

## Mathematics I

**Course Title:** Mathematics I  
**Course No:** MTH112  
**Nature of the Course:** Theory  
**Semester:** I

**Full Marks:** 80 + 20  
**Pass Marks:** 32 + 8  
**Credit Hrs:** 3

**Course Description:** The course covers the concepts of functions, limits, continuity, differentiation, integration of function of one variable; logarithmic, exponential, applications of derivative and antiderivatives, differential equations, vectors and applications, partial derivatives and Multiple Integrals.

**Course Objectives:** The objective of this course is to make students able to

- understand and formulate real world problems into mathematical statements.
- develop solutions to mathematical problems at the level appropriate to the course.
- describe or demonstrate mathematical solutions either numerically or graphically.

### Course Contents:

#### Unit 1: Function of One Variable (5 Hrs.)

Four ways of representing a function, Linear mathematical model, Polynomial, Rational, Trigonometric, Exponential and Logarithmic functions, Combination of functions, Range and domain of functions and their Graphs

#### Unit 2: Limits and Continuity (4 Hrs.)

Precise definition of Limit, Limits at infinity, Continuity, Horizontal asymptotes, Vertical and Slant asymptotes

#### Unit 3: Derivatives (4 Hrs.)

Tangents and velocity, Rate of change, Review of derivative, Differentiability of a function, Mean value theorem, Indeterminate forms and L'Hospital rule

#### Unit 4: Applications of Derivatives (4 Hrs.)

Curve sketching, Review of maxima and minima of one variable, Optimization problems, Newton's method

#### Unit 5: Antiderivatives (5 Hrs.)

Review of antiderivatives, Rectilinear motion, Indefinite integrals and Net change, Definite integral, The Fundamental theorem of calculus, Improper integrals

#### Unit 6: Applications of Antiderivatives (5 Hrs.)

Areas between the curves, Volumes of cylindrical cells, Approximate Integrations, Arc length, Area of surface of revolution

**Unit 7: Ordinary Differential Equations (6 Hrs.)**

Introduction, Introduction to first order equations Separable equations, Linear equations, Second order linear differential equations, Non homogeneous linear equations, Method of undetermined coefficients

**Unit 8: Infinite Sequence and Series (5 Hrs.)**

Infinite sequence and series, Convergence tests and power series, Taylor's and Maclaurin's series

**Unit 9: Plane and Space Vectors (4 Hrs.)**

Introduction, Applications, Dot product and cross Product, Equations of lines and Planes, Derivative and integrals of vector functions, Arc length and curvature, Normal and binormal vectors, Motion in space

**Unit 10: Partial Derivatives and Multiple Integrals (3 Hrs.)**

Limit and continuity, Partial derivatives, Tangent planes, Maximum and minimum values, Multiple integrals

**Text Book**

1. Calculus Early Transcendentals, James Stewart, 7E, CENGAGE Learning.

**Reference Book**

1. Calculus Early Transcendentals, Thomas, 12<sup>th</sup> Editions, Addison Wesley.