V be a finite dimensional inner product space. *Let* W be a subspace of V. Then V is the direct sum of W *and* $W^{\perp}$ (i.e) $V = W \oplus W^{\perp}$.

20. a) Prove that any square matrix A can be expressed uniquely as the sum of a symmetric matrix and a skew symmetric matrix.

(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) Prove that any square matrix A satisfies its characteristic equation.

(OR)

b) If P and A are $n \times n$ matrices and P is a nonsingular matrix then A and $P^{-1}AP$ have the same eigen values.

22. a) Let f be the bilinear form defined on $V_2(R)$ by $f(x,y) = x_1y_1 + x_2y_2$ where $x = (x_1, x_2)$ and $y = f(y_1, y_2)$.

Find the matrix of f. i) w.r.t the standard basis $\{e_1, e_2\}$.

ii) w.r.t the basis $\{(1,1),(1,2)\}$.

(OR)

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

SECTION – D

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

23. State and prove Fundamental theorem of homomorphism.
24. Prove that every finite dimensional 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 vectors 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 diagonalform using Lagrange's method.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019
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 magnification or contraction is

   a) $w = \frac{1}{z}$ b) $w = bz, (b > 0, real)$

   c) $w = z + b$ d) None

2. The fixed points of a translation are given by

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

3. If f (z) = u + iv then $\left|f^{1}(z)\right|^{2} =$

   a) $\frac{\partial(x,y)}{\partial(u,v)}$ b) $\frac{\partial(u,v)}{\partial(x,y)}$ c) $\frac{\partial(u,x)}{\partial(v,y)}$ d) None

4. With usual notations, the Milne Thompson formula is f(z) = ______

   a) $\int[\phi_1(z,0)+\phi_2(z,0)]dz+c$ b) $\int[\phi_1(z,0)+i\phi_2(z,0)]dz+c$

   c) $\int[\phi_1(z,0)-i\phi_2(z,0)]dz+c$ d) None

5. If the curve C is given by z = z(t), $a \le t \le b$ then its opposite curve –C is defined in [a,b] as

   a) z(t) = z(a+b+t) b) z(t) = z(b+a-t)

   c) z(t) = z(b-a+t) d) None

6. If f is an analytic function in a simply connected region D and C is any simple closed curve in D, then the value of $\int_c f(z)dz$ is

a) Zero b) one c) area of D d) None

7. The function f(z) = $\frac{1}{z}$ has a singularity at

a) one b) zero c) ∞ d) None

8. The total number of types of singularity is

a) Two b) Three c) Four d) None

9. If **a** is a simple pole for f(z) then Res [f(z);a] = _____

a) $\lim_{z\to a} f(z)$ b) $\lim_{z\to a}(z-a)f(z)$

c) $\lim_{z\to a} \frac{f(z)}{z-a}$ d) None

10. If $z = cos\theta + isin\theta$, then $z + z^{-1}$ = _____

a) $cos\theta$ b) 2 $cos\theta$ c) 2i $cos\theta$ d) None

SECTION – B

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

11. Under the transformation $w = iz + i$ show that the half plane $x > 0$ maps onto the half plane $v > 1$.

12. Find the invariantpoints of $w = \frac{1+z}{1-z}$.

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

14. Define Harmonic function.

15. Evaluate using Cauchy's integral formula $\frac{1}{2\pi i}\int_C \frac{z^2+5}{z-3}\,dz$ where C is $|z| = 4$.

16. Find the zeros of a function $f(z) = z^2 \sin z$.

17. Find the residue of $\cot z$ at $z = 0$.

SECTION – C

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

18. a) Find the bilinear transformation that maps the points $z_1 = 2,\ z_2 = i,\ z_3 = -2$ onto the points $w_1 = 1,\ w_2 = i,\ w_3 = -1$ respectively.

(OR)

b) Prove that a bilinear transformation $w = \frac{az+b}{cz+d}$ where $ad - bc \neq 0$ maps real axis into itself if and only if a, b, c, d are real.

19. a) Show that $f(z) = \frac{xy^2(x+iy)}{x^2+y^4}$ if $z \neq 0$

$= 0$ if $z = 0$ isnot differentiable at $z = 0$.

(OR)

b) Provethat the function $u = 2x - x^3 + 3xy^2$ is harmonic and determine its conjugate.

20. a) Evaluate $\int_C f(z)dz$ where $f(z) = y - x - i\,3x^2$ and C is the line segment from $z = 0$ to $z = 1+i$.

(OR)

b) State and prove Cauchy integral formula.

21. a) Expand cos z into a Taylor's series about the point $z = \frac{\pi}{2}$ and determine its region of convergence.

(OR)

b) Determine and classify the singular points of $f(z) = \dfrac{z}{e^z - 1}$.

22. a) Calculate the residue of $\dfrac{z+1}{z^2 - 2z}$ at its poles.

(OR)

b) Use Residue theorem to evaluate $\int_C \dfrac{3z^2 + z - 1}{(z^2 - 1)(z - 3)} dz$ around the circle $|z| = 2$.

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. *If* $u(x, y) = \dfrac{\sin 2x}{\cos h\, 2y + \cos 2x}$ find the corresponding analytic function $f(z) = u + iv$.

25. Evaluate $\int_C \dfrac{e^z}{(z+2)(z+1)^2} dz$ where C is $|z| = 3$.

26. Obtain the Taylor's series to represent the function $\dfrac{z^2 - 1}{(z+2)(z+3)}$ in the region $|z| < 2$.

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

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. Let G be a (p, q) graph. Then ______________.

   a) $q \leq \binom{p}{2}$ b) $q > \binom{p}{2}$ c) $q \neq \binom{p}{2}$ d) $p \leq \binom{q}{2}$

2. $\aleph(m,n)$=__________

   a) $\aleph(m,m)$ b) $\aleph(n,m)$ c) $\aleph(n,n)$ d) none of these

3. A graph which is not connected is said to be _______________.

   a) planar b) Complete c) disconnected d) closed

4. A ___________ of a graph G is a point whose removal increase the number of components

   a) cut point b) bridge c) not a cut point d) not a bridge

5. Every Hamiltonian graph is _____________

   a) 3 – connected b) 2 – connected

   c) 1 - connected d) 4 – connected

6. Every tree is _______________ graph

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

7. The graph $K_{3,3}$ is_____________

   a) planar b) not planar c) complete d) not regular

8. Let M be a matching in G. A path in G is called an ______________ of its lines alternately X-M and m.

a) M-alternating path b) M-augmenting path

c) path d) walk

9. The _____________ of a graph G is the minimum number of colours needed to colour G

a) colouring b) chromatic number

c) crossing number d) colour class

10. Every uniquely n–colourable graph is ____________ connected.

a) 2 b) n c) n – 1 d) n + 1

SECTION – B

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

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

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

13. *If* G is a $k-$connected graph, prove that $q \ge \frac{pk}{2}$.

14. *Let* G be a Hamiltonian graph. *Let* S be a non empty subset of $V(G)$. Prove that $w(G-S) \le |S|$.

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

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

17. Find the chromatic number of K_p.

SECTION – C

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

18. a) Prove that $r(m,n) = r(n,m)$.

(OR)

b) *If* G_1 has q_1 edges and G_2 has q_2 edges, find the number of edges in $G_1 \times G_2$.

19. a) Prove that any $u-v$ walk in a graph contains a $u-v$ path.

(OR)

b) Prove that every non-trivial connected graph has at least two points which are not cut points.

20. a) *If* G is a graph in which the degree of every vertex is at least two, prove that G contains a cycle.

(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 matchings in the complete bipartite graph $K_{(n,m)}$.

(OR)

b) State and prove Euler's theorem.

22. a) *If* G is $k-$ critical, prove that $\delta(G) \ge k-1$.

(OR)

b) *If* G is a (p,q) graph, prove that the coefficient of λ^{p-1} in $f(G,\lambda)$ is $-q$.

SECTION – D

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

23. Prove that the maximum number of lines among all p point graphs with no triangle is $\left[\frac{p^2}{4}\right]$.

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

25. State and prove Dirac's theorem.

26. State and prove Hall's marriage theorem.

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

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. Which costs can vary with order quantity?

   a) unit cost only b) holding cost only

   c) re-order cost only d) all the above

2. If EOQ is calculated, but is found to be of in appropriate size, would the total cost per unit

   a) rise slowly around EOQ b) rise quickly around EOQ

   c) fall slowly around EOQ d) Fall quickly around EOQ

3. In a queueing system expected waiting time in the system 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 be exponentially distributed

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. The expansion of PERT
   a) Problem Evaluation and Review Technique
   b) Problem Evaluation and Refused Technique
   c) Program Evaluation and Refused Technique
   d) Program Evaluation and Review Technique
7. The general assumption which is not correct in solving a sequencing problem is that
   a) the time taken by different jobs in moving from one machine to another is negligible
   b) the processing times on various machines are independent of the order in which different jobs are processed on them
   c) a job once started on a machine would be performed to the point of completion uninterrupted
   d) a machine can process more than one job at a given point of time
8. In the optimal replacement policy of the equipment after n period's is do not replace if the next period's operating cost is ______________ the weighted average of previous cost
   a) less than b) greater than c) equal to d) none of the above
9. While dealing with replacement situations
   a) the total cost of an item over a given period of n years would be equal to Purchase price + Maintenances cost of n years + Value of the item after n years
   b) the total depreciation of depreciable items increases with passage of time, where as in successive years depreciation declines
   c) both a and b
   d) none of the above
10. In a replacement problem, the effective maintenance 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. What do you mean by Set up cost?
12. What is meant by lead time in inventory control?
13. What do you understand by Queue Discipline?
14. List any two differences between PERT and CPM.
15. Define total float of an activity.
16. How do you classify the replacement problem?
17. What is no passing rule in sequencing problem?

SECTION – C

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

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

(OR)

b) The monthly demand for an electronic machine is approximately 600 units. Every time an order is placed, a fixed cost of Rs.800 is incurred. The daily holding cost per unit inventory is Re.0.40. If the lead time is 10 days, determine EOQ and the number of orders per month. In the past two months, the demand rate has gone as high as 50 units per day. For a re-ordering system based on inventory level, what should be the buffer stock?

19. a) A T.V repairman finds that the time spent on his jobs has an Exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

(OR)

b) At a railway station, only one train is handled at a time. The railway yard is sufficient only for two trains to wait while other is given signal to leave the station. Trains arrive at the station at an average rate of 6 per hour and the railway station can handle them on the average of 12 per hour. Assuming Poisson arrivals and exponential service distribution, find the steady state probabilities for the various number of trains in the system. Also find the average waiting time of a new train coming into the yard.

20. a) Construct the network diagram comprising activities B,C….Q and N such that the following constraints are satisfied:

$B < E, F$; $C < G,L$; $E,G, < H$; $L,H < I$; $L < M$; $H < N$; $H < J$; $I,J < P$; $P < Q$.

The notation $X < Y$ means that the activity X must be completed before Y can begin.

(OR)

b) A small project consists of seven activities for which the relevant data are given below. Calculate the earliest start, earliest finish, latest start and latest finish for each activity of the project and determine the critical path.

Activity	A	B	C	D	E	F	G
Preceding Activities	-	-	-	A, B	A, B	C,D, E	C,D,E
Duration (days)	4	7	6	5	7	6	5

21. a) In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given below. Determine the sequence of performing the jobs that would minimize the total elapses time.

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) Find the optimal sequence of jobs that minimizes the total elapsed time based on the following information processing time on machines is given in hours and passing is not allowed:

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

22. a) The data collected in running a machine, the cost of which is Rs.60000 are given below:

Determine the optimum period for replacement of the machine.

Year	1	2	3	4	5
Resale value (Rs.)	42000	30000	20400	14400	9650
Cost of Spares (Rs.)	4000	4270	4880	5700	6800
Cost of labour (Rs.)	14000	16000	18000	21000	25000

(OR)

b) The cost of a new machine is Rs.5000. The maintenance cost of n^{th} year is given by $C_n = 500(n - 1)$; $n = 1,2,\ldots.$Suppose that the discount rate per year is 0.5. After how many years, it will be economical to replace the machine by a new one?

SECTION – D

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

23. A manufacturing company needs 2500 units of a particular component every year. The company buys it at the rate of Rs.30 per unit. The order processing cost for this for this part is estimated as Rs.15 and the cost of carrying a part in stock comes to about Rs.4 per year. The company can manufacture this part internally. In that case, it saves 20% of the price of the product. However, it estimates a set-up cost of Rs.250 per production run. The annual production rate would be 4800 units. However, the inventory holding costs remain unchanged

    i) Determine the EOQ and the optimal number of orders placed in a year.

    ii) Determine the optimum production lot size and the average duration of the production run

    iii) Should the company manufacture the component internally or continue to purchase ot from the supplier?

24. The rate of arrivals of customers at a public telephone booth follows Poisson distribution with an average time of 10 minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution, with mean time of 3 minutes.

    i) What is the probability that a person arriving at the booth will have to wait?

    ii) What is the average length of the non-empty queues that form from time to time?

    iii) The company will install a second booth when it is convinced that the customers would expect waiting for at least 3 minutes for their turn to make a call. By how much time should the flow of customers increase in order to justify a second booth?

    iv) Estimate the fraction of the day that the phone will be in use.

    v) What is the probability that it will take him more than 10 minutes altogether to wait for phone and complete his call?

25. A small project is composed of seven activities whose time estimates are listed as follows. The durations are in weeks. ‘a’ refers to optimistic time, ‘m’ refers to most likely time and ‘b’ refers to pessimistic time duration.

    i) Draw the network

    ii) Find the expected duration and variance of each activity. What is expected project length?

    iii) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed in

        a) at least 4 weeks earlier than expected?

        b) not more than 4 weeks later than expected?

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
a	1	1	2	1	2	2	3
m	1	4	2	1	5	5	6
b	7	7	8	1	14	8	15

26. Solve the following sequencing problem giving an optimal solution if passing is not allowed.

Items	**Machines (Processing time in hours)**			
	M1	**M2**	**M3**	**M4**
I	15	5	4	15
II	12	2	10	12
III	16	3	5	16
IV	17	3	4	17

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

VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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B.A. / B.Sc. Degree (Semester) Examinations, April 2019

Part – IV : Non-Major Elective Subject : Second Semester : Paper – I

STATISTICS AND OPERATIONS RESEARCH

Under CBCS – Credit 2

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

SECTION – A

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

1. The Arithmetic mean is denoted by ______________.
   a) $\sum x_i$ b) x_i c) $\bar{x}$ d) x
2. The weighted mean is denoted by ________________.
   a) $\sum x_i$ b) $\overline{x_w}$ c) $\bar{x}$ d) x
3. The arithmetic mean of the numbers 4, 3, 5, 4 is ________.
   a) 5   b) 2   c) 4   d) 3
4. The median of the set of numbers 2, 3, 6, 7, 5, 6, 7, 1, 4, 5, 5 is ______
   a) 5   b) 3   c) 6   d) 7
5. The mode of the set of numbers 7,3,4,5,7,1,3, 7 is ________
   a) 5   b) 3   c) 9   d) 7
6. Linear programming involving ____________ variables to solved by a graphical method easily
   a) one   b) three   c) two   d) no
7. In a transportation problem demand is also called ________________.
   a) required   b) available   c) supply   d) none
8. In a transportation problem supply is also called _________________.
   a) required   b) available   c) demand   d) none
9. The transportation problem is a _____________ class of a LPP.
   a) particular   b) special   c) ordinary   d) none
10. The assignment problem is a _______ case of transportation problem.
    a) special   b) particular   c) ordinary   d) none

SECTION – B

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

11. Find the mean of the frequency distribution.

x_i	15	16	17	18	19
f_i	2	1	3	3	1

12. Find the mean and mode of the distribution 2, 4, 5, 6, 7, 8, 3, 2, 1
13. Find the median of the distribution 66, 65, 64, 70, 61, 60, 56, 63, 60, 67, 62.
14. Find the quartiles of the distribution 66, 65, 64, 70, 61, 60, 56, 63, 60, 67, 62.
15. Solve $max\ z = x + 2y$.
    Subject to the constraints $x + y \leq 4, 2x - y \leq 2\ and\ x, y \geq 0$
16. Solve $max\ z = 2x + 2y$
    Subject to the constraints $x + y \leq, 2x - y \leq 2\ and\ x, y \geq 0$
17. Solve the transportation problem using NWC

	D_1	D_2	D_3	Supply
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
Demand	7	9	18	

SECTION – C

Answer ALL Questions : (3 × 9 = 27)

18. a) Calculate the arithmetic mean from the following frequency table.

Weight in Kgs	50	48	46	44	42	40
No.of persons	12	14	16	13	11	09

(OR)

b) Find the median for the following data.

X	1	2	3	4	5	6	7	8	9
F	8	10	11	16	20	25	15	9	6

19. a) Find the median and quartile marks of 10 students in statistics test given by 40, 90, 61, 68, 72, 43, 50, 84, 75, 33.

(OR)

b) Obtain the initial basic feasible solution for the following transportation problem using North West Corner rule.

	D	E	F	G	Available
A	19	30	50	10	7
B	70	30	40	60	9
C	40	08	70	20	18
Demand	5	8	7	14	

20. a) Find the feasible solution for the LPP, using graphical method

$$\max\ z = 3x_1 + 5x_2,$$

Subject to the constraints

$$x_1 + 2x_2 \leq 2000,$$
$$x_1 + x_2 \leq 1500,$$
$$x_2 \leq 600, and\ \ x_1 \geq 0, x_2 \geq 0.$$

(OR)

b) Solve the assignment problem.

	I	II	III	IV
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

SECTION – D

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

21. Calculate the arithmetic mean, standard deviation and variance in the following frequency distribution.

Marks	10	9	8	7	6	5	4	3	2	1
Frequency	1	5	11	15	12	7	3	3	0	1

22. a) Find the mode for the following data

Size of shoes	3	4	5	6	7	8	9	10
No. of persons	10	28	38	42	45	15	8	7

b) Find the median and quartile marks of 10 students in statistics test given by 40, 90, 61, 68, 72, 43, 50, 84, 75, 33.

23. Find the feasible solution for the LPP, using graphical method

$$\min z = 20x_1 + 40x_2,$$

Subject to the constraints

$$36x_1 + 6x_2 \geq 108,$$
$$3x_1 + 12x_2 \geq 36,$$
$$20x_1 + 10x_2 \geq 100$$
and $x_1 \geq 0, x_2 \geq 0$.

24. a) Solve the transportation problem using VAM.

	D	E	F	G	Available
A	8	26	17	11	250
B	13	28	4	26	300
C	38	19	18	15	400
Demand	200	225	275	250	

b) Solve the transportation problem using NWC.

	I	II	III	IV	Available
A	5	3	6	2	19
B	4	7	9	1	37
C	3	4	7	5	34
Demand	16	18	31	25	

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VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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

COMPETITATIVE MATHEMATICS

Under CBCS – Credit 2

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

SECTION – A

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

1. Which of the following has most number of divisors?

   a) 99 b) 101 c) 176 d) 182

2. The H.C.F of 36 and 84 is

   a) 4 b) 6 c) 12 d)18

3. The value of $34.95 + 240.016 \quad 23.98$ is

   a) 298.0946 b) 298.111 c) 298.946 d) 299.09

4. The square root of $\left(272^2 - 128^2\right)$ is

   a) 144 b) 200 c) 240 d) 256

5. Find the average of all the numbers between 6 and 34 which are divisible by 9?

   a) 18 b) 20 c) 24 d) 30

6. A man is 24 years older than his son. In two years, his age will be twice the age of his son. The present age of the son is?

   a) 14 years b) 18 years c) 20 years d) 22 years

7. The value of 45 % of 750 – 25 % of 480 is

   a) 216 b) 217.5 c) 236.5 d) 245

8. By selling an article for Rs.100, a man gains Rs.15. Then, his gain % is

   a) 15 b) $12\frac{2}{3}$ c) $17\frac{11}{17}$ d) $17\frac{1}{4}$

9. If $2A = 3B = 4C$, then $A : B : C$ is

a) 2 : 3 : 4 b) 4 : 3 : 2 c) 6 : 4 : 3 d) 20 : 15 : 2

10. Anand and Deepak started a business investing Rs.22,500 and Rs.35,000 respectively. Out of a total profit of Rs.13,800 Deepak's share is ?

a) 5400 b) 7200 c) 8400 d) 9600

SECTION – B

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

11. Find the H. C. F of 108, 288 and 360?
12. If $268 \times 74 = 19832$, then find the value of 2.68×0.74?
13. Find the average of first 40 natural numbers?
14. What is the square root of 0.0009?
15. Find the value of x if 9% of $x = 63$?
16. If a radio is purchased for Rs.490 and sold for Rs.465.50, find the loss percent?
17. Find the mean proportional between 0.08 and 0.18?

SECTION – C

Answer ALL Questions : **(3 × 9 = 27)**

18. a) If two numbers are in the ratio of 15 : 11 and their H.C.F is 13, find the numbers?

(OR)

b) If $\sqrt{1+\frac{x}{144}} = \frac{13}{12}$, then find the value of x?

19. a) 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?

(OR)

b) If the cost price is 96 % of the selling price, then what is the profit percent?

20. a) If x : y = 3 : 4, find (4x + 5y) : (5x – 2y)?

(OR)

b) A, B & C enter into partnership. A invests 3 times as much as B invests and B invests two-third of what C invests. At the end of the year, the profit earned is Rs.6000. What is the share of B?

SECTION – D

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

21. Arrange the fractions $\frac{17}{18}, \frac{31}{36}, \frac{43}{45}$ & $\frac{59}{60}$ in the ascending order?
22. Rohit was 4 times as old as his son 8 years ago. After 8 years, Rohit will be twice as old as his son. What are their present ages?
23. A dealer sold three-fourth of his articles at a gain of 20 % and the remaining at cost price. Find the gain earned by him in the whole transaction?
24. A, B and C enter into a partnership by investing in the ratio of 3 : 2 : 4. After one year, B invests another Rs.2,70,000 and at the end of 2 years, C also invests Rs.2,70,000. At the end of the three years, profit are shared in the ratio of 3 : 4 : 5. Find the initial investment of each?

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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

APPLIED STATISTICS

Under CBCS – Credit 2

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

SECTION – A

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

1. Given n attributes, total number of class frequencies is __________.

   a) 2^n b) 3^n c) n^2 d) 3^n

2. For any three given attributes total number of negative class frequencies is _______________.

   a) 8 b) 7 c) 3^3 d) 2^3

3. Class frequencies of type $(\alpha),(\beta),(\alpha\beta),(\alpha\beta x)$ etc are known as ____________ class frequencies.

   a) positive b) negative c) contrary d) attribute

4. There is no negative class frequency of order ____________.

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

5. $If\ (AB) < \dfrac{(A)(B)}{N}$ then $A\ and\ B$ are ____________.

   a) independent b) positively associated
   c) negatively associated d) none

6. Two attributes $A\ and\ B$ are said to be ______________ if there is same proportion of A amongst B's as amongst B's

   a) independent b) positively associated
   c) negatively associated d) none

7. Equivalent positive class condition for $(ABC) \geq 0$

   a) $(ABC) \leq (AB)$ b) $(ABC) \leq (BC)$
   c) $(ABC) \leq (AC)$ d) none

8. A set of independent class frequencies if ______________ iff no ultimate class frequency is negative.

a) independent b) positively associated

c) negatively associated d) none

9. ______ is aused at determining whether there is a significant difference between class means in view of variability within the separate class.

a) ANOVA b) null hypothesis

c) alternate hypothesis d) none

10. In one criterion of classification, the degrees of freedom for F-test

a) $(k-1, N-K)$ b) $(K, N-1)$ c) $(K-1, N-1)$ d) none

SECTION – B

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

11. Prove that $(AB)=(ABC)+(ABx)$.

12. Prove that $(AB)=N-(\alpha)-(\beta)+(\alpha\beta)$.

13. Given $(A)=30,\ (B)=25,\ (\alpha)=30,\ (\alpha\beta)=20$

Find i) N ii) $(\alpha\beta)$

14. Find where the following data are consistant $N=600,\ (A)=300,$ $(B)=400,\ (AB)=50.$

15. Check whether the attributes A *and* B are independent $(A)=30,$ $(B)=60,\ (AB)=12,\ N=150.$

16. Show whether the A *and* B are independent or positively associated or negatively associated $N=930,\ (A)=300,\ (B)=400,\ (AB)=230.$

17. Define consistent and incensistent.

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 haowmany candidates.

i) have passed in Maths

ii) have passed in English, failed in Maths

iii) haved passed in both **(OR)**

b) Of 500 men in a locality exposed to cholera 172 in all were attacked; 178 were inoculated and of these 128 were attacked. Find the number of persons.

i) not inoculated not attaked

ii) inoculated not attacked

iii) not inoculated attacked

19. a) Find the greatest and least value of (ABC) *if* $(A)=50;\ (B)=62;$ $(C)=80;\ (AB)=35;\ (AC)=45$ *and* $(BC)=42.$ **(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 and 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) $(A)=470;\ (AB)=300;\ (\alpha)=530,\ (\alpha B)=150$

ii) $(AB)=66,\ (A\beta)=88,\ (\alpha B)=102,\ (\alpha\beta)=136$ **(OR)**

b) In a class test is which 135 candidates were examined for proficiency in Physics and Chemistry was discovered that 75 students failed in Physics, 90 failed in Chemistry and 50 failed in both. Find the magnitude of association and state if there is any association between failing in Physics and Chemistry.

SECTION – D

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

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 condusion

Batches	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
A	1600	1610	1650	1680	1700	1720	1800	---
B	1580	1640	1640	1700	1750	---	---	---
C	1460	1550	1600	1620	1640	1660	1740	1820
D	1510	1520	1530	1570	1600	1680	---	---

22. A company manufacturing a certain product appointed 4 salemen S_1, S_2, S_3, S_4 in three different areas A, B *and* C The quantity of product sold is given below. Carry out the analysis of variance to test there is significant difference in the sale of 4 salesman and it the sales carried out in in different areas.

	S_1	S_2	S_3	S_4
A	22	27	38	45
B	28	32	40	38
C	25	40	36	22

23. Given the following positive class frequencies. Find the remaining class frequencies.

$N = 20,\ (A) = 9,\ (B) = 12,\ (C) = 8,\ (AB) = 6,\ (BC) = 4,\ (CA) = 4,$

$(ABC) = 3.$

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

University	MKU	MSU
Total number of cadidates	1600	200
Pass in Physics	320	80
Pass in Chemistry	90	40
Pass in Physics and Chemistry	30	20

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B.Sc. Mathematics Degree (Semester) Examinations, April 2019

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. If the relation ρ defined on **Z** by $a\rho b \Leftrightarrow ab \text{ is odd}$, then ρ said to be
   a) reflexive and symmetric b) reflexive but not symmetric
   c) symmetric but not reflexive d) neither symmetric nor reflexive
2. Let S be the set of all lines in the Euclidean plane $\boldsymbol{R} \times \boldsymbol{R}$. Define $a\rho b \Leftrightarrow a$ is parallel to b. Then ρ is __________
   a) not reflexive b) not symmetric
   c) not transitive d) an equivalence relation
3. Let Sbe the set of all lines in the Euclidean plane $\boldsymbol{R} \times \boldsymbol{R}$. Define $a\rho b \Leftrightarrow a$ is perpendicular to b. Then ρ is __________
   a) reflexive b) symmetric
   c) transitive d) an equivalence relation
4. In **Z**, define $a\rho b \Leftrightarrow ab > 0$ then ρ is
   a) not reflexive b) not symmetric
   c) not transitive d) an equivalence relation
5. The least element of the poset $\wp(A)$, where A is a non-empty set
   a) A b) φ c) $\wp(A)$ d) $singleton\ set\ of\ A$
6. The least element of the poset $(\boldsymbol{N}, \leq)$
   a) 1 b) 2 c) 3 d) 0

7. The greatest element of the poset $(\boldsymbol{N}, \leq)$

a) 1 b) 2 c) 3 d) none

8. Any distributive lattice is a __________

a) modular lattice b) Boolean Algebra c) both d) none

9. The lattice M_5 is a ___________

a) distributive lattice b) modular lattice c) both d) neither

10. In any lattice, the complement of 0 is _________

a) 1 b) 0 c) 2 d) none

SECTION – B

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

11. Define reflexive relation and give an example.
12. Define symmetric relation and give an example.
13. Define chain and give an example.
14. Obtain the diagram for the poset $(S, \leq)$ where $S = \{10,9,8,6,5\}$ with the relation usual $\leq$.
15. Define a modular lattice and give an example.
16. Define a complement of an element in a lattice.
17. Define a Boolean Algebra and give an example.

SECTION – C

Answer ALL Questions : **(3 × 9 = 27)**

18. a) i) Let $S = \{10,9,8,6,5\}$ with the relation usual $\leq$. Prove that $(S, \leq)$ is poset and obtain the diagram.

ii) Define anti-symmetric relation and give an example.

(OR)

b) i) Define an equivalence relation and give an example.

ii) In $\mathbb{Z}$, define a relation ρ by "$a \, \rho \, b \Leftrightarrow ab \text{ is a perfect square}$".

Show that ρ is an equivalence relation in $\mathbb{Z}$.

19. a) Draw a diagram for the following posets

i) $(\{10,9,8,6,5\}, \leq)$

ii) (A, $\leq$) where A={2,5,8,20,40}, $a \leq b \Leftrightarrow a \text{ divides } b$.

iii) M_5.

iv) $(\wp(\{1,2\}), \subseteq)$

v) (The set of all sub groups of S_3, $\subseteq$)

(OR)

b) Find all the sub- lattices of the lattices M_5 and N_5.

20. a) i) Prove that the lattice of normal sub groups of any group is a modular lattice.

ii) Show that N_5 is neither distributive lattice nor modular lattice.

(OR)

b) i) Define a Boolean Algebra. Also show that for any set S, $(P(S), \subseteq)$ is a Boolean algebra

ii) Prove that a Boolean algebra cannot have exactly three elements.

SECTION – D

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

21. a) Let ρ be an equivalence relation defined on a set S. Then prove that the following are equivalent.

i) $a \, \rho \, b \Leftrightarrow [a] = [b]$.

ii) Any two distinct equivalence classes are disjoint.

iii) S is the union of all equivalence classes.

b) Show that the union oftwo equivalence relations need not be an equivalence relation.

22. a) i) Define a lattice.

ii) Let L be a lattice and $a, b \in L$. Then prove that the following are equivalent

i) $a \leq b$

ii) $a \vee b = b$

iii) $a \wedge b = a$.

iv) Let L be the set of all sub groups of a group G.

In L we define $A \leq B \Leftrightarrow A \subseteq B$.Then prove that L is a lattice.

b) Show that M_5 is not a modular lattice.

23. a) Draw the lattice diagram for $(D_{70}, /)$ the Boolean Algebra of all divisors of 70. Find its atoms. Show that it is isomorphic to the Boolean Algebra $(\wp(\{1,2,3\}), \subseteq)$. b) Let L be a lattice.

b) Let $a, b, c \in L$. Then state and prove the idempotent law, associative law, commutative law and absorption law.

24. a) Draw the lattice diagram for $(D_{210}, /)$ the Boolean Algebra of all divisors of 210. Find its atoms. Show that it is isomorphic to the Boolean Algebra $(\wp(\{1,2,3,4\}), \subseteq)$.

b) In any lattice L, prove that L_5 and L'_5 are equivalent.