# Lesson Plan

## B.A 1st Semester 2024-2025

Mathematics-I((Calculus)B23-MAT-101)

Course Type: CC-1/MCC-1

**Contents of the Course**

| Unit | Topics | Contact Hours |
|---|---|---|
| I. | ε-δ definition of limit and continuity of a real valued function, Basic properties of limits, Types of discontinuities, Differentiability of functions, Application of L'Hospital rule to indeterminate forms, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's series expansion with different forms of remainder. | 12 |
| II. | Asymptotes: Horizontal, vertical and oblique asymptotes for algebraic curves, Asymptotes for polar curves, Intersection of a curve and its asymptotes, Curvature and radius of curvature of curves (cartesian, parametric, polar & intrinsic forms), Newton's method, Centre of curvature and circle of curvature. | 12 |
| III. | Multiple points, Node, Cusp, Conjugate point, Tests for concavity and convexity, Points of inflexion, Tracing of curves, Reduction formulae. | 12 |
| IV. | Rectification, intrinsic equation of a curve, Quadrature, Area bounded by closed curves, Volumes and surfaces of solids of revolution. | 12 |

**Course Learning Outcomes (CLO)**

After completing this course, the learner will be able to:

1. Gain knowledge of the concepts and theory of limit, continuity and differentiability of functions. Attain skills of calculating the limit of functions and examining the continuity and differentiability of different types of functions, and perform successive differentiation of functions. To apply the procedural knowledge to obtain the series expansions of functions which find multidisciplinary applications.

2. Understand concepts of asymptotes and curvature, the geometrical meaning of these terms and to have procedural knowledge to solve related problems.

3. Determine singular points of a curve and classify them. Understand the concept of rectification of curves and derive the reduction formulae.

4. Have theoretical knowledge and practical skills to evaluate the area bounded by the curves, and volume and surface area of solids formed by revolution of curves.

5. Attain cognitive and technical skills required for solving different problems of calculus associated with tracing of curves, determination of curvature, and rectification of curves, volume and surface area of solids of revolution. Have technical and practical skills of solving calculus problems related to differentiation and integration of functions by using MAXIMA software.

| | Theory | Practical | Total |
|---|---|---|---|
| Credits | 3 | 1 | 4 |
| Internal Assessment Marks | 20 | 10 | 30 |
| End Term Exam Marks | 50 | 20 | 70 |
| Exam Time | 3 Hrs. | 3 Hrs. | |

**Instructions for Students**

**Note:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

**Recommended Books/E-Resources/LMS:**


- Howard Anton, I. Bivens & Stephan Davis (2021). Calculus (12th edition). J. Wiley & Sons.
- Gabriel Klambauer (1986). Aspects of Calculus (4th edition). Springer.
- Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs. Alpha Science Int'l Ltd.
- Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
- George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir 2018). Thomas' Calculus (14th edition). Pearson Education.
- 6. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2002). Calculus (3rd edition). Dorling Kindersley (India) Pvt. Ltd.

## Tentative Lesson Schedule

| Months | Topics | Contact Hours |
|---|---|---|
| July 2024 | ε-δ definition of limit and continuity of a real valued function, Basic properties of limits, Types of discontinuities, Differentiability of functions, Application of L'Hospital rule to indeterminate forms | 5 Hours |
| August 2024 | Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's series expansion with different forms of remainder. Asymptotes: Horizontal, vertical and oblique asymptotes for algebraic curves, Asymptotes for polar curves, Intersection of a curve and its asymptotes, | 12 Hours |
| September 2024 | Curvature and radius of curvature of curves (cartesian, parametric, polar & intrinsic forms), Newton's method, Centre of curvature and circle of curvature. | 12 Hours |
| October 2024 | Multiple points, Node, Cusp, Conjugate point, Tests for concavity and convexity, Points of inflexion, Tracing of curves, Reduction formulae. | 12 Hours |
| November 2024 | Rectification, intrinsic equation of a curve, Quadrature, Area bounded by closed curves, Volumes and surfaces of solids of revolution. | 7 Hours |
| **PRACTICAL** | | |
| | The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write | 30 Hours |

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| | up and execution of the program. (A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:<br>1. Problems of curve tracing when equation is given in Cartesian coordinates.<br>2. Problems of curve tracing when equation is given in Parametric form.<br>3. Problems of curve tracing when equation is given in Polar coordinates.<br>4. Problem of determination of length of a curve expressed in Cartesian coordinates.<br>5. Problem of determination of length of a curve expressed in Polar coordinates.<br>6. Problem of determination of radius of curvature expressed in Cartesian coordinates.<br>7. Problem of determination of radius of curvature expressed in Polar coordinates.<br>8. Problem of determination of radius of curvature expressed in Parametric form.<br>9. Problem of determination of volumes and surfaces of solids of revolution for Cartesian curve.<br>10. Problem of determination of volumes and surfaces of solids of revolution for Parametric curve.<br>11. Problem of determination of volumes and surfaces of solids of revolution for Polar curve.<br>**(B)The following practicals will be done using MAXIMA software and their record will be maintained in the practical note book:**<br>1. Learn to use basic operators and functions in Maxima software.<br>2.Simplify algebraic expressions and expressions containing radicals, logarithms, exponentials and trigonometric functions.<br>3. Expand algebraic, rational, trigonometric and logarithmic expressions.<br>4. Find derivatives of algebraic, trigonometric, exponential and logarithmic functions. | |

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| | 5. Find derivatives of functions involving above mentioned functions.<br>6. Problems of successive differentiation.<br>7. Find indefinite integrals of different functions.<br>8. Find definite integrals of different functions.<br>9. To plot curves involving Cartesian, parametric and polar forms.<br>10. To demonstrate singular points. | |

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