VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST
(Autonomous & Residential)
[Affiliated to Madurai Kamaraj University]
B.Sc. Physics/Chemistry Degree (Semester) Examinations, April 2018
Part – III : Allied Subject : Fourth Semester : Paper – II

MATHEMATICS - II
Under CBCS – Credit 5

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

SECTION – A

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

1. In a differential equation, if there is a single independent variable and the derivatives are ordinary derivatives, then it is called an _____equation.
   a) ordinary b) partial c) particular d) complete
2. A solution obtained from a general solution by giving particular values to the arbitrary constants is called a _____ solution.
   a) general b) particular c) complete d) constant
3. If the roots of auxilary equation are real and distinct, then the general solution of y" + ay' + by = 0 is _____.
   a) y = a cos x + b sin x b) y = $c_1 e^{m_1 x} + c_2 e^{m_2 x}$
   c) y =4x d) y = a cos x
4. If the roots of auxilary equation are equal, then the general solution of y" + ay' + by = 0 is _____.
   a) y = $e^{mx}(c_1 x + c_2)$ b) y = $c_1 e^{m_1 x} + c_2 e^{m_2 x}$
   c) y = a cos x + b sin x d) y = a cos x
5. L(x) = _____.
   a) $\frac{1}{s}$ b) $\frac{1}{s^2}$ c) $\frac{1}{s^3}$ d) $\frac{1}{s^4}$
6. L(sin ax) = _____.
7. The solution of f(x,y,z,p,q) = 0 which has as many arbitrary constants as there are independent variables is called _____.
8. A _____ of f(x,y,z,p,q) = 0 is obtained by giving particular values to the arbitrary constants.
9. If f(x) = $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$, then a_n = _____.
10. If f(x) = $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$, then b_n = _____.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) Solve $y - x\frac{dy}{dx} = a(y^2 + \frac{dy}{dx})$.

(OR)

b) Solve $\frac{dy}{dx} = \frac{y^3 + 3x^2y}{x^3 + 2xy^2}$.

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

(OR)

b) Solve $(D^2 + D + 1)y = \sin 2x$.

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

(OR)

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

14. a) Form the partial differential equation by eliminating the arbitrary constants a and b from $z = (x+a)^2 + (y+b)^2 + c^2$.

(OR)

b) Solve 2p + 3q = 1.

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

(OR)

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

SECTION – C

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

16. Solve $\frac{dy}{dx} = \frac{x - y + 1}{x + y - 3}$.

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

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

19. Solve $(y^2 + z^2)p - xyq + xz = 0$.

20. Find the Fourier series for $(-\pi, \pi)$

where $f(x) = \begin{cases} 1+x & if \quad 0 < x < \pi \\ -1+x & if \quad -\pi < x < 0 \end{cases}$

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
Part – III : Allied Subject : Fourth Semester : Paper – I

PROGRAMMING IN C++
Under CBCS – Credit 3

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

SECTION – A

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

1. _____ operator is used for Line Feed.
   a) endl b) setw c) new d) delete
2. ____ refers to the use of the same thing for different purposes.
   a) virtual b) overloading c) friend d) static
3. The members that have been declared as _____can be accessed only from within the class.
   a) public b) protected c) private d) scope
4. A _____ is a special member function whose task is to initialize the objects of its class.
   a) class b) inline c) virtual d) constructor
5. A class derived from only one base class is called as _____ inheritance.
   a) single b) multilevel c) multiple d) hybrid
6. List out the Applications of OOP.
7. Comment on Virtual Function.
8. What is Class?
9. What is the use of default argument?
10. Define Multilevel Inheritance.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) Discuss various concepts on Object-Oriented Programming.
    (OR)
    b) List out the Benefits of Object Oriented Programming.
12. a) Elucidate call by reference with simple example program. **(OR)**
    b) Examine return by reference with simple example program.
13. a) Analyze various declarations of a class with example program. **(OR)**
    b) Write Short notes on Static Member Function and give an example for program.
14. a) Examine Parameterized Constructor with example.
    (OR)
    b) Describe Multiple Constructors with example program.
15. a) Write a C++ program to illustrate the concept of Hierarchical Inheritance. **(OR)**
    b) Summarize Multiple Inheritance with example Program.

SECTION – C

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

16. Examine different types of operators used in C++ with example.
17. Enumerate Inline Function with example Program.
18. Summarize Static Data Members and give example Program.
19. Characterize Copy Constructor with example Program.
20. Analyze Single Inheritance with an example.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
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. $\int (ax+b)^n .dx =$ _____
   a) $\frac{(ax+b)^{n+1}}{a(n+1)}$ b) $\frac{(ax+b)^{n-1}}{n-1}$
   c) $n(ax+b)^{n-1}$ d) $(n+1)(ax+b)^{n+1}$
2. If $f(2a-x) = -f(x)$ then $\int_0^{2a} f(x)dx$ = _____.
   a) 1 b) a c) 0 d) 2a
3. The Beta function defined as $\beta(m,n) = \int_0^1 x^{m-1}(1-x)^{n-1}dx$ converges if _____.
   a) m > 0 b) n > 0 c) both m, n > 0 d) both m, n > 1
4. The value of $\int_0^a \int_0^b \int_0^c dx\,dy\,dz$ is _____.
   a) a + b + c b) abc c) $(abc)^2$ d) $\frac{a+b+c}{3}$
5. The Fourier coefficient a_0 for $f(x) = x$ in $(-\pi, \pi)$ is _____.
   a) 0 b) 1 c) π d) $-\pi$
6. $\int \frac{dx}{x^2 - a^2} =$ _____.
7. $\int_0^{\frac{\pi}{2}} \sin 7x\,dx =$ _____ .
8. The Gamma function is defined as $\Gamma(n) =$ _____.
9. Define: Jacobian.
10. Write down the Fourier series formula in *f(x)*, for $(-\pi, \pi)$.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) Evaluate $\int \frac{e^x}{e^{x/2}-1}\,dx$ **(OR)**

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

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

(OR)

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

13. a) Evaluate $\iint xy\,dx\,dy$ taken over the positive quadrant of the circle $x^2+y^2=a^2$. **(OR)**

b) Express $\int_0^1 x^m(1-x^n)^p\,dx$ in terms of Gamma functions and evaluate the integral $\int_0^1 x^5(1-x^3)^{10}\,dx$.

14. a) Evaluate $\int\int_R (x-y)^4 e^{x+y}\,dx\,dy$ where R is the square with vertices (1,0) (2,1) (1,2) and (0,1).

(OR)

b) Evaluate $\iiint xyz\,dx\,dy\,dz$ over the positive octant of the sphere $x^2+y^2+z^2=a^2$ by transforming into spherical co-ordinates.

15. a) Find the fourier sine series for $f(x) = c$ in the range 0 to π.

(OR)

b) In the range $(0, 2l)$, $f(x)$ is defined by the relations

$$f(x) = \begin{cases} 0 & when\ 0 < x < l \\ a & when\ l < x < 2l \end{cases}$$

expand $f(x)$ as a Fourier series of period $2l$.

SECTION – C

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

16. Evaluate $\int \frac{6x+5}{\sqrt{6+x-2x^2}}\,dx$.

17. Establish a reduction formula for $\int \sin^m x\cos^n x\,dx$. Also find $\int_0^{\pi/2} \sin^m x\cos^n x\,dx$.

18. Prove that $\beta(m,n) = \frac{\overline{|(m)}\,\overline{|(n)}}{\overline{|(m+n)}}$.

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

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

Also deduce that i) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots = \frac{\pi^2}{6}$

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

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

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018

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 y-axis are _____
   a) 1,0,0 b) 0,1,0 c) 0,0,1 d) 0,1,1
2. The equations of the line passing through (x_1, y_1, z_1) and having l, m, n are direction cosines is
   a) $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$ b) $\frac{x+x_1}{l}=\frac{y+y_1}{m}=\frac{z+z_1}{n}$
   c) $\frac{x-x_1}{l^2}=\frac{y-y_1}{m^2}=\frac{z-z_1}{n^2}$ d) $\frac{x+x_1}{l^2}=\frac{y+y_1}{m^2}=\frac{z+z_1}{n^2}$
3. The equation of the sphere with centre origin and radius ‘a’ is _____.
   a) $x^2-y^2-z^2=a^2$ b) $x+y+z=a$
   c) $x^2+y^2+z^2=a^2$ d) $x-y-z=a$
4. A vector $\vec{f}$ is called harmonic vector if _____.
   a) $\nabla\vec{f}=0$ b) $\nabla^2\vec{f}=0$ c) $\nabla\vec{f}=\vec{f}$ d) $\nabla^2\vec{f}=\vec{f}$
5. Stokes’ 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
6. Write down the ‘normal form’ of the equation of a plane.
7. Define: Skew lines.
8. Define sphere.
9. Define: Solenoidal vector.
10. State the Green’s theorem in plane.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) A line makes angles $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube. Prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$.

(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 $x + 2y - 3z + 8 = 0$.

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

b) 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.

13. a) Find the equation of the sphere through the points (2,3,1), (5,-1,2), (4,3,-1) and (2,5,3).

(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 also find the point of contact.

14. a) If $\nabla\phi = 2xyz\vec{i} + x^2z\vec{j} + x^2y\vec{k}$ determine $\phi(x, y, z)$.

(OR)

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

15. a) Show that if $\vec{F} = x^3\vec{i} + y^3\vec{j} + z^3\vec{k}$, $\iint_S \vec{F}.\hat{n}\,ds = \frac{12}{5}\pi a^5$, where S is a sphere of radius a. **(OR)**

b) Verify Stokes' theorem when $\vec{F} = (2x - y)\vec{i} - yz^2\vec{j} - y^2\vec{k}$ where S is the upper hemisphere of the unit sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary.

SECTION – C

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

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

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

18. 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 $4x + 3y = 25$.

19. Prove that $\vec{V} = r^n\vec{r}$ is irrotational. Find n when it is also solenoidal.

20. Given the vector field $\vec{F} = xz\vec{i} + yz\vec{j} + z^2\vec{k}$, evaluate $\int_C \vec{F}.\vec{dr}$ from the point (0,0,0) to (1,1,1), where C is the curve.

i) $x = t, y = t^2, z = t^3$

ii) Rectilinear path from (0,0,0) to (1,0,0) then to (1,1,0) and then to (1,1,1)

iii) The straight pat from (0,0,0) to (1,1,1).

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
Part – III : Core Subject : Fourth Semester : Paper – I

SEQUENCE AND SERIES
Under CBCS – Credit 5

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

SECTION – A

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

1. A subset A of R is said to be _____ if there exists an element $\alpha \varepsilon R$ such that $a \leq \alpha$ for all $a \varepsilon A$
   a) bounded below b) bounded above
   c)not bounded d) none of these
2. Let $a_1, a_2 \ldots\ldots\ldots a_n$ be positive real numbers, $(a_1 a_2 \ldots\ldots\ldots a_n)^{1/n}$ is called the _____ of $a_1, a_2, \ldots\ldots a_n$
   a) Arithmetic Mean b) Geometric Mean
   c) Harmonic Mean d) none of these
3. A sequence _____ converge to two different limits.
   a) can b) cannot c) always d) none of these
4. A sequence which is neither convergent nor divergent is said to be an _____ sequence.
   a) convergent b) divergent
   c) oscillating d) none of these
5. Every bounded sequence has _____ limit points.
   a) Atleast one b) atmost one c) exactly one d) 2
6. If a sequence (a_n) converges to *l*, then every subsequence of (a_n) also _____.
7. Let $\sum a_n$ be a series of positive terms.Then $\sum a_n$ _____ if $\lim_{n\to\infty} \frac{a_n}{a_{n+1}} > 1$.
8. Let $\sum a_n$ be a series of positive terms.Then $\sum a_n$ _____if $\lim_{n\to\infty} \frac{a_n}{a_{n+1}} < 1$
9. A series whose terms are alternatively positive and negative is called an _____series.
10. A series Σa_n is said to be absolutely convergent if _____.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) State and prove Cauchy-Schwarz inequality.

(OR)

b) State and prove Weierstrass' inequalities.

12. a) Prove that any convergent sequence is a bounded sequence.

(OR)

b) Show that $\lim_{n\to\infty}(n^{1/n}) = 1$.

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

(OR)

b) Show that $\lim_{n\to\infty} \frac{n!}{n^n} = 0$.

14. a) Discuss the convergence of the series $\sum \frac{1}{\sqrt{n^3 + 1}}$.

(OR)

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

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

(OR)

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

SECTION – C

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

16. State and prove Triangle inequalities.
17. If $(a_n) \to a$ and $(b_n) \to b$, prove that $(a_n b_n) \to ab$.
18. State and prove Cauchy's first limit theorem.
19. State and prove Cauchy's General Principle of Convergence.
20. State and prove Leibnitz Test.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
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. Greatest Height attained by a particle is _____.
   a) $\frac{u^2 \sin^2 \alpha}{2g}$ b) $\frac{u^2 \cos^2 \alpha}{2g}$ c) $\frac{2g}{u^2 \sin^2 \alpha}$ d) $\frac{2g}{u^2 \cos^2 \alpha}$
2. Time of flight of a particle is _____.
   a) $\frac{u \cos \alpha}{g}$ b) $\frac{2u \sin \alpha}{g}$ c) $\frac{u \cos^2 \alpha}{g}$ d) $\frac{u \sin^2 \alpha}{g}$
3. Two bodies are said to _____when the direction of motion of each before impact is along the common normal at the point where they touch.
   a) impinge obliquely b) collide obliquely
   c) impinge directly d) none of these
4. The common normal at the point of contact is called the _____.
   a) line of impact b) straight line
   c) curved line d) none of these
5. The _____ of the oscillation is the number of complete oscillations that the particle makes in one second.
   a) Period b) Frequency c) SHM d) none of these
6. Period of Simple Harmonic Motion is _____.
7. Radial component of acceleration is_____.
8. Transverse component of velocity is _____.
9. If I is the M.I. of a body about any axis, I_G is its M.I. about a parallel axis through G, then I = _____.
10. If m is the mass of a particle and r is its perpendicular distance from a given line, then mr^2 is called _____ of the particle about the line.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) A stone is thrown with a velocity of 39.2 m/sec at 30^0 to the horizontal. Find at what times it will be at a height of 14.7 m.($g = 9.8$ m/sec^2). **(OR)**

    b) A particle is projected at an angle α with a velocity u and it strikes up an inclined plane of inclination β at right angles to the plane. Prove that $\cot \beta = 2 \tan (\alpha - \beta)$.

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

    (OR)

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

13. a) If the displacement of a moving point at any time be given by the equation of the form $x = a \cos \omega t + b \sin \omega t$, show that the motion is a simple harmonic motion.

    (OR)

    b) Show that the energy of a system executing S.H.M.is proportional to the square of the amplitude and of frequency.

14. a) Find the Pedal equation of a circle where pole is at any point.

    (OR)

    b) Find the formula in polar co-ordinates of the perpendicular from the pole on the tangent in a central orbit.

15. a) Find the Moment of Inertia of a uniform rod.

    (OR)

    b) Find the Moment of Inertia of a rectangular lamina.

SECTION – C

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

16. Prove that the path of a projectile is a parabola.
17. Find the loss of kinetic energy due to direct impact of two smooth spheres.
18. Discuss the composition of two SHM of the same period in two perpendicular directions.
19. Derive the Differential equation of a central orbit.
20. Find the Moment of Inertia of Uniform Circular Disc.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
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 $\mathbb{R}[x]$, let S = {1, x, x^2, x^3}, then L(S) = _____.
   a) $\mathbb{R}[x]$ b) $V_3(\mathbb{R})$
   c) S d) set of all polynomials of degree ≤ 3
2. The norm of the vector (1,2,3) in $V_3(\mathbb{R})$ with standard inner product is _____.
   a) 6 b) 14 c) $\sqrt{14}$ d) 1
3. A square matrix A is said to be idempotent if _____.
   a) $A^2 = 0$ b) $A^2 = A$ c) $A^2 = I$ d) $A^2 = A^{-1}$
4. The product of the eigen values of $\begin{pmatrix} -3 & 3 \\ -2 & 4 \end{pmatrix}$ is _____.
   a) –6 b) 6 c) 0 d) -12
5. The quadratic form of the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ is _____.
   a) $x^2 + y^2$ b) $2xy$ c) $x^2 + 2xy$ d) $(x+y)^2$
6. Define Homomorphism.
7. Define Orthonormal set.
8. Define Non-singular matrix.
9. Define Characteristic equation.
10. Define Symmetric bilinear form.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) Show that the map $T : \mathbb{R}^2 \to \mathbb{R}^2$ defined by T(a,b) = (2a – 3b, a + 4b) is a linear transformation.

(OR)

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

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

(OR)

b) If S is any subset of V then prove that $S^{\perp}$ is a subspace of V.

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

(OR)

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

14. a) Show that the system of equations $x+2y+z=11, 4x+6y+5z=8, 2x+2y+3z=19$ is inconsistent.

(OR)

b) Find the sum of the squares of the eigen values of

$A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$

15. a) Find the linear transformation $T: V_3(\mathbb{R}) \to V_3(\mathbb{R})$ determined by the matrix $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$ with respect to the standard basis $\{e_1, e_2, e_3\}$.

(OR)

b) Reduce the quadratic form $x_1^2 + 4x_1x_2 + 4x_1x_3 + 4x_2^2 + 16x_2x_3 + 4x_3^2$ to the diagonal form.

SECTION – C

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

16. State and Prove the Fundamental theorem of homomorphism on Vector space.

17. Let V be the set of all polynomials of degree ≤ 2 together with the zero polynomial. In V, an inner product is defined as $\langle f, g \rangle = \int_{-1}^{1} f(x)g(x)dx$. Apply gram-Schmidt process to construct an orthonormal basis for V with basis $\{1, x, x^2\}$.

18. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & -1 \\ 2 & 1 & 3 \end{bmatrix}$ using elementary operations.

19. State and Prove Cayley-Hamilton theorem.

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

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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. Find the invariant point of the transformation $\omega = \frac{1}{Z-2i}$ =____

   a) i b) $-i$ c) 1 d) $2i$

2. An entire function is analytic at _____

   a) every point of C b) every point of R
   c) some point of C d) some point of R

3. If C is the unit circle $|Z| = 1$ then $\int_C \frac{e^Z}{Z} dZ =$ _____

   a) πi b) $2\pi i$ c) $-2\pi i$ d) 1

4. The singular points of $\frac{1}{z(z-i)}$ are _____

   a) 0, i b) 0, $-i$ c) 1, i d) i ,$-i$

5. If $f(Z) = \cot Z$ then Res $\{f(z);0\}$ is _____

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

6. Define Bilinear transformation.
7. Define Entire functions.
8. State Cauchy's theorem.
9. Define Singular points.
10. State Fundamental theorem of algebra.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) Show that the transformation $\omega = \frac{2z+3}{z-4}$ maps the circle $z\bar{z} - 2(z+\bar{z}) = 0$ into a straight line given by $2(\omega+\bar{\omega})+3=0$.

(OR)

b) Find the bilinear transformation which maps the points $z_1 = 2, z_2 = i, z_3 = -2$ onto $\omega_1 = 1, \omega_2 = i, \omega_3 = -1$ respectively.

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

(OR)

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

13. a) Show that $\int_c |z|^2 dz = -1+i$ where C is the square with vertices 0(0,0) , A(1,0), B(1,1) and C(0,1)

(OR)

b) State and prove Liouville's theorem.

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

(OR)

b) Determine and classify the singular points of

i) $f(z) = \frac{z}{e^z - 1}$ (ii) $f(z) = \sin(1/z)$

15. a) State and prove Cauchy's Residue theorem.

(OR)

b) Prove that $\int_0^\infty \frac{\cos x}{1+x^2} dx = \frac{\pi}{2e}$

SECTION – C

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

16. Prove that any bilinear transformations preserves cross ratio.

17. State and prove Cauchy-Riemann equations.

18. State and prove Cauchy's Integral formula.

19. State and prove Taylor's theorem.

20. Using the method of Contour integration evaluate

$$\int_{-\infty}^{\infty} \frac{\cos x}{(x^2+a^2)(x^2+b^2)} dx, (a>b>0)$$

VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST
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[Affiliated to Madurai Kamaraj University]
B.Sc. Mathematics Degree (Semester) Examinations, April 2018
Part – III : Core 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. The maximum degree of any point in a graph with p points is _____.
   a) p b) p-1 c) 0 d) 1- p
2. A closed walk of odd length contains a _____.
   a) path b) trial c) triangle d) cycle
3. Which of the following is a correct statement?
   a) In a tree, every vertex is of even degree
   b) Every tree, is a bipartite graph
   c) Every tree, is disconnected
   d) In a tree, every point is a cut point
4. The graph K_5 –e is _____.
   a) non-planar b) planar c) disconnected d) none
5. The chromatic number of K_4 is _____.
   a) 4 b) 1 c) 3 d) 2
6. Define the Complete graph.
7. The partition P = (7,6,5,4,3,2) is graphical (or) not?
8. Define Hamiltonian graph.
9. Define the Crossing number.
10. State the Five colour theorem.

SECTION – B

Answer ALL Questions: (5 × 7 = 35)

11. a) Prove that in any graph G the number of points of odd degree is even. **(OR)**
    b) Prove that $\alpha+\beta = p$.
12. a) Prove that a graph G with p points and $\delta = (p-1)/2$ is connected. **(OR)**
    b) Prove that any graph G, $K \le \lambda \le \delta$.
13. a) If G is a graph with $p \ge 3$ vertices and $8 \ge p/2$ .Then prove that G is a Hamiltonian.
    (OR)
    b) Prove that every tree has a centre consisting of other one point or two adjacent points.
14. a) Find the number of perfect matching in the complete bipartite graph $K_{n, n}$.
    (OR)
    b) Prove that K_5 is a non-planar.
15. a) The following statements are equivalent for any graph G.
    i) G is a 2-colourable ii) G is a bi-partite
    iii) Every cycle of G has even length
    (OR)
    b) State and prove Dirac's theorem.

SECTION – C

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

16. Prove that the maximum number of lines among all p point graphs no triangle is $(P^2/4)$.
17. Prove that a partition P, $(d_1, d_2 \ldots\ldots d_p)$ of an even number into parts with $p-1 \ge d_1 \ge d_2 \ge \ldots \ge d_p$ is graphical *iff* the modified partition
    $P' = (d_2-1, d_3-1, \ldots\ldots d_{d1+1}-1, d_{d1+2} \ldots\ldots d_p)$ is graphical.
18. Show that the Peterson graph is non- Hamiltonian.
19. State and prove that Hall's marriage theorem.
20. State and prove the five colour theorem.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
Part – III : Core 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. Define Lead time.
2. Write the formula of EOQ problem for the optimum order quantity Q^o.
3. The server utilization factor is known as _____.
4. Write the formula of Expected number of items.
5. What is Critical Path?
6. Find the total for the certain network. 1 $\longrightarrow$ 2

   E1=20 E2=39

   L1=38 L2=57

   a) 38 b) 57 c)18 d)19
7. _____ is the time for which machine does not have a job to the process.
8. _____is obtained by adding the idle time for either job to the processing time for that job.
9. What is the replacement problem?
10. Total cost =_____.

SECTION – B

Answer ALL Questions: **(5 × 7 = 35)**

11. a) An oil engine manufacturer purchase lubricants at the rate at Rs.42 per piece from a vendor. The requirement of these lubricants is 1800 per year, what should be the order quantity per order if the cost per placement of an order is Rs.16 and inventory carrying charges per rupee per year is only 20 paise.

(OR)

b) The demand for an item in a company is 18,000 units per year, and the company can produce the items at a rate of Rs.3,000 per month. The cost of one setup is Rs. 500 and the holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per month. Determine

i) optimum production batch quantity and the number of strategies

ii) optimum cycle time and production time.

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

(OR)

b) Obtain the steady state probabilities for the model (M/M/1) : (N/FIFO).

13. a) In a boiler overhauling project following activities to be performed.

A. Inspection of boiler by boiler Engineer and preparation of list of parts to be replaced/ repaired.
B. Collecting quotation for the parts to be purchased.
C. Placing the orders and purchasing.
D. Dismantling of the defective parts from the boiler.
E. Preparation of necessary instructions of repairs.
F. Repair of parts in the workshop.
G. Cleaning of the various mountings and fittings.

H. Installation of the repaired parts.
I. Installation of purchased parts.
J. Inspection.
K. Trail run.

(OR)

b) A project consists of eight activities with the following relevant information.

i) Draw the PERT network and find out the expected time (T) and completion time.

Activity	Immediate Predecessor	Optimistic	Most likely	Pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D,E	3	6	15
H	F,G	1	2	3

14. a) Let the four 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 is given below.

MACHINES

JOB	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

Determine a sequence of these four jobs that minimizes the total elapsed time (T).

(OR)

b) Write the algorithm of processing to jobs through k machines.

15. a) A firm is considering replacement of machineswhose cost price is Rs.12,200 and the scrapvalue Rs.200 the running (maintaince and operating) cost in rupees are found from experience to be as follows:

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

When should the machines be replaced?

(OR)

b) State and prove Group replacement theorem.

SECTION – C

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

16. A machines of produces three products 1,2 and 3 in lots. The shop has a ware house whose total floor area is 4000 sq.m .The relevant data for the three items is given below:

Item	1	2	3
Annual demand (units)	500	400	600
Cost per unit(Rs)	30	20	70
Setup cost per lot (Rs)	800	600	1000
Floor area required(sq.m)	5	4	10

The inventory carrying charges for the shop are 20 % of the average inventory valuation per annum for each item. If no stock hours are allowed and at no time can the warehouse capacity be exceed. Determine the optimal lot size for each item.

17. Write brief notes on Birth-Death process.

18. A small project consists of seven activities for which the relevant data are given below.

Activity	Proceedence	Time Duration (Days)
A	-	4
B	-	7
C	-	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

i) Draw the network and find the project completion time.
ii) Calculate total float for each of the activities.
iii) Draw the time scaled diagram.

19. A book blinder has one printing press, one binding machines and the menu scraps 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 (hrs)	30	120	50	20	90	100
Binding time (hrs)	80	100	90	60	30	10

20. 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. Machines B which has the same capacity as A, cost Rs.2500 but will have running cost of Rs.1200 per year for 6 years increasing by Rs.200 per year thereafter if money is worth 10% per year, which machine should purchased ? [Assume that the machine will eventually be sold for scrub at a negligible price].

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B.A./B.Sc./B. Com. Degree (Semester) Examinations, April 2018
Part – IV : NME 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 of 12, 14, 16 is
   a) 12 b) 14 c) 16 d) None of these
2. The median for the set of numbers 6, 8, 2, 5, 9, 5, 5
   a) 5 b) 9 c) 6 d) 8
3. The mode for the set of numbers 2, 6, 1, 2, 2, 3, 4, 5 is
   a) 1 b) 4 c) 5 d) 2
4. The range of the marks 20, 22, 27, 30, 40, 48, 45, 32, 31, 35 of 10 students is
   a) 27 b) 26 c) 30 d) 40
5. The variance of the first 4 natural numbers (1, 2, 3, 4) is
   a) 1 b) 1.25 c) 1.50 d) 4

Give short Answer:

6. The square of standard deviation is called _____.
7. Optimum feasible solution for a linear programming problem is obtained at one of the corner points. [True / False]
8. When total demand is equal to total supply the transportation problem is said to be _____.
9. The assignment problem is a special case of transportation problem. [True / False]
10. Write down the Quartile deviation formula.

SECTION – B

Answer ALL Questions: **(4 × 10 = 40)**

11. a) Calculate the A.M. 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) The four parts of a distribution are as follows

	Frequency	Mean
Part 1	50	61
Part 2	100	70
Part 3	120	80
Part 4	30	83

Find the mean of the entire distribution.

12. a) show that (i) The A.M. of the first n natural numbers is $\frac{1}{2}(n + 1)$

ii) The weighted A.M. of first n natural numbers whose weights are equal to the corresponding numbers is equal to $\frac{1}{3}(2n + 1)$.

(OR)

b) Mean weight of 800 students in two classes A and B is 50 Kgs. These are 45 students in class A. The mean weight of the students in class B is 48. Find the mean weight of the students in class A.

13. a) From the following data calculate the percentage of tenants paying monthly rent (i) more than 105 (ii) between 130 and 190.

Monthly rent	No. of tenants	Monthly rent	No. of tenants
60-80	18	140-160	88
80-100	21	160-180	75
100-120	45	180-200	18
120-140	85	Total	350

(OR)

b) Use Vogel's approximation method to obtain an initial basic feasible solution of the transportation problem

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

14. a) Obtain all the basic solutions to the following system of linear equation

$x_1 + 2x_2 + x_3 = 4$

$2x_1 + x_2 + 5x_3 = 5$

(OR)

b) Prove: $\sigma^2 = s^2 - d^2$ where $d = \bar{x} - A$.

SECTION – C

Answer any TWO Questions: **(2×12½ =25)**

15. Find the arithmetic mean $\bar{x}$, standard deviation σ and percentage of cases, within $\bar{x} + \sigma$, $\bar{x} + 2\sigma$ and $\bar{x} + 3\sigma$ in the following frequency distribution

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

16. Use the graphical method to solve the following L.P.P.

Maximize $Z = 2x_1 + 3x_2$ subject to the constraints.

$x_1 + x_2 \le 30; \quad x_1 - x_2 \ge 0 \quad x_2 \ge 3$

$0 \le x_1 \le 20$ and $0 \le x_2 \le 12$.

17. The following table gives the monthly wages of workers in a factory. Compute (i) Standard deviation (ii) quartile deviation and (iii) coefficient of variation

Monthly wages	No. of workers	Monthly wages	No. of workers
125 - 175	2	375 - 425	4
175 - 225	22	425 - 475	6
225 - 275	19	475 - 525	1
275 - 325	14	525 - 575	1
325 - 375	3	Total	72

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
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. The product of two numbers is 2028 and their H.C.F. is 13. The number of such pairs is
   a) 1 b) 2 c) 3 d) 4
2. Which of the following are in descending order of their values?
   a) $\frac{5}{9},\frac{7}{11},\frac{8}{15},\frac{11}{17}$ b) $\frac{5}{9},\frac{8}{15},\frac{11}{17},\frac{7}{11}$ c) $\frac{11}{17},\frac{7}{11},\frac{8}{15},\frac{5}{9}$ d) $\frac{11}{17},\frac{7}{11},\frac{5}{9},\frac{8}{15}$
3. The value of (1+0.1+0.01+0.001) is
   a) 1.001 b) 1.011 c) 1.003 d) 1.111
4. Find the average of the first 40 natural numbers.
   a) 20.5 b) 21.5 c) 22.5 d) 23.5
5. 2 is what percent of 50?
   a) 2% b) 4% c) 6% d) 8%

Give Short Answer:

6. Write down the formula for gain % = _____.
7. If $\frac{A}{3}=\frac{B}{4}=\frac{C}{5}$, then A:B:C is _____.
8. If $x=1+\sqrt{2}$ and $y=1-\sqrt{2}$, the value of (x^2+y^2) = _____.
9. The ages of Ramesh and Jothi are in the ratio 3:1. Fifteen years hence, the ratio will be 2:1. Their present ages are _____.
10. Write down the formula for loss% = _____.

SECTION – B

Answer ALL Questions: **(4 × 10 = 40)**

11. a) i) Find the H.C.F. of 108, 288 and 360.

ii) Arrange the fractions $\frac{17}{18}, \frac{31}{36}, \frac{43}{45}, \frac{59}{60}$ in the ascending order.

(OR)

b) i) If $\sqrt{2} = 1.4142$, find the value of $\left(\frac{\sqrt{2}}{2+\sqrt{2}}\right)$.

ii) Evaluate $\sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+\sqrt{225}}}}}$.

12. a) i) The average of four consecutive even numbers is 27. Find the largest of these numbers.

ii) The product of the ages of Gowtham and Rajeshwari is 240. If twice the age of Rajeshwari is more than Gowtham's age by 4 years, what is Rajeshwari's age?

(OR)

b) i) When the price of a product was decreased by 10%, the number sold increased by 30%. What was the effect on the total revenue?

ii) A person incurs 5% loss by selling a watch for Rs.1140. At what price should the watch be sold to earn 5% profit?

13. a) i) Find the least number exactly divisible by 12,15,20 & 27.

ii) Evaluate i) $35 \div 0.07$ ii) $2.5 \div 0.0005$ iii) $136.09 \div 43.9$

(OR)

b) The H.C.F and L.C.M. of two numbers are 11 and 385 respectively. If one number lies between 75 and 125, then what is that number?

14. a) i) If $x : y = 3 : 4$, find $(4x+5y) : (5x-2y)$.

ii) Simplify: $\frac{0.05 \times 0.05 \times 0.05 + 0.04 \times 0.04 \times 0.04}{0.05 \times 0.05 - 0.05 \times 0.04 + 0.04 \times 0.04}$

(OR)

b) i) Find the average of all prime numbers between 30 and 50.

ii) Divide Rs.1162 among A, B, C in the ratio 35:28:20.

SECTION – C

Answer any TWO Questions: **(2×12½ =25)**

15. a) An article was sold for Rs.144. If the percentage of profit was numerically equal to the cost price, how much was the cost of the article?

b) If $a = \frac{\sqrt{5}+1}{\sqrt{5}-1}$ and $b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$ find the value of $\left[\frac{a^2+ab+b^2}{a^2-ab+b^2}\right]$.

16. a) Find the L.C.M. of 22,54,108, 135 and 198.

b) Find the value of $\left[35.7 - \left[3 + \frac{1}{3+\frac{1}{3}}\right] - \left[2 + \frac{1}{2+\frac{1}{2}}\right]\right]$.

17. a) Find (i) The fourth proportional to 4, 9, 12

(ii) The third proportional to 16 and 36.

(iii) The mean proportional between 0.08 and 0.18.

b) A, B and 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?

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018
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 qualitative characteristics of a population are called
   a) Frequencies b) attributes c) Positive classes d) None
2. For any three given attributes total number of positive class frequencies is
   a) 2^3 b) 3^3 c) 3^2 d) 7
3. The following are the ultimate class frequencies of two attributes A and B. (AB) = 975; (α B) = 100; (A β) = 25; ($\alpha\beta$) = 950. Then (β) is
   a) 975 b) 875 c) 925 d) 950
4. Given n attributes, the total number of class frequencies is
   a) 2^n b) 3^n c) 2^n-1 d) None
5. Yule's coefficient Q and the coefficient of colligation Y are related by
   a) $Q = \frac{1+y^2}{2y}$ b) $Q = \frac{2y}{1+y^2}$ c) $Q = \frac{y}{1-y^2}$ d) None

Give Short Answer:

6. The class frequencies of type (A), (B), (AB), (ABC) are known as _____.
7. A and B are _____ if $(AB) = \frac{(A)(B)}{N}$.
8. If A and B are perfectly associated, then (AB) = _____.
9. The classes of highest order are called _____.
10. A set of class frequencies is said to be _____ if none of them is negative.

SECTION – B

Answer ALL Questions: **(4 × 10 = 40)**

11. a) Given (A) = 30; (B) = 25; (α) =30; $(\alpha\beta) = 20$

Find (i) N (ii) (β) (iii) (AB) (iv) (A β) (v) (α B)

(OR)

b) Given that (A) = (α) = (B) = (β) = $\frac{N}{2}$

Show that (i) (AB) = $(\alpha\beta)$

(ii) (A β) = (α B)

12. a) There were 200 students in a college whose results in the first semester, second semester and the third semester are as follows. 80 passed in the first semester, 75 passed in the second semester, 96 passed in the third semester, 25 passed in all the three semesters, 46 failed in all the three semesters, 29 passed the first two and failed in the third semester, 42 failed in the first two semesters, but passed in the third semester. Find how many students passed in at least two semesters.

(OR)

b) Given (ABC) = 149, (AB γ) = 738; (A β C) = 225,

$(A\beta\gamma) = 1196$, (α BC) = 204; (α B γ) = 1762, (α β C) = 171,

$(\alpha\beta\gamma) = 21842$. Find (A), (B), (C), (AB), (AC), (BC) and N.

13. a) In a very hotly fought battle 70% of the soldiers atleast lost an eye 75% atleast lost an ear, 80% atleast lost an arm and 85% atleast lost a leg. How many at least must have lost all the four?

(OR)

b) A company produces tube lights and conducts a test on 5000 lights for production defects of frames (F), chokes (C), starters (S) and tubes (T). The following are the records of defects,

(F) = 130,	(C) = 120,	(S) = 115;	(T) = 86;
(FC) = 100,	(CS) = 130,	(ST) = 75;	(FT) = 60;
(CT) = 54,	(FS) = 37,	(FCS) = 90,	(CST) = 85,
(FST) = 112,	(FCT) = 108,	(FCST) = 5	

14. a) Find the limits of (BC) for the following available data. N = 125; (A) = 48; (B) = 62; (C) = 45; (A β) = 7 and (A γ) = 18.

(OR)

b) Find the greatest and least values of (ABC) if (A) = 50, (B) = 60, (C) = 80, (AB) = 35; (AC) = 45 and (BC) = 42.

SECTION – C

Answer any TWO Questions: **(2×12½ =25)**

15. From the following data compare the association between marks in Maths and Chemistry in Madurai Kamaraj University (MKU) and Manonmaniam Sundaranar University (MSU)

University	**MKU**	**MSU**
Total Number of candidates	200	1600
Pass in Maths	80	320
Pass in Chemistry	40	90
Pass in Maths & Chemistry	20	30

16. Show that for n attributes A_1, A_2, ...A_n.

$(A_1, A_2....A_n) \geq (A_1)+(A_2)+....+(A_n)$ - (n-1) N, where N is the total number of observations.

17. 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.

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B.Sc. Mathematics Degree (Semester) Examinations, April 2018

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. Any distributive lattice is a

   a) Toset b) Modular lattice

   c) Boolean Algebra d) Chain

2. In the set of real numbers R we define $a \rho b$ iff a^3=b. Then ρ is

   a) Reflexive b) Symmetric c) Transitive d) None

3. M_5 is

   a) modular b) not modular c) distributive d) none

4. Which one of the following is a distributive lattice?

   a) N_5 b) $(\wp(S), \subseteq)$ c) M_5 d) None

5. Which one of the following is the idempotent law?

   a) a + a = a b) a + 1 = 1 c) a + (a * b) = a d) (a')' = a

Give Short Answer:

6. In a Boolean algebra, $(a \vee b)'$ = _____.

7. In any lattice, if $a \leq b$, then $a \vee b$ = _____.

8. Any poset in which any two elements are comparable is called a _____.

9. Any modular lattice is a distributive lattice. [True / False]

10. Any chain is a distributive lattice. [True / False]

SECTION – B

Answer ALL Questions: **(4 × 10 = 40)**

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

(OR)

b) Prove: Let L be a lattice and a, b, c, d $\in$ L.
Then $a \le b$ and $c \le d \Rightarrow$
i) $a \vee c \le b \vee d$ and
ii) $a \wedge c \le b \wedge d$

12. a) Prove: In any lattice,
L_5: $a \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)$ and
L_5': $a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)$ are equivalent.

(OR)

b) Prove: The lattice of normal subgroups of any group is a modular lattice.

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

(OR)

b) Prove: Let a be any element of a Boolean algebra B. Then
i) if $a + x = 1$ and $a * x = 0$ then $x = a'$.
ii) $(a')' = a$.
iii) $0' = 1$ and $1' = 0$

14. a) Draw the lattice diagram of D_{70}, the Boolean algebra of all divisiors of 70. Find its atoms. Show that $D_{70} \cong \left(\wp\left(\{1,2,3\}\right), \subseteq\right)$

(OR)

b) Prove that in any lattice L,
$a \wedge (b \vee c) \ge (a \wedge b) \vee (a \wedge c)$ and
$a \vee (b \wedge c) \le (a \vee b) \wedge (a \vee c) \quad \forall a, b, c \in L.$

SECTION – C

Answer any TWO Questions: **(2×12½ =25)**

15. Prove: Let ρ be an equivalence relation defined on a set S. Then.

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

ii) Any two distinct equivalence classes are disjoint.

iii) S is the union of all the equivalence classes.

16. Let L be any non-empty set with two binary operations $\vee$ and $\wedge$ defined on it and satisfying L_1, L_2, L_3, L_4, L_1', L_2', L_3' and L_4'. Then prove that L is a lattice relative to a suitable definition of $\le$ and $\vee$ and $\wedge$ are the l.u.b. and g.l.b in this lattice.

17. Draw the lattice diagram of D_{210} the Boolean algebra of all divisors of 210. Find its atoms. Show that $D_{210} \cong \left(\wp\left(\{1,2,3,4\}\right) \subseteq\right)$.