MATHEMATICS
B.Sc. Part –I (SEMESTER –I)
Paper – I (COMPLEX NUMBERS AND ALGEBRA)

UNIT – 1: ELEMENTARY FUNCTIONS OF COMPLEX VARIABLES

10 lectures

    1.1 DeMoivre's Theorem.

    1.2 n^{th} roots of unity.

    1.3 Expansion of $\cos n\theta, \sin n\theta$.

    1.4 Direct circular functions and hyperbolic functions.

    1.5 Relations between circular and hyperbolic functions.

    1.6 Some basic properties of hyperbolic functions.

    1.7 Inverse circular and hyperbolic functions.

    1.8 Examples.

UNIT – 2: MATRICES   10 lectures

    2.1 Definitions of Hermitian and Skew Hermitian matrices.

    2.2 Rank of a Matrix.

    2.3 Eigen values, Eigen vectors and the characteristic equation of a matrix.

    2.4 Cayley Hamilton theorem and its use in finding inverse of a matrix.

    2.5 System of linear homogeneous equations.

    2.6 System of linear non-homogeneous equations.

        1.6.1 Condition for consistency.

        1.6.2 Nature of the general solution.

    2.7 Examples.

UNIT - 3 QUADRATIC FORMS AND CONGRUENCE OF MATRICES

10 lectures

    3.1 Quadratic form (Definition)

    3.2 Matrix of a quadratic form with simple examples

    3.3 Quadratic forms corresponding to a symmetric matrix with examples

    3.4 Linear transformations

    3.5 Congruence of Matrices and Congruence of Quadratic form

    3.6 Reduction of Real Quadratic form with examples.

UNIT - 4: GROUPS   10 lectures

    4.1 Semigroups, Monoids (Definitions with example)

    4.2 Definition of group and example

    4.3 Abelian Group, Finite and Infinite Group

    4.4 Elementary properties of Group

        If $\langle G, * \rangle$ is group then

        a) Identity element in G is unique

        b) For every $a \in G$ has unique inverse in G

        c) For every $a \in G, (a^{-1})^{-1} = a$

        d) For all $a, b \in G, (a * b)^{-1} = b^{-1} * a^{-1}$(Reversal Law)

        e) If $a, b, c \in G$ then

            i) $a * b = a * c \Rightarrow b = c$ (Left Cancellation Law)

            ii) $b * a = c * a \Rightarrow b = c$ (Right Cancellation Law)

REFERENCE BOOKS

1) Algebra for B.Sc. Part - I (Sem-I) - Dr. S. B. Kalyanshetti, Dr. S. D. Thikane, S. R. Bhosale, N. I. Dhanshetti, S. R. Patil, Shraddha Prakashan, Solapur.
2) Algebra for B.Sc. Part - I (Sem-I) - L. G. Kulkarni, Dr. B. P. Jadhav, Kubde, Phadke Prakashan, Kolhapur.
3) Algebra and Complex variables - H. V. Kumbhojkar, Dattar and Bapat, Nirali Prakashan.
4) A Text Book of Algebra and Geometry - J. D. Yadhav, S. A. Alandkar, N. I. Dhanshetti, Published by Shivaji University mathematics Society (SUMS),2003.
5) Modern Algebra - A. R. Vasishtha.
6) A Text Book Of Matrices - Shanti Narayan.

Paper – II (CALCULUS)

UNIT – 1: SUCCESSIVE DIFFERENTATION   8 lectures
    1.1 n^{th} order derivative of standard functions : $y = (ax + b)^m$,

$$y = e^{ax}, y = a^{mx}, y = \frac{1}{ax+b}, y = log(ax + b), y = sin(ax + b)),$$

$$y = cos(ax + b), y = e^{ax} sin(bx + c), y = e^{ax} cos(bx + c)$$

    1.2 Leibnitz's Theorem.
    1.3 Examples.

UNIT - 2 : SERIES EXPANSIONS AND INDETERMINATE FORMS
                                      10 lectures
    2.1 Taylor's Theorem.
    2.2 Maclaurin's Theorem.
    2.3 Taylor's Series
    2.4 Maclaurin's Series
    2.5 Series expansions of some standard functions: e^x,
        $\sin x, \cos x, \tan x, (1 + x)^n, \log (1 + x)$
    2.6 Indeterminate forms : $\frac{0}{0}, \frac{\infty}{\infty}, 0.\infty$
    2.7 L'Hospitals Rule (Statement only).

UNIT – 3: CURVATURE   10 lectures
    3.1 Definition of Radius of Curvature.
    3.2 Curvature of a circle.
    3.3 Radius of Curvature for Intrinsic equations.
    3.4 Radius of Curvature for Cartesian equations.
    3.5 Radius of Curvature for Parametric equations.
    3.6 Radius of Curvature for Polar equations.

UNIT – 4: FUNCTIONS OF TWO VARIABLES   12 lectures
    4.1 Functions of two variables.
    4.2 Limit of a function of two variables.
    4.3 Continuity of a function of two variables.
    4.4 Partial derivatives of first order.

4.5 Partial derivatives of Higher order.
4.6 Total derivative
4.7 Composite function.
4.8 Total derivative of Composite function.
4.9 Implicit function.
4.10 Homogeneous functions of two variables.
4.11 Euler's Theorem on Homogeneous functions of two variables.

REFERENCE BOOKS

1) Calculus for B.Sc. Part - I (Sem – I) - Dr. S. B. Kalyanshetti, Dr. S. D. Thikane, S. R. Bhosale, N. I. Dhanshetti, S. R. Patil, Shraddha Prakashan, Solapur.
2) Calculus for B.Sc. Part - I (Sem – I) - L. G. Kulkarni, Dr. B. P. Jadhav, Kubde, Phadke Prakashan, Kolhapur.
3) Calculus and Differential equations - H. V. Kumbhojkar, Dattar and Bapat, Nirali Prakashan.
4) A Text Book of Calculus and Differential equations - H. T. Dinde, A. D. Lokhande, published by Shivaji University Mathematics society, Kolhapur.
5) Differential Calculus - Shanti Narayan

MATHEMATICS

B.Sc. Part –I (SEMESTER –II)
Paper – III (GEOMETRY)

UNIT – 1: CHANGE OF AXIS   9 lectures
  1.1 Translation.
  1.2 Rotation.
  1.3 Translation and Rotation.
  1.4 Rotation and then Translation.
  1.5 Invariants, Basic Theorems.

UNIT – 2: POLAR COORDINATES   10 lectures
  2.1 Relation between Cartesian and Polar coordinates.
  2.2 Distance formula and area of a triangle.
  2.3 Polar equations of a straight line:
        2.3.1 Joining two lines.
        2.3.2 Normal form.
        2.3.3 Line parallel and perpendicular to the initial line.
        2.3.4 General equation.
  2.4 Polar equations of a circle :
        2.4.1 Centre – Radius form.
        2.4.2 Centre at the pole.
        2.4.3 Passing through the pole and touching the polar axis at
                the pole.
        2.4.4 Passing through the pole and with centre on the initial
                line.
        2.4.5 Passing through the pole and the diameter through pole
                making an angle with initial line.
  2.5 Equation of chord, tangent and normal to the circle
        $r = 2a\cos\theta$.
  2.6 Polar equations of a conic in the form $\frac{l}{r} = 1 \pm e\cos\theta$.
  2.7 Polar equations of a conic in the form $\frac{l}{r} = 1 \pm e\cos(\theta - \alpha)$..
  2.8 Chord, Tangent and normal of a conic.

UNIT – 3: THE SPHERE   10 lectures
  3.1 Equations in different forms.
        3.1.1 Centre – Radius form.
        3.1.2 General form.
        3.1.3 Diameter form.
        3.1.4 Intercept form.
  3.2 Intersection of a sphere with straight line and a plane.
  3.3 Power of a point and radical plane.
  3.4 Tangent plane and condition of tangency.
  3.5 Equations of a circle.
  3.6 Intersection of (i) two sphere, (ii) a sphere and plane.
  3.7 Orthogonality of two spheres

UNIT– 4: CONE   9 lectures
  4.1 Definitions of Cone, Vertex, Generator.
  4.2 Equation of a Cone with vertex at a point (x_1, y_1, z_1).

4.3 Equation of a Cone with vertex at origin.

4.4 Right circular cone and equation of a right circular cone.
4.5 Enveloping cone and equation of an enveloping cone.
4.6 Equation of a tangent plane.
4.7 Condition of tangency.

REFERENCE BOOKS -

1) Geometry for B.Sc. Part – I (Sem II) - Dr. S. B. Kalyanshetti, Dr. S. D. Thikane, S. R. Bhosale, N. I. Dhanshetti, S. R. Patil, Shraddha Prakashan, Solapur.
2) Geometry for B.Sc. Part – I (Sem II) - L. G. Kulkarni, Dr. B. P. Jadhav, Kubde, Phadke Prakashan, Kolhapur.
3) Algebra and Complex variables - H. V. Kumbhojkar, Dattar and Bapat, Nirali Prakashan.
4) A Text Book of Algebra and Geometry - J. D. Yadhav, S. A. Alandkar,
5) N. I. Dhanshetti, Published by Shivaji University mathematics Society (SUMS), 2003

Paper – IV (DIFFERENTIAL EQUATIONS)

UNIT – 1: DIFFERETIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE   10 lectures

1.1 Introduction.

1.2 Exact differential equations.

    1.2.1 Necessary and sufficient condition for exactness.

1.3 Integration factors with Rules.

1.4 Linear Equation $\frac{dy}{dx} + Py = Q$

1.5 Bernoulli's Equation $\frac{dy}{dx} + Py = Qy^n$

1.6 Orthogonal Trajectories.

    1.6.1 Definition of trajectory of the given family.

    1.6.2 Definition of orthogonal trajectory.

    1.6.3 Rule for finding the orthogonal trajectory to a given family of curves when its equation is given in 1) Cartesian 2)Polar co-ordinates

    1.6.4 Examples

UNIT – 2: LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS $f(D)y = X$ 18 lectures

2.1 Introduction $f(D)y = X$.

2.2 General (Complete) Solution of $f(D)y = X$.

2.3 Solution of $f(D)y = 0$.

2.4 Solution of Auxiliary equation with real and non – repeated roots.

2.5 Solution of Auxiliary equation with real and repeated roots.

2.6 Solution of Auxiliary equation with imaginary (non – repeated & repeated) roots.

2.7 Solution of $(D)\, y = X$, where X is of the form.

    2.7.1 e^{ax}, a is constant.

    2.7.2 $\sin(ax)$ and $\cos(ax)$.

    2.7.3 x^m, m is positive integer.

    2.7.4 $e^{ax}.V$, V is a function of x.

    2.7.5 xV, V is a function of x.

UNIT – 3: EQUATIONS OF FIRST ORDER BUT NOT OF FIRST DEGREE   6 lectures

    3.1 Equations that can be factorized.

        3.1.1   Equations solvable for p.

    3.2 Equations that cannot be factorized.

        3.2.1   Equations solvable for x.

        3.2.2   Equations solvable for y.

UNIT – 4: CLAIRAUT'S EQUATION   6 lectures

    4.1 Clairaut's form.

    4.2 Method of solution.

    4.3 Equations reducible to Clairaut's form.

    4.4 Special forms reducible to Clairaut's form.

REFERENCE BOOKS

1) Differential equations for B.Sc. Part – I (Sem II) - Dr. S. B.
2) Kalyanshetti, Dr. S. D. Thikane, S. R. Bhosale, N. I. Dhanshetti, S. R. Patil, Shraddha Prakashan, Solapur.
3) Differential equations for B.Sc. Part – I (Sem II) - L. G. Kulkarni, Dr. B. P. Jadhav, Kubde, Phadke Prakashan, Kolhapur.
4) Calculus and Differential equations - H. V. Kumbhojkar, Dattar and Bapat, Nirali Prakashan.
5) A Text Book of Calculus and Differential equations - H. T. Dinde, A. D. Lokhande, published by Shivaji University Mathematics society, Kolhapur.
6) Differential Equations - Diwan & Agashe.
7) Differential Equations – M. L. Khanna, Jai Prakash Nath and Co. Meerut

MATHEMATICS PRACTICAL
B.Sc. - I (Sem. I & Sem II)
Computational Mathematics Laboratory I (CML- I)

EXP. No.	Name of experiment	No. Of Practicals
1	Inverse of matrix by Cayley Hamilton Method	1
2	Eigen values and Eigen vectors of matrix	1
3	a)Solution of system of m linear homogeneous equations in n unknowns	1

	b) Solution of system of m linear nonhomogeneous equations in n unknowns.	
4	Matrix- Linear dependence and independence	1
5	Matrix – Quadratic forms	1
6	Successive Differentiation	1
7	Radius of curvature for Cartesian equations	1
8	Radius of curvature for Parametric equations	1
9	Radius of curvature for Polar equations	1
10	Euler's Theorem on homogeneous fuctions	1
11	Translation and Rotation	1
12	Cartesian and Polar Coordinates, Distance formula, Area of a triangle	1
13	Polar Equation of a circle in different forms, centre and radius of a circle	1
14	Equation of a Sphere in different forms, centre and radius of a Sphere	1
15	Touching Sphere	1
16	Orthogonal Trajectories (Cartesian Coordinates)	1
17	Orthogonal Trajectories (Polar Coordinates)	1
18	Mechanical Applications of Differential equations (Kepler's Law Of Motion)	1
19	Electrical Applications of differential equation	1
20	Simple Harmonic Motion	1

Reference books:-

1) Mathematics paper I –Algebra By Dr. S. B. Kalyanshetti, Dr. S.D. Thikane,S.R. Bhosale, N. I. Dhanshetti, S. R. Patil
(Shradha prakashan, Solapur)

2) Mathematics paper I –Algebra By L. G. Kulkarni, Dr. B. P. Jadhav, Kubde(Phadke Prakashan, Kolhapur)

3) Maths paper II –Calculus By Dr. S. B. Kalyanshetti, Dr. S.D. Thikane,S.R. Bhosale, N. I. Dhanshetti, S. R. Patil
(Shradha prakashan, Solapur)

4) Mathematics paper II –Caculus By L. G. Kulkarni, Dr. B. P. Jadhav, Kubde(Phadke Prakashan, Kolhapur)

5) Engineering Mathematics I-By G.V.kumbhojkar

(C.Jamanadas co.)

6) Geometry for B.Sc. Part - I Sem II - Dr. S. B. Kalyanshetti, Dr. S. D. Thikane, S. R. Bhosale, N. I. Dhanshetti, S. R. Patil, Shraddha Prakashan, Solapur. Exp. No. 11 to 15

7) Geometry for B.Sc. Part - I Sem II - L. G. Kulkarni, Dr. B. P. Jadhav, Kubde, Phadke Prakashan, Kolhapur. Exp. No. 11 to 15

8) A Hand Book Of Computational Mathematics Laboratory - R. B. Kulkarni, Dr. H. T. Dinde Pub. SUMS Kolhapur Exp. No. 18,20.