"Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Autonomous)

DEPARTMENT OF MATHEMATICS

B.Sc. Part - I
Semester-I & II

SYLLABUS

Under Choice Based Credit System

to be implemented from Academic Year 2021-22

B. Sc. Part-I

Paper No.	Course code	Title of Old Paper	Title of New Paper	Percentage of Change (%)	No. of Credits
Semester I					
I	DSC - 1003A	Differential Calculus	Calculus, Algebra and Geometry	50%	4
Semester II					
II	DSC - 1003B	Differential Equations	Multivariable Calculus & Ordinary Differential equations	50%	4

Computational Mathematics Lab- DSC 1003(PR) Total Credit 04

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

B. Sc. Mathematics Part – I CBCS
Semester - I
Calculus, Algebra and Geometry (DSC -1003A)
Theory: 60Hours (75 lectures of 48 minutes) - Credits -4

Section I: Calculus

Course Outcomes: After the completion of the course the student will be able to -

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.

CO4: Calculate the radius of curvature of circle in parametric and cartesian form

Unit	Syllabus	Lectures/ Teaching Hours	Credits
Module 1	$\varepsilon - \delta$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..	06	01
Module 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	09	01
Module 3	Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem in finite form with Lagrange, Cauchy and Roche– Schlomilch forms of remainder.	07	01
Module 4	Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves	08	01

Reference Books:

1) Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
2) Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
3) Wieslaw Krawcewicz & Bindhyachal Rai (2003). *Calculus with Maple Labs*. Narosa.
4) Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
5) George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018).
6) *Thomas' Calculus* (14th edition). Pearson Education.Mathematics, Springer Verlag, 2003.

B. Sc. Mathematics Part – I CBCS
Semester - I
Calculus, Algebra and Geometry (DSC -1003A)
Theory: 60Hours (75 lectures of 48 minutes) - Credits -4

Section I: Algebra and Geometry

Course Outcomes: After the completion of the course the student will be able to -

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.

CO4: Understand various equation form of sphere

Unit	**Syllabus**	**Lectures/ Teaching Hours**	**Credits**
Module 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.	06	01
Module 2	Relations, Equivalence relations, Equivalence classes; Functions, Composition of functions, Inverse of a function; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, The fundamental theorem of arithmetic, Modular arithmetic and basic properties of congruence's; Principles of mathematical induction and well ordering.	09	01
Module 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	01
Module 4	Planes: Distance of a point from a plane, Angle between two planes, pair of planes, Bisectors of angles between two planes; Straight lines: Equations of straight lines,	08	01

	Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy		

Reference Books:

1) Titu Andreescu, & Dorin Andrica (2014). *Complex Numbers from A to...Z*. (2ndedition). rkhäuser.
2) Robert J. T. Bell (1994). *An Elementary Treatise on Coordinate Geometry of Three Dimensions*. Macmillan India Ltd.
3) D. Chatterjee (2009). *Analytical Geometry: Two and Three Dimensions*. Narosa Publishing House.
4) Leonard Eugene Dickson (2009). *First Course in the Theory of Equations*. The Project Gutenberg EBook (http://www.gutenberg.org/ebooks/29785)
5) Bernard Kolman & David R. Hill (2003). *Introductory Linear Algebra with Applications* (7th edition). Pearson Education Pvt. Ltd. India.
6) David C. Lay, Steven R. Lay & Judi J. McDonald (2016). *Linear Algebra and its Applications*
7) (5th edition). Pearson Education Pvt. Ltd. India

B. Sc. Mathematics Part – I CBCS
Semester - II
Multivariable Calculus & Ordinary Differential equations
(DSC -1003A)

Theory: 60Hours (75 lectures of 48 minutes) - Credits -4

Section I: Multivariable Calculus

Course Outcomes: After the completion of the course the student will be able to -

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, and understanding the architecture of curves and surfaces in plane and space etc.
CO4: Calculate extreme value of function of two variable by various method.

Unit	Syllabus	Lectures/ Teaching Hours	Credits
Module 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**	01
Module 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, Envelopes and evolutes	**08**	01
Module 3	Extrema of functions of two and more variables, Method of Lagrange multipliers, Constrained optimization problems, Definition of vector field, Divergence, curl, gradient and vector identities.	06	01
Module 4	Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, Triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals,	09	01

Reference Books:

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

2) James Stewart (2012). *Multivariable Calculus* (7th edition). Brooks/Cole. Cengage.
3) Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). *Calculus* (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.
4) George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018).
5) *Thomas' Calculus* (14th edition). Pearson Education

B. Sc. Mathematics Part – I CBCS
Semester - II
Multivariable Calculus & Ordinary Differential equations
(DSC -1003A)

Theory: 60Hours (75 lectures of 48 minutes) - Credits -4

Section II: Ordinary Differential equations

Course Outcomes: After the completion of the course the student will be able to -

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.

CO4: Learn various technique of solving Clairaut's equation

Unit	**Syllabus**	**Lectures/ Teaching Hours**	**Credits**
Module 1	Differential equations of first order and first degree, Linear differential equations and equations reducible to linear form, Exact differential equations, 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's theorem for the existence and uniqueness of the solutions of the first order differential equations.	**08**	01
Module 2	Statement of existence and uniqueness theorem for linear differential equations, General theory of linear differential equations of second order with variable coefficients, Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Transformations of the equation by changing the dependent/independent Variable.	**07**	01
Module 3	Principle of superposition for a homogeneous linear differential equation, Linearly dependent and linearly independent solutions on an interval, Concept of a general solution of a linear differential equation, Linear	07	01

	homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler-Cauchy equation.		
Module 4	Power series method, Legendre's equation, Legendre polynomials, Rodrigue's formula, Orthogonality of Legendre polynomials, Frobenius method, Bessel's equation, Bessel functions and their properties, Recurrence Relations	08	01

Reference Books:

1) Belinda Barnes & Glenn Robert Fulford (2015). *Mathematical Modelling with Case Studies*: *A Differential Equation Approach Using* Maple *and* MATLAB (2nd edition). Chapman & Hall/CRC Press, Taylor & Francis.
2) Daniel A. Murray (2003). *Introductory Course in Differential Equations*, Orient.
3) B. Rai, D. P. Choudhury & H. I. Freedman (2013). *A Course in Ordinary Differential Equations* (2nd edition). Narosa.
4) Shepley L. Ross (2007). *Differential Equations* (3rd edition), Wiley India.
5) George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis

COMPUTATIONAL MATHEMATICS LAB (I)DSC-1003A(PR) DSC 3A: DIFFERENTIAL CALCULUS
60 Hours (75 Lectures) credits 2

Sr. No.	Title of the experiment	Sessions
1	Radius of curvature (Cartesian, Polar and Parametric curves)	03
2	Asymptotes (Cartesian and Polar curves)	02
3	Tracing of curves (Cartesian and Polar curves)	02
4	Application of De Moivre's theorem	1
5	Inverse of Matrix by Cayley-Hamilton method	1
6	Roots of an equations(Cardan's Method)	1

COMPUTATIONAL MATHEMATICS LAB (II) DSC 3B: DIFFERENTIAL EQUATIONS
60 Hours (75 Lectures) credits 2

Sr. No.	Title of the experiment	Sessions
1	Directional derivative	1
2	Jacobian	1
3	Extrima of a function of two or more variables	1
4	Lagrange' Multiplier method	1
5	Double integral	1
6	Triple integral	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

EVALUATION PATTERN

SCHEME OF MARKING (THEORY)

Sem.	DSC	Marks	Evaluation	Sections	Answer Books	Standardof passing
I	DSC1003 A	40+40	Semesterwise	Two sections each of 40marks	As per Instruction	35% (28 marks)
II	DSC1003 B	40+40	Semesterwise	Two sections each of 40 marks	As per Instruction	35% (28marks)

SCHEME OF MARKING (CIE) Continuous Internal Evaluation

Sem.	DSC	Marks	Evaluation	Sections	Answer Books	Standardof passing
I	DSC1003 A	20	Concurrent	-	As per Instruction	35% (7 marks)
II	DSC1003 B	20	Concurrent	-	As per Instruction	35% (7 marks)

SCHEME OF MARKING (PRACTICAL)

Sem.	DSC	Marks	Evaluation	Sections	Standard ofpassing
I AND II	DSC1003 A (pr)	50	Annual	As per Instruction	35% (18 marks)
	DSC1003 A (pr)				

***A separate passing is mandatory**

Nature of Theory Question Paper

Instructions**:** *1) All the questions are* ***compulsory****.*
2) Answers to the two sections should be written in ***same*** *answer book.*
3) Figures to the right indicate ***full*** *marks.*
4) Draw neat labeled diagrams ***wherever*** *necessary.*
5) Use of log table/calculator is allowed.

SECTION-I

Time : 2 hours **Total Marks: 40**

Q.1. Choose correct alternative. **8**

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)

vi)

A) B) C) D)

vii)

A) B) C) D)

viii)

A) B) C) D)

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

A)

B)

C)

Q.3. Attempt any four. **16**

a)

b)

c)

d)

e)

f)