“ Education for Knowledge, Culture and Science ”

… Shikshanmaharshi Dr. Bapuji Salunkhe

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Department of Mathematics

B.Sc.-I

Semester-I & II

CBCS Syllabus to be implemented from June 2020 Onwards.

B.Sc.Part-I [Semester I]

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks Term end exam	Marks (Internal) Continuous Assessment	Credit
DSC -1003 A	Calculus, Algebra and Geometry	5	3 hours	80	20	4

B. Sc. Part-I [Semester II]

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks Term end exam	Marks (Internal) Continuous Assessment	Credit
DSC -1003 B	Multivariable Calculus & Ordinary Differential Equations	5	3 hours	80	20	4

Core Course Practical in Mathematics- CCPM-I (PR) Total Credit 04

Course code	Title o the course	Instructions Lectures /Week	Duration of term end exam	Marks [End of academic year]	Credit
DSC 1003A	Calculus, algebra and Geometry	4	3 hours	50	4
DSC 1003B	Differential Equations	4	3 hours		

MATHEMATICS-DSC -1003 A
Semester: I
Calculus, Algebra and Geometry
Theory: 60Hours (75 lectures of 48 minutes) - Credits -4 (Marks-100)
Section I: Calculus

Course Outcomes:

After studying this course student will understand and learn about

CO1: Calculate the limit and examine the continuity of a function at a point.

CO2: Understand the consequences of various mean value theorems for differentiable functions.

CO3: Sketch curves in Cartesian and polar coordinate systems.

Unit	Contents	Hours Allotted
1	$\epsilon - \delta$ definition of limit of a real valued function, Limit at infinity and infinite limits; Continuity of a real valued function, Properties of continuous functions, Intermediate value theorem, Geometrical interpretation of continuity, Types of discontinuity; Uniform continuity.	07
2	Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Differentiability and monotonicity, Chain rule of differentiation; Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Geometrical interpretation of mean value theorems; Successive differentiation, Leibnitz's theorem	08
3	Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem infinite form with Lagrange and Cauchy forms of remainder; Indeterminate form.	07
4	Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflexion, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves	08

Recommended Book:

1.Shanti Naryan, Dr. P.K.Mittal, Differential Calculus, S Chand Publications.

2.Hari kishan, Calculus, Atlantic Publication.

3.Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.

4.Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.

Section II: Algebra and Geometry

Course Outcomes:

After studying this course student will understand and learn about
CO1: Familiarize with relations, equivalence relations and partitions.
CO2: Employ De Moivre's theorem in a number of applications to solve numerical problems.
CO3: Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.

Unit	Contents	Hours Allotted
1	Elementary theorems on the roots of an equations including Cardan's method, The remainder and factor theorems, Synthetic division, Factored form of a polynomial, The Fundamental theorem of algebra, Relations between the roots and the coefficients of polynomial equations, Imaginary roots, Integral and rational roots; Polar representation of complex numbers, The *n*th roots of unity, De Moivre's theorem for integer and rational indices and its applications.	08
2	Relations, Equivalence relations, Equivalence classes; Functions, Composition of functions, Inverse of a function; Finite, countable and uncountable sets	**07**
3	Systems of linear equations, Row reduction and echelon forms, Linear independence, The rank of a matrix and applications, Determinants, The inverse of a matrix, Eigen values and eigenvectors, The characteristic equation and the Cayley−Hamilton theorem.	**07**
4	Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy	**08**

Recommended Book:

1. G.V Kumbhojkar and Dr. H. V. Kumbhojkar, Algebra and Geometry, Nirali Prakashan.
2. S.K. Shah and S.C. Garg, A Textbook of Algebra, Vikas Publishing House PVT LTD.
3.Shanti Narayan and P. K. Mittal , A Textbook of Matrices , S. Chand
4.Robert J. T. Bell (1994). *An Elementary Treatise on Coordinate Geometry of ThreeDimensions*. Macmillan India Ltd.
5.D. Chatterjee (2009). *Analytical Geometry: Two and Three Dimensions*. NarosaPublishing House.
6.Leonard Eugene Dickson (2009). *First Course in the Theory of Equations*.

MATHEMATICS-DSC -1003B
Semester: II
Multivariable Calculus & Ordinary Differential equations
Theory: 60 Hours (75 lectures of 48 minutes) - Credits -4 (Marks-100)
Section I: Multivariable Calculus

Course Outcomes: After completing this course, students will understand and learn about

CO1: Learn conceptual variations while advancing from one variable to several variables in calculus.

CO2: Apply multivariable calculus in optimization problems.

CO3: Applications of multivariable calculus tools in physics, economics, optimization, andunderstanding the architecture of curves and surfaces in plane and space etc.

Unit	Contents	Hours Allotted
1	Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Tangent planes, Chain rule, Directional derivatives., Tangent planes and normal lines.	**07**
2	Higher order partial derivatives, Total differential and differentiability, Jacobians, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem for functions of two variables and more variables.	**08**
3	Extreme values : Extreme values of function of two variable, Necessary condition for extreme values, Sufficient condition for extreme values, Lagrange's method of undermined multipliers>	06
4	Vector Calculus: Differentiation of vector, tangent line to curve, velocity and acceleration, gradient, divergence and curl: definition and examples. Solenoidal and irrotational vector. Conservative vector field, vector identities.	09

Recommended Books:

1.Shanti Naryan, Dr. P.K.Mittal, Differential Calculus, S Chand Publications.

2. S.P.Patankar, Differential Calculus, Nirali Prakashan.

3.Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, Schaum's Outlines Vector Analysis, Mc Graw Hill Education

4.Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). Basic Multivariable Calculus, Springer India Pvt. Limited

5.James Stewart (2012). *Multivariable Calculus* (7th edition). Brooks/Cole. Cengage.

Section II: Ordinary Differential Equations

Course Outcomes: After studying this course student will understand and learn about

CO1: Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.

CO2: Know Picard's method of obtaining successive approximations of solutions of first order differential equations, passing through a given point in the plane and Power series method for higher order linear equations.

CO3: Formulate mathematical models in the form of ordinary differential equations to suggest solutions of the day to day problems arising in physical, chemical & biological disciplines.

Unit	Contents	Hours Allotted
1	Differential equations of first order and first degree, Linear differential equations and equations reducible to linear form, Exact differentialequations, Integrating factor, First order higher degree equations solvable for *x*, *y* and *p*. Clairaut's form and singular solutions. Picard's method of successive approximations and the statement of Picard'stheorem for the existence and uniqueness of the solutions of the first order differential equations.	**08**
2	Linear differential Equations with Constant Coefficients: Definition : General Solution, Auxillary equations, complementary function, types of complementary function, real and distinct roots, real and repeated roots, complex roots, complex and repeated roots, mixed roots, examples on different types of complementary functions, particular integral, particular integrals of the functions: $e^{ax}, Sin\ ax, cos\ ax, x^m, e^{ax}V\ , XV$ and general method.	**08**
3	Homogeneous linear differential equations: The Cauchy-Euler equations, Legendre's Linear equations methods of Solutions of Cauchy-Euler equations, and Legendre's linear equations, examples.	07
4	General theory of linear differential equations of Second order with Variable coefficients, transformation of the equations by changing the dependent or independent variable. [Bessel's equation, Bessel functions, and their properties]	07

References:

1. Shepley L. Ross (2007). *Differential Equations* (3rd edition), Wiley India.
2. M. D. Raisinghania, Ordinary and Partial Differential equation, S.Chand Publication.
3. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). Wiley.
4. Daniel A. Murray (2003). *Introductory Course in Differential Equations*, Orient.
5. B. Rai, D. P. Choudhury & H. I. Freedman (2013). *A Course in Ordinary Differential Equations* (2nd edition). Narosa.
6. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis

Core Course Practical in Mathematics- CCPM-I DSC-1003A(PR):

DIFFERENTIAL CALCULUS

60 Hours (75 Lectures) credits 2

Sr. No.	Title of the experiment	Sessions
1	Successive Differentiation	01
2	Indeterminant form	01
3	Mean value theorem	01
4	Asymptotes (Cartesian and Polar curves)	01
5	Tracing of curves (Cartesian curves)	01
6	Tracing of curves (Polar curves)	01
7	Application of De Moivre's theorem	01
8	Inverse of Matrix by Cayley-Hamilton method	01
9	Eigen value and Eigen vector of Matrix	01
10	Roots of an equations (Cardan's Method)	01

Core Course Practical in Mathematics- CCPM-I DSC-1003A(PR):

DIFFERENTIAL EQUATIONS

60 Hours (75 Lectures) credits 2

Sr. No.	Title of the experiment	Sessions
1	Directional derivative	1
2	Jacobian	1
3	Extrema of a function of two or more variables	1
4	Lagrange's Multiplier method	1
5	Vector (gradient, divergence and curl)	1
6	Cauchy Euler's-equations	1
7	Picard Method of successive approximations	1
8	Application of differential equations-I (Orthogonal Trajectory)	1
9	Application of differential equations-II (Growth and decay models)	1
10	Application of differential equations-III (Lotka Volterra population model.)	1

Nature of Theory Question Paper

***Instructions*:** *1) All the questions are **compulsory**.*
*2) Figures to the right indicate **full** marks.*
*3) Draw neat labeled diagrams **wherever** necessary.*
4) Use of log table/calculator is allowed.

SECTION-I

Time : 2 hours **Total Marks: 35**

Q.1. A. Choose correct alternative. **05**

i)

A) B) C) D)

ii)

A) B) C) D)

iii)

A) B) C) D)

iv)

A) B) C) D)

v)

A) B) C) D)

B. Fill in the Blanks. **02**

i)

ii)

Q.2. Attempt any two. **16**

i)

ii)

iii)

Q.3. Attempt any Three. **12**

i)

ii)

iii)

iv)

v)