Shri Acharyaratna Deshbhooshan Shikshan Prasarak Mandal , Kolhapur

Mahavir Mahavidyalaya, Kolhapur (Autonomous)

Affiliated to Shivaji University, Kolhapur

DEPARTMENT OF MATHEMATICS

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

Curriculum, Teaching and Evaluation Structure

for

B.Sc.-I Mathematics

Semester-I & II

(Implemented from academic year 2023-24 onwards)

B. Sc. Part – I Semester -I Mathematics

DSC-I: Differential Calculus

Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes (COs):

On completion of the course, the students will be able to:

1. Calculate the limit and examine the continuity of a function at a point.
2. Employ theorem on properties of continuity in various examples.
3. Understand the consequences of various mean value theorems for differentiable functions.
4. Understand Higher order derivatives, Taylor's theorem and indeterminate form

UNIT	Contents	Hours Allotted
1	Limit And Continuity: 1.1 Definition of limit of a real-valued function 1.2 Algebra of limits 1.3 Limit at infinity and infinite limits 1.4 Definition: Continuity at a point and Continuous functions on interval 1.5 Theorem: If f and g are continuous functions at point x = a, then f +g, f- g, f.g and f/g are continuous at point. 1.6 Theorem: Composite function of two continuous functions is continuous. 1.7 Examples on continuity. 1.8 Classification of Discontinuities (First and second kind), Removable Discontinuity, Jump Discontinuity. Properties of continuity of Real Valued functions: 1.9 Theorem: If a function is continuous in the closed interval [a, b] then it is bounded in [a, b] 1.10 Theorem: If a function is continuous in the closed interval [a, b], then itattains its bounds at least once in [a, b]. 1.11 Theorem: If a function f is continuous in the closed interval [a, b] and if f(a)and f(b) are of opposite signs then there exists $c \in (a, b)$ such that f(c) = 0, 1.12 Theorem: If a function f is continuous in the closed interval [a, b] and if f (a)$\neq$ f(b) then f assumes every value between f (a) and f (b). 1.13 Uniform continuity.	15

2	Differentiability: 2.1 Differentiability of a real-valued function 2.2 Geometrical interpretation of differentiability 2.3 Relation between differentiability and continuity 2.4 Chain rule of differentiation 2.5 Mean Value theorems: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem 2.6 Geometrical interpretation of mean value theorems. 2.7 Partial differentiation Successive differentiation 2.8 Successive differentiation 2.9 Leibnitz's theorem and its application 2.10 Maclaurin's and Taylor's theorems 2.11 Maclaurin's and Taylor's expansion for standard function	15
	2.12 Indeterminate form.	

Recommended Books:

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

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

Reference Books:

1. Hari Kishan, Calculus, Atlantic Publishers.

2. Michael Spivak, Calculus, Cambridge University Press.

B. Sc. Part – I Semester -I Mathematics

DSC-II: Basic Algebra and Complex NumbersTheory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots
2. Employ De Moivre's theorem in a number of applications to solve numerical problems.
3. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
4. Find eigenvalues and corresponding eigenvectors for a square matrix.

UNIT	Contents	Hours Allotted
1	Theory of Equations 1.1 Elementary theorems on the roots of an equations 1.2 The remainder and factor theorems, Synthetic division 1.3 Factored form of a polynomial. 1.4 The Fundamental theorem of algebra. 1.5 Relations between the roots and the coefficients of polynomial equations 1.6 Integral and rational roots. Complex Numbers: 1.7 Introduction 1.8 Polar representation of complex numbers 1.9 De Moivre's theorem (integer and rational indices) 1.10 Roots of a complex number, expansion of $\cos n\theta, \sin n\theta$ 1.11 Euler's exponential form of a complex number 1.12 circular function and its periodicity 1.13 Hyperbolic function	15
2	Matrices: 2.1 Types of Matrices, Transpose of matrix, Conjugate of matrix, Transposed-conjugate of a matrix 2.2 Row reduction and echelon forms 2.3 The rank of a matrix and applications, Inverse of matrix 2.4 Eigenvalues and eigenvectors of matrix 2.5 Cayley-Hamilton theorem and its application System of linear equations 2.6 Homogeneous linear equations 2.7 Nature of solution of AX = 0 2.8 Non – Homogeneous linear equations 2.9 Working rule for finding solution of AX = B Examples.	15

Recommended Books:

1. W. S. Bunside and A. R. Panton:The Theory of Equations: With an Introduction to the Theory of Binary Algebraic Forms, Dover Phoenix Editions, 2005.

2. Brown and Churchill, Complex Variables and Applications, 7th Edition, McGraw Hill, 2010.

3. Serge Lang: Introduction to Linear Algebra, Second Edition, 1986

DSC-PR -I : DSC MATHEMATICS LAB – I

Practical Four Lectures of 60 minutes per week per batch

Marks-25 (Credits: 02)

Sr.No	Experiment Name
1	Examples of Rolle's theorem.
2	Examples of Lagrange's mean value
3	Examples of Indeterminate form.
4	Examples of Successive differentiation
5	Examples of Factor theorem and Synthetic division
6	Examples of De Moivre's theorem
7	Examples of Eigenvalues and Eigenvectors
8	Examples of Cayley-Hamilton theorem
9	Examples of homogeneous linear equation
10	Examples on Non-homogeneous linear equation

B. Sc. Part – I Semester -II Mathematics

DSC-III: Differential Equations - I

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations
2. Calculate P.I and C.F. of different types of differential equation
3. Solve differential equation of degree more than one.
4. Learn techniques of solving Clairaut's Equation.

UNIT	Contents	Hours Allotted
1	Differential Equations of first order and first degree: 1.3 Revision: Definition of Differential equation, order and degree of Differential equation. 1.4 Definition: Exact Differential equations. 1.4.1 Theorem: Necessary and sufficient condition for exactness. 1.2.2Working Rule for solving an exact differential equation 1.2.3 Integrating Factor (I.F.) by using rules (without proof). 1.5 Linear Differential Equation: Definition. 1.5.1 Method of solution. 1.6 Bernoulli's Differential Equation: Definition. 1.6.1 Method of solution. 1.7 Orthogonal trajectories: Cartesian and polar co-ordinates. Linear Differential Equations with constant Coefficients: 1.8 Definition: Complementary function (C.F.) and particular integral (P.I.), operator D. 1.9 General Solution of f(D) y=0. 1.9.1 Solution of f (D) y = 0 when A.E. has non-repeated roots. 1.9.2 Solution of f (D) y = 0 when A.E. has repeated roots. 1.9.3 Solution of f (D) y = 0 when A.E. has non-repeated roots real and complex roots. 1.10 Solution of D(y) = X, where X is of the form 1.10.1 $e^{ax}, where\ a\ is\ constant$ 1.10.2 $\sin(ax)\ \ and\ \cos(ax)$ 1.10.3 x^m, m is positive integer 1.10.4 $e^{ax}V, where\ V\ is\ a\ function\ of\ x$ 1.10.5 $xV, where\ V\ is\ a\ function\ of\ x.$	20

2	Equations of first order but not first degree: 2.1 Equations that can be factorized 2.2 Equation solvable for p 2.3 Equations that cannot be factorized 2.4 Equation solvable for x 2.5 Equation solvable for y Clairaut's Equation : 2.6 Clairat's form and Method of solution	10

	2.7 Equation reducible to Clairaut's form 2.8 Special form reducible to Clairaut's form	

Recommended Books:

1. Daniel A. Murray, Introductory course in Differential Equations, Khosla Publishing House

(1 January 2021)

2. Diwan, Agashe, Differential Equations, Popular Prakashan, Mumbai

Reference Books:

1. M. L. Khanna, Differential Equations, Jai Prakash Nath and Company

2. Dr. M. D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publications

B. Sc. Part – I Semester -II Mathematics

DSC-IV: Geometry

Theory: 30 hrs.

Marks-25 (Credits: 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Define the translation, rotation and understand relation between rotation and translation.
2. Estimate polar equation of circle, conic, chord, tangent.
3. Understand the various equation form sphere.
4. Learn various equation forms of cone.

UNIT	Contents	Hours Allotted
1	Changes of axis: 1.1 Translation 1.2 Rotation 1.3 Translation and Rotation 1.4 Rotation followed by Translation 1.5 Translation followed by Rotation 1.6 Invariants, Basic theorems Polar Coordinates 1.7 Polar equation of circle: 1.8 Centre – radius form 1.9 Centre at the pole 1.10 Passing through the pole and touching the polar axis at the pole 1.11 Passing through the pole and with centre on the initial line 1.12 Passing through the pole and the diameter through pole making an angle α with initial line 1.13 Equation of chord, tangent and no r mal to the circle $r = 2a\cos\theta$ 1.14 Polar equation of a conic in the form $\frac{l}{r} = 1 \pm e\cos\theta$ 1.15 Polar equation of a conic in the form $\frac{l}{r} = 1 \pm e\cos(\theta - \alpha)$ 1.16 chord, tangent and normal of conic	15

2	Sphere: 2.1 Equation in different form • centre – radius form • General form • Diameter form • Intercept form 2.2 Intersection of sphere with straight line and a plane 2.3 Power of a point and radical plane 2.4 Tangent plane and condition of tangency 2.5 Equation of circle 2.6 Intersection of (i) two sphere (ii) a sphere and plane 2.7 Orthogonality of two spheres Cone 2.8 Definitions of cone, vertex, generators 2.9 Equation of a cone with vertex at a point (X_1, Y_1, Z_1)	15

	2.10 Equation of a cone with vertex at origin 2.11 Right circular cone and equation of a right circular cone 2.12 Enveloping cone and equation of an enveloping cone 2.13 Equation of a tangent plane 2.14 Condition of tangency	

Recommended Books:

1. Shanti Narayan: Analytical Solid Geometry, S. Chand and Company Ltd, New Delhi, 1998.

Reference Books:

1. S.P. Patankar, S.P. Thorat, Geometry, Nirali Prakashan.

2. Askwyth, E. H: The Analytical Geometry of the Conic Sections.

3. P.K.Jain and Khalil Ahmad, A Textbook of Analytical Geometry of Three Dimensions, Wiley Estern Ltd. 1999.

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DSC-PR -I I: DSC MATHEMATICS LAB – I

Practical Four Lectures of 60 minutes per week per batch

Marks-25 (Credits: 02)

Sr.No	Experiment Name
1	Examples of Exact differential equation
2	Examples of Orthogonal trajectories
3	Examples on D(y) = X, where X is of the form $e^{ax}, where\ a\ is\ constan,$ $\sin(ax)$ and $\cos(ax)$
4	Examples on D(y) = X, where X is of the form x^m, m is a positive integer, $e^{ax}V, where\ V\ is\ a\ function\ of\ x$
5	Examples of Equation solvable for p
6	Examples of reducible to Clairaut's equation
7	Examples on Translation
8	Examples on Rotation
9	Examples of Polar coordinates
10	Examples of Equation of sphere in different forms

Recommended Books:

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

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

Reference Books:

1. Hari Kishan, Calculus, Atlantic Publishers.

2. Michael Spivak, Calculus, Cambridge University Press

Suggested methods of Teaching:	
1.	Offline Traditional Board Teaching
2.	Power Point Presentation
3.	Online Teaching on platform of Zoom or Google Meet

Scheme of Course Evaluation		
1.	End Semester Examination (ESE)	40
2.	Continuous Internal Evaluation (CIE)	10
3.	**Total Marks**	**50**

Suggested techniques for Continuous Internal Evaluation (10 Marks)	
1.	Seminar
2.	Field Report
3.	Assignments
4.	Open book test
5.	Offline / online MCQ test
6.	Visit/Tour report
7.	Surprise test
8.	Formula Test

End Semester Examination Question Paper Pattern (40 Marks) Theory			
Q. No.	**Nature /Type of Question**	**Marks**	**Total**
1.	Multiple Choice Question (06)	Each for 01 Marks	**06**
2.	Write definition or Formulas (5)	Each for 02 Marks	**10**
3.	Solve the following question Any 3 out of 5	Each for 04 Marks	**12**
4.	Solve the following question A Or B	Each for 06 Marks	**06**
5.	Solve the following question A Or B	Each for 06 Marks	**06**
Total			**40**

Practical Examination

(A) The practical examination will be conducted on one day for three hours perday per batch of the practical examination.

(B) Each candidate must produce a certificate from the Head of the Department inher/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on therecommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the semister. Candidates must produce their journals at the time of practical examination.

Question Paper Pattern (25 Marks) Semisterwise Practical Exam		
Semister	**Nature / Type of Question**	**Marks**
I	Solve any one question out of Two	**10**
	Solve any Two question out of four	**10**
	Certified Journal & Oral	**05**
	Total Marks (For Semister I)	**25**
II	Solve any one question out of Two	**10**
	Solve any Two question out of Four	**10**
	Certified Journal & Oral	**05**
	Total Marks (For Semister II)	**25**
Total Marks		**50**