**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
(Autonomous & Residential)
[Affiliated to Madurai Kamaraj University]

**B.Sc. Physics / Chem.** Degree (Semester) Examinations, April 2020
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 $y'' = 3x^2 - 7$ is

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

2. If $y = ax^2$, then $y' =$ _____

   a) $2a$ b) $2x$ c) $2ax$ d) 0

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 value of $d\left(tan^{-1}\left(\frac{x}{y}\right)\right)$ =_____

   a) $\frac{ydx+xdy}{x^2+y^2}$ b) $\frac{ydx+xdy}{x^2-y^2}$ c) $\frac{ydx-xdy}{x^2+y^2}$ d) $\frac{ydx-xdy}{x^2-y^2}$

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

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

6. The Particular integral of the differential equation $(D^2 - D + 1)y = 0$ is___

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

7. In a homogeneous linear equations, $xDy =$ _____

   a) $\theta x$ b) $\theta z$ c) $\theta t$ d) $\theta y$

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. One of the solution of the differential equation $\frac{dx}{xy} = \frac{dy}{y^2} = \frac{dz}{x(yz-2x)}$ is _____

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

10. One of the solution of the differential equation $\frac{dx}{y} = \frac{dy}{z} = \frac{dz}{x}$ is _____

a) $xy - z = c$ b) $zx - \frac{y^2}{2} = c$ c) $xy - \frac{z^2}{2} = c$ d) $yz - \frac{x^2}{2} = c$

## SECTION – B

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

11. Define singular solution of the differential equation.
12. Write the Criterian for exact differential equation.
13. Give general solution of the differential equation $\frac{dy}{dx} + Py = Q$
14. What is the solution of the auxiliary equation if the roots are real and distinct?
15. Find the complementary function of $(D^2 + 5D + 6)y = x^2$.
16. Find the particular integral of $(D^2 – 5D + 6)y = e^{2x}$.
17. Convert $x^2y^{11} + 4xy^1 + 2y = 0$ into constant coefficients.

## SECTION – C

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

18. a) Show that the differential equation of the family of circles of fixed radius r with centre on y axis is $(x^2 - r^2)(y')^2 + x^2 = 0$.

**(OR)**

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

19. a) Verify $\frac{dy}{dx} = \frac{y^2}{1-xy}$

**(OR)**

b) Solve $xy' + y = y^2 \log x$

20. a) Solve $(D^2 – 4)y = e^{2x}$.

**(OR)**

b) Find the Particular integral of the differential equation of $(D^2 + 9)y = 4\sin 3x$.

21. a) Find the complementary function of the equation $(2x + 1)^2 y'' – 2(2x + 1)y' 12y = 6x$.

**(OR)**

b) Find the general solution of $x^2 y'' + 4x y' + 2y = \log x$.

22. a) Solve the exact differential equation $xdx + ydy - \left(\frac{xdy - ydx}{x^2 + y^2}\right) = 0$.

**(OR)**

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

## SECTION – D

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

23. Solve the differential equation $\left(D^2 + 16\right)y = e^{-3x} + \cos x$.
24. Solve $(x^3 – 3xy^2)dx – (y^3 – 3x^2y)dy = 0$.
25. Solve : $(D^2 – 2D + 2)y = e^x \sin x$.
26. Solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - 5y = \sin(\log x)$
27. Solve the differential equation $\left(1 + x^2\right)y' + y = \tan^{-1} x$ by integrating factor method.

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**B.Sc. Physics / Chem.** Degree (Semester) Examinations, April 2020
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. Write the types of deriving partial differential equations.
12. Form the differential equation by eliminating the arbitrary constants $a$ *and* $b$ from $z = axy + b.$
13. Define Lagrange's Equation.
14. Define Laplace transform.
15. Prove L (cosh ax) = $\frac{s}{s^2-a^2}$
16. What is $L^{-1}[F(s+a)]$?
17. In the form $P_p + Q_q = R,$ state $P, Q, R$?

## SECTION – C

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

18. a) Form a partial differential equation by eliminating the arbitrary functions f and g from z = f(2x + y) + g(3x – y)

**(OR)**

b) Solve: 2p + 3q = 1

19. a) Eliminate arbitrary function from $z = f\left(\frac{y}{x}\right)$ and form partial differential equation. **(OR)**

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

20. a) Find the Laplace Transform of $x^2 e^{-ax}$.

**(OR)**

b) Find L[$\sin^3 3x$]

21. a) Find the inverse Laplace Transform for $\frac{1}{(s+3)^2+25}$

**(OR)**

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

22. a) Find $L[\cos ax]$ *and* $L[\sin ax].$

**(OR)**

b) Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)}\right].$

## SECTION – D

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

23. Find the General Solution of $x(y^2-z^2)p++y(z^2-x^2)q = z(x^2-y^2).$
24. Solve $L[t^2+\cos 2t\cos t+\sin^2 2t].$
25. Find $L\left(\frac{1-\cos x}{x}\right)$ and L($x^2$coshax).
26. Using Laplace Transform solve y′′ + 4y′ + 13y = $2e^{-x}$ given y(0) = 0 and y′(0) = –1.
27. Solve $\left(\frac{y-z}{yz}\right)p+\left(\frac{z-x}{zx}\right)q=\left(\frac{x-y}{xy}\right).$

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 size of the character array should be _____ larger than the number of characters in the string.
   a) four b) three c) two d) one
2. The _____ is a function that is expanded in line when it is invoked.
   a) inline function b) called function
   c) new function d) reference function
3. C++ permits initialization of the variables at run time which is referred to as _____ initialization.
   a) static b) dynamic c) variable d) runtime
4. Which of the following statement is correct?
   a) Two functions having same number of argument, order and type of argument can be overloaded if both functions do not have any default argument
   b) Overloaded function must have default arguments
   c) Overloaded function must have default arguments starting from the left of argument list
   d) A function can be overloaded more than once
5. _____ member variable is initialized to zero when the first object of its class is created where no other initialization is permitted.
   a) friend b) static c) public d) private

6. If a member function does not alter any data in the class, that may be declared as _____
   a) constant member function  b) private member function
   c) static member function  d) friend function
7. A _____ takes a reference to an object of the same class as itself as an argument.
   a) default constructor  b) default argument constructor
   c) implicit constructor  d) copy constructor
8. The conversion from a class to any other type or any other class should make use of a _____ in the source class.
   a) casting operator  b) constructor
   c) not applicable  d) operator function
9. Which access type data gets derived as private member in derived class:
   a) Private  b) Public  c) Protected  d) Protected and Private
10. When the properties of one class are inherited by more than one class is called _____ inheritance
   a) single  b) multiple  c) multilevel  d) hierarchical

## SECTION – B

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

11. What do you mean by Tokens?
12. Enumerate the rules of naming variables in C++.
13. What do you mean by friend function?
14. What is meant by private member function?
15. What do you mean by Copy Constructors?
16. What do you mean by Destructors?
17. What is derived Class?

## SECTION – C

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

18. a) Elucidate Briefly about the Benefits of Object Oriented Programming.

**(OR)**

b) Explain about default arguments in C++?

19. a) Write short notes on Function Overloading with examples.

**(OR)**

b) Point out Call by Reference with example.

20. a) How is a member Function of a class defined and accessed? Examine with example.

**(OR)**

b) Write Short notes on : Static Member Functions.

21. a) What is a Multiple Constructors? Illustrate with example.

**(OR)**

b) Analyze with example Constructors with default Arguments.

22. a) Explain about Return by Reference function in C++?

**(OR)**

b) Describe destructors with suitable example?

## SECTION – D

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

23. Examine the different types of Operators used in C++ with example.
24. Write a C++ Program to Illustrate the Concept of Friend Function.
25. Discuss function overloading with example?
26. Summarize Operator Overloading in C++ with example.
27. Explain Parameterized constructors with example?

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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. $\int \operatorname{cosec} x^2 dx =$ _____
   a) $\tan x + c$ b) $\cot x + c$ c) $-\cot x + c$ d) none
2. $\int \frac{dx}{\sqrt{a^2 + x^2}} =$ _____
   a) $\sin h^{-1}\left(\frac{x}{a}\right) + c$ b) $\frac{1}{a}\sin h^{-1}\left(\frac{x}{a}\right) + c$
   c) $\frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c$ d) none
3. $f(x)$ is an odd function if
   a) $f(0) = 0$ b) $f(-x) = f(x)$
   c) $f(-x) = -f(x)$ d) none
4. If n is odd, $\int_0^{\frac{\pi}{2}} \sin^n x \, dx =$ _____
   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
5. The Cartesian limits for the integration over the positive quadrant of the circle $x^2 + y^2 = a^2$ are

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

c) $-\sqrt{a^2 - x^2} \le x \le \sqrt{a^2 - x^2}, 0 \le y \le a$ d) none

6. $\Gamma(1) =$ _____

a) 1 b) 0 c) $\infty$ d) none

7. The area of the cardioid $r = a(1 + cos\theta)$ is

a) $\pi a^2$ b) $\frac{3}{2}\pi a^2$ c) $\frac{2}{3}\pi a^2$ d) none

8. For the integration over the upper half the sphere $x^2 + y^2 + z^2 = a^2$, the rectangular cartesianlimits are

a) $0 \le x \le a, 0 \le y \le a 0 \le z \le a$

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

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

d) none

9. The Fourier coefficient $a_0$ in the Fourier series for an even function $f(x)$in $[-\pi, \pi]$ is given by

a) 0 b) $\frac{2}{\pi}\int_0^{\pi} f(x)\,dx$ c) $\frac{1}{\pi}\int_0^{\pi} f(x)\,dx$ d) none

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

a) 0 b) $\frac{1}{\pi}\int_0^{\pi} f(x)\sin nx dx$ c) $\frac{1}{\pi}\int_0^{\pi} f(x)\cos nx dx$ d) none

## SECTION – B

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

11. Evaluate : $\int sin^4 x dx$

12. Integrate: $\frac{1}{1+\tan x}$

13. Find: $\int xe^x dx$

14. Find the value of $\int_0^a \int_0^b \int_0^c dxdydz$.

15. Find the value of $\int_0^1 \int_0^1 dxdy$.

16. Evalute $\int_0^{\pi/2} \sin^7 x dx$..

17. Evalute $\int_0^{\alpha} \int_x^{\alpha} e^{-y}/y\, dxdy$.

## SECTION – C

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

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

**[OR]**

b) Find the value of $\int \frac{x^{24}}{x^{10} + 1} dx$

19. a) Prove that $\int_0^{D_4} \log(1 + \tan\theta)\, do = \frac{\bar{\wedge}}{8}\log^2$

**[OR]**

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

20. a) Evaluate $\iint (x^2 + y^2)\, dx\, dy$ over the region for which ×, y are each >, 0 and x + y ≤ 1.

**[OR]**

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

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

**[OR]**

b) Find the area of the Cardioids $r = q(1+\cos\theta)$.

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

**[OR]**

b) Establish a reduction formula for $\int \sin^n x \, dx.$

## SECTION – D

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

23. Integrate: $\frac{3x+1}{(x-1)^2(x+3)}$

24. Evaluate I = $\int_0^{D_2} \log\sin x \, dx.$

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

26. Evaluate $\iiint xyz \, dx \, dy \, dz$ taken through the positive octaut of the sphere $x^2 + y^2 + z^2 = a^2$

27. Given that $x + y = u \;\; y = uu$ change the variable to $u, \vartheta$ in the integral $\iint \left[xy(1-x-y)\right]^{1/2} dxdy$ taken over the area of triangle with sides $x = 0, \;\; y = 0, \;\; x + y = 1$ *and* evaluate it.

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
Part – III : Core Subject : Second Semester : Paper – II

**ANALYTICAL GEOMETRY 3D VECTOR CALCULUS**
Under CBCS – Credit 4

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

## SECTION – A

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

1. The equation of the yz- plane is _____
   a) $x = 0$ b) $y = 0$ c) $z = 0$ d) $x = 0 = y$
2. The distance between the points P(0,0,0) and Q(0,3,4) is
   a) 1 b) 2 c) 5 d) 6
3. The image of the point (1,2,3) under the reflection in the xy – plane is
   a) (1,2,3) b) (1,2,-3) c) (1,-2,3) d) (-1, 2, 3)
4. The mirror reflection of the point (1,2,3) in the yz- plane is _____
   a) (1,2,-3) b) (1,-2,3) c) (-1,2,3) d) (1,2,3)
5. The center of the sphere $(x-2)^2 + (y-3)^2 + (z-1)^2 = 9$ is _____
   a) (1,2,3) b) (2,3,1) c) (3,2,1) d) (1,1,1)
6. The yz –plane section of the sphere $x^2 + y^2 + z^2 = a^2$ is _____
   a) $y^2 + z^2 = a^2, x = 0$ b) $x^2 + z^2 = a^2, y = 0$
   c) $x^2 + y^2 = a^2, z = 0$ d) none
7. A vector function $\vec{f}$ is called *solenoidal* if _____
   a) div f =0 b) curl f =0 c) div $\vec{f} = 0$ d) curl $\vec{f} = 0$

8. For the unit vectors $\vec{i}.\vec{j} = \vec{j}.\vec{k} = \vec{k}.\vec{i} =$ _____

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

9. The value of $\iint_0^a x dx\, dy =$ _____

a) $\frac{1}{2}$ b) $\frac{a^3}{2}$ c) $\frac{a^3}{3}$ d) $\frac{a^2}{2}$

10. Green's theorem connects

a) line integral and double integral

b) line integral and surface integral

c) double integral and surface integral

d) surface integral and volume integral

## SECTION – B

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

11. Define direction cosines.

12. Find the angle between the planes

$2x - y + z = 6; x + y + zz = 3.$

13. Find the equation of the straight line joining the points (2, 5, 8) and (-1, 6, 3).

14. Define sphere.

15. Find the Co-ordinates of the centre and radius of the sphere

$2x^2 + 2y^2 + 2z^2 - 2x + 4y + 2z - 15 = 0.$

16. Define great circle.

17. Write the condition for the lines to be coplanar.

## SECTION – C

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

18. a) Find the equation of the plane passing through the points (3,1,2), (3,4,4) and perpendicular to the plane $5x + y + 4z = 0$

**[OR]**

b) Find the equation of the plane through the point (1,-2,3) and the intersection of the planes $2x - y + 4z = 7$ and $x + 2y - 3z + 8 = 0.$

19. a) Prove 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.

**[OR]**

b) Put in the symmetrical form the lines $3x - 2y + z - 1 = 0 = 5x + 4y - 6z - 2$

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

**[OR]**

b) Find the equation of a sphere which touches the sphere $x^2 + y^2 + z^2 - 6x + 2z + 1 = 0$ at the point (2,-2,1) and passes through the origin.

21. a) Find the distance between the parallel planes $2x - 2y + z + 3 = 0$ and $4x - 4y + 2z + 5 = 0$

**[OR]**

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

22. a) Find the perpendicular distance from P(3,9,-1) to the line

$$\frac{x+8}{-8}=\frac{y-31}{1}=\frac{z-13}{5}$$

**[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.

## SECTION – D

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

23. Find the equation of the plane passing through the points (2,-5,-3) (-2,-3,5) and (5,5,-3)

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

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

25. Find the equation of the sphere which passes through the circle

$x^2+y^2+z^2-2x-4y=0,\quad x+2y+3z=8$ and touches the plane

$4x+3y=25.$

26. Find the equation of the sphere through the four points (2,3,1), (5,-1,2), (4,3,-1) & (2,5,3).

27. Find the equation of the sphere which touches the sphere

$x^2+y^2+z^2-6x+2z+1=0$ at the point (2, -2, 1) and passes through the origin.

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 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

2. The following statement are true except _____

   a) $(\frac{1}{n})$ is a convergent sequence b) $(\frac{1}{n})$ is a bounded sequence
   c) $(\frac{1}{n})$ is a monotonic sequence d) $(\frac{1}{n})$ is a strictly monotonic decreasing sequence

3. Every bounded sequence has atleast _____ limit point.

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

4. $\lim_{n\to\infty}\left(\frac{n^2+n+1}{n^3+2}\right)$ = _____

   a) 0 b) $\frac{1}{2}$ c) 1 d) $\infty$

5. If a sequence $(a_n)$ converges to $l$, then every subsequence of $(a_n)$ also _____

a) convergent to $l$ b) divergent to $l$

c) convergent absolutely d) convergent to $l/2$

6. The following statement are false except _____

a) The range of a sequence is an infinite set

b) Any bounded sequence is convergent

c) Any constant sequence is convergent

d) Any monotonic sequence is

7. Let $\sum a_n$ be a convergent series converging to the sum s. Then

$\lim_{n\to\infty} a_n =$ _____

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

8. Let $\sum a_n$ be a series of positive terms. Then $\sum a_n$ is _____

a) Convergent if $\lim_{n\to\infty} a_n^{1/n} > 1$ b) convergent if $\lim_{n\to\infty} a_n^{1/n} < 1$

c) divergent if $\lim_{n\to\infty} a_n^{1/n} < 1$ d) divergent if $\lim_{n\to\infty} a_n^{1/n} = 1$

(Hint: Cauchy's root test)

9. A series whose terms are increasingpositive valuesis called a _____ series.

a) Convergent b) divergent c) monotone d) oscillating

10. The series $\sum_{n=1}^{\infty} \frac{5^n}{n^2+1}$ is _____

a) Convergent b) divergent

c) neither convergent nor divergent d) both convergent and divergent

## SECTION – B

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

11. Define greatest lower bound.

12. Show that $\lim_{n\to\infty} \frac{n+1}{n} = 1.$

13. What do you mean by Oscillatory sequence?

14. Define Cauchy sequence.

15. Define subsequence.

16. State Comparison Test.

17. Define absolutely convergent series.

## SECTION – C

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

18. a) Prove that any Cauchy sequence is bounded sequence.

**[OR]**

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

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

**[OR]**

b) Prove that any Convergent sequence is a Cauchy sequence.

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 $\lim_{n\to\infty}\left(n^{1/n}\right)=1$.

**[OR]**

b). Examine the convergence of $\frac{1}{1.2}-\frac{1}{3.4}+\frac{1}{5.6}-.....$

## 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. State and prove triangle inequalities.

27. If $(a_n)\to a$ *and* $(b_n)\to b$ prove that $(a_n b_n)\to ab$.

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**B.Sc., Mathematics** Degree (Semester) Examinations, April 2020
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 _____ is the path which the projected particle describes
   a) avelocity of projection b) angle of projection
   c) trajectory d) time of flight
2. Time taken to reach the greatest height.
   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=0 are said to be _____
   a) perfectly inelastic b) perfectly elastic c) elastic d) inelastic
4. A _____ sphere impinges on a fixed smooth plane, its velocity is not altered by impact.
   a) perfectly inelastic b) perfectly elastic c) elastic d) inelastic
5. The oscillation of a simple pendulum is an example of _____
   a) S.H.M b) not S.H.M
   c) ordinary motion d) extra ordinary motion
6. Length of the simple equivalent pendulum
   a) $g/e$ b) $g/\mu$ c) $\mu/g$ d) $\mu$ g

7. The normal component of acceleration is _____

a) $\ddot{r} - r\dot{\theta}^2$ b) r $\dot{\theta}$ c) $\frac{1}{r}\frac{d}{dt}\left(r^2\dot{\theta}\right)$ d) $\dot{r}$

8. The (p,r) equation to the central orbit

a) $\frac{h^2}{p^3}\frac{dp}{dr} = P$ b) $\frac{h^2}{p^2}\frac{dp}{dr} = P$ c) $\frac{h^3}{p^2}\frac{dp}{dr} = P$ d) $\frac{h}{p}\frac{dp}{dr} = P$

9. M.I of a rectangular lamina about an axis through C.G perpendicular to its plane

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

10. M.I of a circular disc about a diameter is _____

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

## SECTION – B

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

11. Define the velocity of projection and trajectory.
12. State the principle of conservation of momentum for a particle.
13. What is meant by Simple Harmonic Motion?
14. Define Simple Equivalent Pendulum.
15. Write the radial component of acceleration.
16. Define time of fligest in projectile.
17. Define 'Direct impact'.

## SECTION – C

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

18. a) A body is projected with a velocity of 98 metres per sec. in a direction making an angle $\tan^{-1} 3$ with the horizon. Show that it rises to a vertical height of 441 metres and that its time of flight is about 19 secs. Also find the horizontal range through the point of projection (take $g = 9.8\ metres/sec^2$)

**[OR]**

b) Find the greatest distance of the projectile from the inclined plane.

19. a) State the Laws of Impact.

**[OR]**

b) A Smooth sphere of mass m impinges obliquely on a smooth sphere of mass M which is at rest. Show that if $m = eM$, the directions of motion after impact are at right angles.

20. a) A particle is moving with Simple Harmonic Motion and while making an oscillation from one extreme position to the 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 $\frac{2\pi}{\cos^{-1}\left(\frac{x_1+x_3}{2\pi}\right)}$..

**[OR]**

b) Find the period of oscillation of the simple pendulum.

21. a) If the greatest height attained by the particle is a quarter of its range on the horizontal plane through the point of projection. Find the angle of projection.

**[OR]**

b) Explain the direct impact of two smooth spheres.

22. a) Find the moment of inertia of a solid right circular cone.

**[OR]**

b) State and prove the perpendicular axes theorem in moment of inertia.

## SECTION – D

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

23. Show that the path of the projectile is a parabola and find the range and height of the projectile.

24. Find the loss of kinetic energy due to oblique impact of two smooth spheres.

25. Show that the resultant motion of two simple harmonic motions of same period, along two perpendicular lines, is along an ellipse.

26. Show that the greatest height which a particle with initial velocity V can reach on a vertical wall at a distance 'a' from the point of projection is $\frac{v^2}{2g} - \frac{ga^2}{2v^2}$.

Prove also that the greatest height above the point of projection attained by the particle in its flight is $\frac{v^6}{2g\left(v^4 + g^2a^2\right)}$.

27. If $v_1$ *and* $v_2$ be the velocities of a projectile at the ends of a Focal chord of its path and U is the velocity at the vertex prove that $v_1^{-2} + v_2^{-2} = U^{-2}$.

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 $M_2(R)$ let $\left\{\begin{pmatrix}1&0\\0&0\end{pmatrix},\begin{pmatrix}0&0\\1&0\end{pmatrix}\right\}$ then L(S) _____
   a) $\left\{\begin{pmatrix}x&0\\x&0\end{pmatrix} \mid x\epsilon R\right\}$ b) $\left\{\begin{pmatrix}x&0\\y&0\end{pmatrix} \mid x,y\epsilon R\right\}$
   c) $\left\{\begin{pmatrix}x&0\\x&0\end{pmatrix} \mid x\epsilon R\right\}$ d) $M_2(R)$
2. In $V_3(R)$ if S is the subspace spanned by {(1,1,1)} and T is the subspace spanned by {(1,2,1)} then dim$(S \cap T)$=….. dim $(S+T)$ is_____
   a) 1;1 b) 0;1 c) 0;2 d) 1;2
3. A unit vector which is orthogonal to (1,3,4) in $V_3(R)$ with standard inner product is _____
   a) $(1,1,-1)$ b) $(2,2,-2)$
   c) $(0,4,-3)$ d) $\left(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},-\frac{1}{\sqrt{3}}\right)$
4. If A=$\begin{pmatrix}1&2\\3&4\end{pmatrix}$ then the conjugate of A is_____
   a) $\begin{pmatrix}i&2i\\3i&4i\end{pmatrix}$ b) $\begin{pmatrix}-i&-2i\\-3i&-4i\end{pmatrix}$ c) $\begin{pmatrix}1&3\\2&4\end{pmatrix}$ d) $\begin{pmatrix}1&2\\3&4\end{pmatrix}$
5. An example of a skew Hermitain matrix is_____
   a) $\begin{pmatrix}1&1-i\\1+i&-2\end{pmatrix}$ b) $\begin{pmatrix}0&-2+3i\\2+3i&0\end{pmatrix}$
   c) $\begin{pmatrix}2i&2-i\\2+i&2i\end{pmatrix}$ d) $\begin{pmatrix}i+1&1\\-1&2i+1\end{pmatrix}$

6. An example of a singular matrix is_____

a) $\begin{pmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$

c) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$

7. Applying the elementary column operations $C_2 \to C_2 - 2C_1$ And $C_3 \to C_3 - C_1$ to the matrix $\begin{pmatrix} 1 & 2 & -1 \\ 0 & -1 & 3 \\ 0 & 0 & 0 \end{pmatrix}$ we get the matrix_____

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

8. The characteristic equation of $\begin{pmatrix} -m & -n \\ 1 & 0 \end{pmatrix}$ is _____

a) $x^2 - mx - n = 0$ b) $x^2 + mx + n = 0$

c) $x^2 + nx + m = 0$ d) $x^2 + nx + mn = 0$

9. The sum and product of the eigen values of $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ are…..

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

10. The matrix of the quadratic from $x^2 - 2y^2 + 4xy - 3z^2 - 8yz + 6xz$ is_____

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

c) $\begin{pmatrix} 1 & 4 & 6 \\ 4 & -2 & -8 \\ 6 & -8 & -3 \end{pmatrix}$ d) $\begin{pmatrix} 1 & -4 & 6 \\ 4 & -2 & 8 \\ -6 & -8 & -3 \end{pmatrix}$

## SECTION – B

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

11. Prove that R is not a vector space over C.
12. Define Kernal of T.
13. What is orthonormal set.
14. What is norm.
15. Define Linear transformation.
16. Define Inner Product space.
17. Define Invertible.

## SECTION – C

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

18. a). Define linearly independent and prove that in $V_3(R)$ the vectors (1,2,1), (2,1,0) and (1,-1,2) are linearly independent.

**[OR]**

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

19. a). Prove that $V_n(R)$ is a real inner product space with inner product defined by:

$\langle x,y \rangle = x_1y_1 + x_2y_2 + \text{----} + x_ny_n$ where $x = (x_1,x_2,\ldots..x_n)$ and $y = (y_1,y_2,\ldots.y_n)$.

**[OR]**

b). Find an orthogonal basis containing the vector (1,3,4) for $V_3(R)$ with the standard inner product.

20. a). Let A and B be orthogonal matrices of the same order. Then (i) $A^T$ is orthogonal (ii) AB is orthogonal.

**[OR]**

b). Prove that A square matrix A of order n is non-singular iff A is invertible.

21. a). State and Prove Schwart's inequality.

**[OR]**

b). State and Prove triangle inequality.

22. 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). Let V be a finite dimensional inner product space, Let W be a Subspace of V, then prove that V is the direct sum of W and $W^{\perp}$.

## SECTION – D

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

23. Let V be a vector space over a field F. Let S,T $\subseteq$ V. Then

a) S$\subseteq$T $\Rightarrow$L(S) $\subseteq$ L(T) b) L (S$\cup$T) L(S) + L(T)

c) L(S) = S iff S is a subspace of V.

24. Prove that every finite dimensional inner product space has an orthonormal basis.

25. Find the rank of the matrixatrix A =

$$\begin{pmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 7 \end{pmatrix}$$

26. State and prove fundamental theorem of Homomorphism.

27. State and prove Gram - Schmidt orthogonalisation process .

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
Part – III : Core Subject : Sixth Semester : Paper – II

**COMPLEX ANALYSIS**
Under CBCS – Credit 4

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

## SECTION – A

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

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

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

2. The fixed points of a magnification or contraction are given by

   a) 0 only b) $\infty$ only c) 0 and $\infty$ only d) None

3. The C. R equations in polar coordinates are

   a) $u_r = \frac{1}{r} v_\theta, v_r = \frac{1}{r} u_\theta$ b) $u_r = -\frac{1}{r} u_\theta, v_r = \frac{1}{r} v_\theta$

   c) $u_r = \frac{1}{r} v_\theta, v_r = -\frac{1}{r} u_\theta$ d) None

4. The Laplace equation in polar form is

   a) $\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} = 0$ b) $\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r} - \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} = 0$

   c) $\frac{\partial^2 u}{\partial r^2} - \frac{1}{r}\frac{\partial u}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} = 0$ d) None

5. The length of the curve C with equation z = z(t), $a \le t \le b$ is given by

   a) $\int_a^b z(t)\, dt$ b) $\int_a^b |z(t)|\, dt$ c) $\int_a^b |z^1(t)|\, dt$ d) None

6. If f(z) is analytic inside and on the circle C given by $|z-a|=r$ and if s is the arc length and $l$ is the circumference of C then f(a) is

a) $\frac{1}{l}\int_o^l f(z)dz$ b) $\int_o^l f(z)dz$ c) $\frac{1}{l}\int_o^l f^1(z)ds$ d) None

7. If the principal part of the Laurent's series of f(z) at z = a has only finite number of terms, then z = a is called

a) A removable singularity b) a pole

c) an essential singularity d) None

8. The region of convergence for the expansion $\frac{1}{1-z}=\sum_{n=0}^{\infty} z^n$ is

a) $|z|<\infty$ b) $|z|<1$ c) $|z|\leq 1$ d) None

9. If **a**is a simple pole for f(z) = $\frac{h(z)}{k(z)}$where h(z) & k(z) are analytic at **a,** h(a)$\neq$ 0& k(a) = 0 then Res [f(z);a] = _____

a) $\frac{h(a)}{k(a)}$ b) $\frac{h^1(a)}{k(a)}$ c) $\frac{h(a)}{k^1(a)}$ d) None

10. With usual notations, by Jordan lemma$\lim_{r\to\infty}\int_c f(z)e^{iaz}dz$ is

a) Zero b) $f^1(a)$ c)a $f^1(a)$ d) None

## SECTION – B

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

11. Define Mobius transformation.

12. Verify CR equations for the function $f(z)=z^3$.

13. State maximum modules theorm.

14. Evalvate $\int_C \frac{z\,dz}{2z+1}$ using Cauchy integral formula.

15. What is the difference between the removable singularity and essential singularity?

16. Find the pole for $f(z)=\frac{\cos Z}{Z^2}$.

17. Calculate the residue of $\frac{z+1}{z^2-2z}$ at its pole $z=2$.

## SECTION – C

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

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

**(OR)**

b) Prove that any bilinear transformation preserves cross ratio.

19. a) If $f(z)$ and $\overline{f(z)}$ are analytic in a region D then prove that $f(z)$ is constant in that region.

**(OR)**

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

20. a) State and prove cauchy's integral formula.

**(OR)**

b) State and prove Cauchy – Riemann equations.

21. a) Find the Laurent's series expansion of the function $\frac{z^2-1}{(z+2)(z+3)}$ valid in the annular region $2<|z|<3$.

**(OR)**

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

22. a) State and prove Canchy's residue theorem.

**(OR)**

b) State and prove Liouville's theorem.

## SECTION – D

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

23. Prove that any silinear transformation can be expressed as a product of translation, rotation, magnification and inversion. Also show that the transformation $w=\frac{5-4z}{4z-2}$ maps the unit circle $|z|=1$ into a circle of radius unity and centre $-1/2$.

24. Expand $f(z)=\frac{z}{(z-1)(2-z)}$ in a Laurent's series valid for

i) $|z|<1$ ii) $1<|z|<2$ iii) $|z|>2$

25. State and prove Cauchy's Inequaling.

26. State and prove Taylor's theorem.

27. Prove that $\int_C \frac{e^{2z}}{(z+1)^3}dz=\frac{4\pi i}{e^2}$ where $C$ is $|z|=3/2$.

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 V={a,b,c,d} and X={(a,b) (a,c), a,d)}
   a) (3,4) b) (4,1) c) (4,3) d) (2,4)
2. Number of lines in $G_1+G_2$ is _____
   a) $q_1+ q_2$ b) $q_1 + q_2 + p_1 p_2$
   c) $q_1+ q_2 + q_1 q_2$ d) $q_1 - q_2$
3. If G is k-connected graph then $q \geq$ _____
   a) $\frac{p}{2}$ b) $\frac{pk}{2}$ c) $\frac{k}{2}$ d) $\frac{k+1}{2}$
4. $K_n$ contains _____ number of lines
   a) $\frac{n(n-1)}{2}$ b) $\frac{n(n+1)}{2}$ c) $\frac{n+1}{2}$ d) $\frac{n+2}{2}$
5. Let G be a (p, q) graph. If G is tree then p = _____
   a) q-1 b) q+1 c) q d) p+1
6. The closure of $K_{4-x}$ is _____
   a) $K_3$ b) $K_4$ c) $K_2$ d) $K_5$
7. Any set M of independent lines of a graph G is called a _____of G
   a) planar b) matching c) trail d) path
8. A connected graph G to be a plane graph if 5,7 and _____ are the number of vertices, edges and faces respectively.
   a) 1 b) 2 c) 3 d) 4

9. For any graph G, $\aleph \leq$ _____

a) $\delta + 1$ b) $\Delta + 1$ c) D d) 0

10. Every planar graph is _____ colorable

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

## SECTION – B

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

11. Prove that the sum of the degrees of the points of a graph is twice the number of lines.
12. Write the adjacency matrix of $K_4$.
13. Draw two non-isomorphic graphs with degree sequence (3,2,2,1,1,1).
14. If G is not connected, prove that $\overline{G}$ is connected.
15. Write Fleury's algorithm.
16. Prove that $K_{3,3}$ is non-planar.
17. Define connected graph.

## SECTION – C

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

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

**(OR)**

b) For any graph G with 6 points, prove that G or $\overline{G}$ contains a triangle.

19. a) Prove that a closed walk of odd length contains a cycle.

**(OR)**

b) Prove that $\lambda \leq \delta$ for any graph.

20. a) If G is a graph with $p \geq 3$ vertices and $\delta \geq p/2$, prove that G is Hamiltonian.

**(OR)**

b) Define a tree. Prove that every two points of a tree are connected by a unique path.

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

**(OR)**

b) Prove that every polyhedron has at least two faces with the same number of lines on the boundary

22. a) Prove that "A graph with $p$ points and $\delta \geq \frac{p-1}{2}$. is connected.

**(OR)**

b) Prove that $r(m,n) = r(n,m)$.

## SECTION – D

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

23. The maximum number of lines among all $p$ points graph with no triangle is $\left[\frac{p^2}{4}\right]$ - prove.
24. Prove that a graph with at least two points is bipartite iff all its cycles are of even length
25. Define closure of graph. Prove that C(G) is well defined
26. State and prove Euler's theorem
27. Show that the Petersen graph is nonhamiltonian.

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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 EOQ is calculated, but an order is than placed which is smaller than this, will the total inventory cost
   a) Increases b) decreases
   c) either increases or decreases d) no change
2. Demand is denoted by _____
   a) $C_0$ b) $C_1$ c) $C_k$ d) D
3. The calling population is assumed to be infinite, when
   a) arrivals are independent of each other
   b) arrivals are dependent upon each other
   c) capacity of the system is infinite
   d) service rate is faster than arrival rate
4. In Model I, $E(n) =$ _____
   a) $\frac{\lambda}{\mu-\lambda}$ b) $\frac{\mu}{\mu-\lambda}$ c) $-\frac{\lambda}{\mu-\lambda}$ d) $-\frac{\mu}{\mu-\lambda}$
5. The term commonly used for activity slack time is
   a) free float b) independent float
   c) total float d) all the above
6. In a network scheduling, $E_n =$
   a) $L_1$ b) $L_n$ c) $L_2$ d) $L_2$

7. If $A_i$, $B_i$ and $C_i$ denote the processing times of $i^{th}$ job on three machine A, B and C respectively then a n- job three machine problem can be reduced to n- job two machine problem, provided that
   a) $min\ A_i \geq max\ B_i$ and/or $min\ C_i \leq max\ B_i$
   b) $min\ A_i \geq max\ B_i$ and/or $min\ C_i \geq max\ B_i$
   c) $min\ A_i \leq max\ B_i$ and/or $min\ C_i \leq max\ B_i$
   d) $min\ A_i \leq max\ B_i$ and/or $min\ C_i \geq max\ B_i$
8. The total cost is divided by the number of years is denoted by
   a) $e(t)$ b) $S(n)$ c) $TC$ d) $A(n)$
9. When time value of money is considered
   a) Costs need to be discounted
   b) Timing of incurrence of costs is important
   c) The present value factors served as the weights
   d) All of the above
10. In a replacement problem, the capital cost is denoted by _____
   a) $C$ b) $S$ c) $f(t)$ d) $A(n)$

## SECTION – B

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

11. State any two Basic terms used in sequencing problem.
12. Write weighted average cost formula.
13. Classification of Replacement problems.
14. Expand PERT and CPM.
15. What do you mean by free float of an activity?
16. Define the term "Total Elapsed time" in Sequencing.
17. List any two situations that needs replacement of items.

## SECTION – C

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

18. a) Explain various Basic components of Network.

**(OR)**

b) Draw a network diagram for the following data

| Activity : | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| Preceding activity : | None | A | A | B | A | B, E | C | D, F | G | H, I |

19. a) Solve the following sequencing problem when passing out is not allowed.

| Item | Machine (processing time in hours) | | | |
|---|---|---|---|---|
| | A | B | C | D |
| I | 15 | 5 | 4 | 15 |
| II | 12 | 2 | 10 | 12 |
| III | 16 | 3 | 5 | 16 |
| IV | 17 | 3 | 4 | 17 |

**(OR)**

b) The cost of a new machine is Rs.5,000. The maintenance cost of $n^{th}$ year is given by Cn = 500 (n-1); n = 1, 2, ..... 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?

20. a) A small project consists of seven activities for which the relevant data are given below. Draw the network and find the project completion time 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 |

**(OR)**

b) Given the following information:

| Activity | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 |
|---|---|---|---|---|---|---|---|---|---|---|
| Duration (in days) | 2 | 8 | 10 | 6 | 3 | 3 | 7 | 5 | 2 | 8 |

i) Draw the network diagram

ii) Identify the critical path and find the total project duration.

21.a) A book binder has one printing press one binding machine and the manuscripts of a number of different books. The time required to perform the printing and binding operations for each book is shown below. Determine the order in which books should be processed, in order to minimize the total time required to turn out all the books:

| Book | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Printing time (hours) | 30 | 120 | 50 | 20 | 90 | 100 |
| Binding time (hours) | 80 | 100 | 90 | 60 | 30 | 10 |

**(OR)**

b) 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 |

22. a) A firm is considering replacement of a machine, whose cot price is ₹.12, 200 and the scrap value, ₹. 200. The running (maintenance and operating) cost in rupees is found from experience to be as follows: When should the machine be replaced?

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Running cost | 200 | 500 | 800 | 1200 | 1800 | 2500 | 3200 | 4000 |

**(OR)**

b) A pipeline is due for repairs. It will cost Rs.10000 and last for 3 years. Alternatively, a new pipe line can he laid at a cost of Rs.30000 and lasts for 10 years. Assuming cost of capital to be 10% and ignoring salvage value, which alternative should be chosen?

## SECTION – D

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

23. The data collected in running a machine, the cost of which is Rs.60,000 are given below :

| 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 |

Determine the optimum period for replacement of the machine.

24. Construct the network diagram comprising activities B, C, ..... Q and N such that the following constraints are statisfied :

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 finished before y can begin.

25. A project consists of eight activities with the following relevant information:

The durations are in days. 'a' refers to optimistic time, 'm' refers to most likely time and 'b' refers to pessimistic time duration. (i) Draw the PERT network and find the expected project completion time. (ii) What duration will have 95% confidence for project completion? (iii) If the average duration for activity F increases to 14 days, what will be its effect on the project completion time which will have 95% confidence?

| Activity | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| Predecessor | - | - | - | A | B | C | D,E | F,G |
| a | 1 | 1 | 2 | 1 | 2 | 2 | 3 | 1 |
| m | 1 | 4 | 2 | 1 | 5 | 5 | 6 | 2 |
| b | 7 | 7 | 8 | 1 | 14 | 8 | 15 | 3 |

(Standard normal Z=1.645, area under the standard normal curve from 0 to Z Y 0.45)

26. We have 4 jobs each of which has to go through the machines $M_j$ (j = 1,2, …6) in the order $M_1$, $M_2$, ….$M_6$. Processing time (in hours) is given below: Determine a sequence of these four jobs that minimizes the total elapsed time.

| **Jobs** | **Machines (Processing time in hours)** | | | | | |
|---|---|---|---|---|---|---|
| | **$M_1$** | **$M_2$** | **$M_3$** | **$M_4$** | **$M_5$** | **$M_6$** |
| **A** | 18 | 8 | 7 | 2 | 10 | 25 |
| **B** | 17 | 6 | 9 | 6 | 8 | 19 |
| **C** | 11 | 5 | 8 | 5 | 7 | 15 |
| **D** | 20 | 4 | 3 | 4 | 8 | 12 |

27. A manufacturer is offered two machines A and B. 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, which has the same capacity as A, costs ₹. 2500 but will have running costs of ₹.1200 per year for six years, increasing by ₹. 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).

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**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
(Autonomous & Residential)
[Affiliated to Madurai Kamaraj University]

**B.A. / B.Sc.** Degree (Semester) Examinations, April 2020
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. For dealing with qualitative data the best average is _____?
   a) Mean b) Harmonic Mean
   c) Median d) Standard deviation
2. In a symmetrical distribution mean, median and mode are _____?
   a) not equal b) equal
   c) great than or equal d) less than or equal
3. Quartile deviation include the _____?
   a) first 50% value b) last 50% value
   c) central 50% value d) 100% value
4. The square root of the variance of a distribution is _____?
   a) Mean b) Quartile deviation
   c) Mode d) Standard deviation
5. 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

6. 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.

7. 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.

8. 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) $m - n$

9. In an assignment problem, number of origins is _____?

   a) equal the number of destinations

   b) greater than the number of destinations

   c) less than the number of destinations

   d)less than or equal to the number of destinations

10. In an assignment problem, the values of $x_{ij}$ = _____?

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

## SECTION – B

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

11. Find the Mean value of 10, 20, 30, 40, 50, 60.
12. Define Mode with example.
13. Define Assigment problem.
14. Define median for continuous data.
15. State Balanced transportation problem .
16. State the necessary and sufficient condition for the existence of a feasible solution to the general transportation problem.
17. Describe Mathematical formulation of Assignment problem.

## SECTION – C

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

18. a) Find the minimum cost for the following assignment problem.

| | Men | | | |
|---|---|---|---|---|
| Task | E | F | G | H |
| A | 18 | 26 | 17 | 11 |
| B | 13 | 28 | 14 | 26 |
| C | 38 | 19 | 18 | 15 |
| D | 19 | 26 | 24 | 10 |

**(OR)**

b) Find Mean of the following data

| Age in years | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|
| No.of Members | 3 | 61 | 132 | 153 | 140 | 51 | 3 |

19. a) Calculate mean for the given information:

| Marks | 05-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 |
|---|---|---|---|---|---|---|---|---|
| No.of Students | 5 | 6 | 15 | 10 | 5 | 4 | 3 | 2 |

**(OR)**

b) Solve the transportation problem by using north west corner rule.

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

20. a) Obtain an initial basic feasible solution to the following transportation problem by using the least cost method .

| | D1 | D2 | D3 | D4 | Capacity |
|---|---|---|---|---|---|
| $O_1$ | 1 | 2 | 3 | 4 | 6 |
| $O_2$ | 4 | 3 | 2 | 0 | 8 |
| $O_3$ | 0 | 2 | 2 | 1 | 10 |
| Demand | 4 | 6 | 8 | 6 | |

**[OR]**

b) Minimize the total man hours for the following Assignment problem with estimate of the man time.

| Task | Men | | |
|---|---|---|---|
| | A | B | C |
| I | 9 | 26 | 15 |
| II | 13 | 27 | 6 |
| III | 35 | 20 | 15 |
| IV | 18 | 30 | 20 |

## SECTION – D

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

21. Calculate Mean ,Median and Mode for the date given below:

| Daily earnings(Rs.) | 50-53 | 53-56 | 56-59 | 59-62 | 62-65 | 65-68 | 68-71 | 71-74 | 74-77 |
|---|---|---|---|---|---|---|---|---|---|
| No. of persons | 3 | 8 | 14 | 30 | 36 | 28 | 16 | 10 | 5 |

22. Find the intial basic feasible solution to the following transportation problem using Vosel's approximation.

| | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| $S_1$ | 20 | 25 | 28 | 31 | 200 |
| $S_2$ | 32 | 28 | 32 | 41 | 180 |
| $S_3$ | 18 | 35 | 24 | 32 | 110 |
| Demand | 150 | 40 | 180 | 170 | |

23. Find the optimum solution for the given transportation problem:

| | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| $S_1$ | 3 | 7 | 6 | 4 | 5 |
| $S_2$ | 2 | 4 | 3 | 2 | 2 |
| $S_3$ | 4 | 3 | 8 | 5 | 3 |
| Demand | 3 | 3 | 2 | 2 | |

24. Determine the optimum Assignment cost for the following problem:

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| A | 85 | 75 | 65 | 125 | 75 |
| B | 90 | 78 | 66 | 132 | 78 |
| C | 75 | 66 | 57 | 114 | 69 |
| D | 80 | 72 | 60 | 120 | 72 |
| E | 76 | 64 | 56 | 112 | 68 |

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**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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 H.C.F. of $2^3X\ 3^2\ X\ 5\ X\ 7^4$, $2^2\ X\ 3^5\ X\ 5^2\ X\ 7^3$,$2^3\ X\ 5^3\ X\ 7^2$
   a) 890 b) 908 c) 980 d) 809
2. Calculate 6202.5 + 620.25 + 62.025 + 6.2025 + 0.62025= ?
   a) 6891.59794 b) 6891.57795 c) 6891.59775 d) 6891.58785
3. Find the square root of 1471369
   a) 1212 b) 1213 c) 2113 d) 2313
4. Of the three numbers, second is twice the first and is also thrice the third. If the average of the three numbers is 44.Find the largest number?
   a) 24 b) 12 c) 36 d) 72
5. The ages of two persons differ by 16 years. If 6 years ago, the elder one be 3 times as old as the younger one, find their present ages?
   a) 14, 30 b) 24, 30 c) 14, 36 d) 10, 20
6. Evaluate :28% of 450+ 45% of 280
   a) 250 b) 251 c) 252 d) 253
7. If the a radio is purchased for Rs. 490 and sold for Rs. 465.50.find loss%.
   a) 2% b) 3% c) 5% d) 4%.
8. Find the fourth proportional to 4, 9, 12,? .
   a) 27 b) 22 c) 23 d) 24

9. A, B and C started a business by investing Rs. 1,20,000, Rs. 1,35,000 and,Rs.1,50,000 respectively. Find the share of A,out of an annual profit of Rs. 56,700.

   a) Rs.16300 b) Rs.16200 c) Rs.16900 d) Rs.16800

10. A, Band C start a business each investing Rs. 20,000. After 5 months A withdrew Rs.5000 , B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69,900 was recorded. Find the share of C?

    a) Rs.28200 b) Rs.28300 c) Rs.28400 d) Rs.28100

## SECTION – B

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

11. Two numbers are in the ratio of 15:11. If their H.C.F. is 13, find the numbers.
12. Arrange the fractions 3/5, 4/7, 8/9, and 9/11 in their descending order.
13. If $\sqrt{3}$ =1.732, find the value of $\sqrt{192} - \frac{1}{2}\sqrt{48} - \sqrt{75}$ correct to 3 places of decimal.
14. Find the H.C.F. of 108, 288 and 360.
15. Find the average of all prime numbers between 30 and 50.
16. Find x: $\sqrt{86.49} + \sqrt{5 + x^2} = 12.3..$
17. Alfred started a business investing Rs. 45,000. After 3 months, Peter joined him with a capital of Rs.60,000. After another 6 months, Ronald joined them with a capital of Rs. 90,000. At the end of the year, they made a profit of Rs. 16,500. Find the share of Peter.

## SECTION – C

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

18. a) i) Find the greatest possible length which can be used to measure exactly the lengths 4 m 95 cm, 9m and 16 m 65 cm.

    ii) Find the L.C.M. of 72, 108 and 2100.

    **[OR]**

    b) i) Simplify: $\frac{0.05 \times 0.05 \times 0.05 + 0.04 \times 0.04 \times 0.04}{0.05 \times 0.05 - 0.05 \times 0.04 + 0.04 \times 0.04}$ .

    ii) If (1 / 3.718) = 0.2689, Then find the value of (1 / 0.0003718).

19. a) i) There are two sections A and B of a class consisting of 36 and 44 students respectively. If the average weight of section A is 40kg and that of section B is 35kg, find the average weight of the whole class?

    ii) By what least number 4320 be multiplied to obtain a number which is a perfect cube?

    **[OR]**

    b) Find the greatest number of five digits which is a perfect square.

20. a) Distance between two stations A and B is 778 km A main covers the journey from A to B at 84 km per hour and returns back to A with a uniform speed of 56 km per hour. Find the average speed of the train during the whole journey.

    **[OR]**

    b) Four milk man rented a pasture. A grazed 24 cows for 3 months, B 10 cows for 5 months, C 35 cows for 4 months and D 21 cows for 3 months. If A's share of rent is Rs.720, find the total rent of the field.

## SECTION – D

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

21. i) Find the least number which when divided by 6,7,8,9, and 12 leave the same remainder 1 in each case?

ii) Find the product: 2.1693 x 1.4 ?

iii) Find the quotient: 3.1603 / 13 ?

iv) Find the product:0.4 x 0.04 x 0.004 x 40 ?

22. 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 by 3 months. Find the age of the teacher.

ii) Find the average of first 40 natural numbers?

iii) If $x = (\sqrt{5} + \sqrt{3}) / (\sqrt{5} - \sqrt{3})$ and $y = (\sqrt{5} - \sqrt{3}) / (\sqrt{5} + \sqrt{3})$, find the value of $(x^2 + y^2)$.

23. i) $1^3 + 2^3 + ..... + 9^3 = 20\ 2S,$ then the value of

$(0.11)^3 + (0.22)^3 + ..... + (0.99)^3$ is?

ii) Find the H.C.F. of 513, 1134 and 1215.

24. i) A, Band C enter into a partnership by investing in the ratio of 3 : 2: 4. After 1 year, B invests another Rs. 2,70,000 and C, at the end of 2 years, also invests Rs.2,70,000. At the end of three years, profits are shared in the ratio of 3 : 4 : 5. Find initial investment of each.

ii) A, Band 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 isRs. 6600. What is the share of B ?

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**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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. The quantitative characteristics of a population are called _____.
   a) attributes b) positive class c) negative class d) none
2. The _____ denotes presence of attributes.
   a) attributes b) positive class c) negative class d) none
3. Given n attributes, total number of class frequencies is _____.
   a) $2^n$ b) $3^n$ c) $2^n$-1 d) none
4. Given n attributes, total number of positive class frequencies is _____.
   a) $2^n$ b) $3^n$ c) $2^n$-1 d) none
5. The class of highest order are called _____.
   a) Positive class b) negative class c) ultimate class d) none
6. A set of class frequencies is said to be _____ if none of them is negative.
   a) Inconsistent b) consistent c) independent d) none
7. In two attributes, the condition which is equivalent to $(\alpha\beta) \geq 0$
   a) $(AB) \geq (A) + (B) - N$ b) $(AB) \leq (A) + (B) - N$
   c) $(AB) \geq (A) - (B) + N$ d) none

8. Two attributes A and B are said to be _____ if $(AB) = \frac{(A)(B)}{N}$

a) Inconsistent b) consistent c) independent d) none

9. Two attributes A and B are said to be _____ if $(AB) \neq \frac{(A)(B)}{N}$

a) Associated b) consistent c) independent d) none

10. A and B are positively associated if _____.

a) $\delta > 0$ b) $\delta < 0$ c) $\delta = 0$ d) none

## SECTION – B

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

11. Define negative classes.
12. Represent frequency class for two attributes in table form.
13. Prove that (αβ)= N-(A)-(B)+(AB).
14. Prove that (AB) = (ABC) + (AB $\gamma$ ).
15. Find whether the following data are consistent

N=600; (A)=300; (B)=400; (AB)=50.

16. Check whether the attributes A and B are independent

N=150; (A)=30; (B)=60; (AB)=12.

17. Write the formula for Yule's coefficient of association.

## SECTION – C

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

18. a) Given (A) = 30; (B) = 25; (α) = 30; (αβ) = 20. Find

i) N ii) (β) iii) (AB) iv) (Aβ) v) (αB)

**[OR]**

b) Given (AB) = 975; (αB) = 100; (Aβ )= 25; (αβ) = 950.

Find the remaining class frequencies.

19. a) Show that there is some error in the following data: 50% of the people are wealthy and healthy,35% are wealthyand not healthy, 20% are healthy but not wealthy.

**[OR]**

b) Check whether the attributes A and B are independent or positively associated or negatively associated :

(AB) = 327; (αB) = 741; (Aβ) = 545; (αβ) = 235

20. a) In a class test in which 135 candidates were examined for proficiency in physics and chemistry, it 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.

**[OR]**

b) Calculate the coefficient of association between intelligence of father and son from the following data.

Intelligent father with intelligent sons 200

Intelligent father with dull sons 50

Dull father with intelligent sons 110

Dull father with dull son 600

Comment on the result

## SECTION – D

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

21. Given n = 1200; (ABC) = 600; (αβϒ) = 50; (ϒ) = 270; (Aβ) = 36; (Bϒ) = 204; (A) - ( α) = 192; (B)- (β) = 620. Find the remaining class frequencies.

22. Find the limit of (BC) for the data given:

N=125 (A)=48 (B)=62 (C)=45 (Aβ)=7 and (Aϒ)= 18

23. From the following data compare the association between M.K.U and M.S.U

| University | M.S.U | M.K.U |
|---|---|---|
| Total number of candidates | 200 | 1600 |
| Pass in Physics | 80 | 320 |
| Pass in Chemistry | 40 | 90 |
| Pass in Physics and Chemistry | 20 | 30 |

24. a) Given that $(A)=(\alpha)=(B)=(\beta)=\frac{N}{2}$ show that

i) $(AB)=(\alpha\beta)$ ii) $(A\beta)=(\alpha B)$

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 attacked

ii) inoculated not attacked

iii) not inoculated attacked

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**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
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**B.Sc. Mathematics** Degree (Semester) Examinations, April 2020
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. A relation $\rho$ is defined on a set S is said to be transitive if _____.
   a) $a \rho a$ for all $a \in S$ b) $a \rho b$ for all $b \in S$
   c) $a \rho b, b \rho c \Rightarrow a \rho c$ d) None of these
2. Let A={blood, sky}.B={red, blue, green};Define a relation ρ from A to
   aρb $\Leftrightarrow$ the colour of a is b. Then ρ=_____.
   a) {(blood, blue),(blood, red)}
   b){(blood, red),(sky, blue)}
   c){(red, blood),(blue, sky)}
   d){(blood, red),(blood, blue),(blood, green)}
3. The greatest element is denoted _____.
   a) 0 b) 1 c)≤ d) None of these
4. The least element of all finite subset of any infinite set is _____.
   a) 1 b) 2 c)ϕ d) None of these
5. Let $L$ be a lattice. Let $a, b \in L$. Then idempotent is _____
   a) $a < b$ b) $a > b$ c) $a \vee a$ d) $a \wedge a$

6. Let $L$ be a lattice. Let $a, b \in L$. Then $a \vee a =$ _____.

a)1 b)0 c)infinite d) $a$

7. $(a \vee b) \wedge a' \wedge b' =$ _____.

a)1 b)0 c)infinite d) $a$

8. 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

9. Let $L$ is complement lattice then $A \wedge A^{\perp} = A \cap A^{\perp} =$_____.

a) $\{0\}$ b) $a=a'$ c) $1$ d) None of these

10. $M_5$ is _____ lattice.

a)Distributive b) Unit

c) Complemented d) None of these

## SECTION – B

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

11. Define equivalence relation.

12. Define symmetric.

13. Write the distributive law in lattice.

14. Define Complemented lattice.

15. Define poset.

16. Define Partition.

17. Define unit element.

## SECTION – C

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

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

**[OR]**

b) i) Show that the union of two equivalence relations need not to be an equivalence relation.

ii) Verify equivalence relations if $S = R, a \rho b$ means $a^2 = b^2$.

19. a) Draw the poset diagram,

i) If poset ({1, 2, 3}) with the relation $\subseteq$.

ii) If poset ({10,9,8,6,5}) with usual $\leq$.

**[OR]**

b) Show that in any distributive lattice

$(a \vee b) \wedge (b \vee c) \wedge (c \vee a) = (a \wedge b) \vee (b \wedge c) \vee (c \wedge a)$.

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

## SECTION – D

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

21. i) Verify equivalence relations if $S = R, a\rho b$ means $a = b$.

    ii) If $S = Z, a\rho b$ means $a \equiv b (\text{mod}\, m)$ then verify equivalence relations.

22. i) Draw a poset $M_5$ diagram, if the set of all subgroup of $V_4 = \{e, a, b, c\}$.

    ii) Draw the poset diagram {1,2,3,5,6,10,15,30); $a \le b \Leftrightarrow a$ *divides* $b$.

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

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

    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. i) Show that in a Boolean algebra B, the complement of any element is not itself.

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

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