

## Basic Mathematics

**Course Title:** Basic mathematics

**Course No:** MTH104

**Nature of the Course:** Theory

**Semester:** I

**Full Marks:** 80 + 20

**Pass Marks:** 32 + 8

**Credit Hrs:** 3

### Course Description:

This course familiarizes students with functions, limits, continuity, differentiation, integration of function of one variable, logarithmic, exponential, applications of derivative and anti-derivates, differential equations, partial derivatives.

### Course Objectives:

1. Students will be able to understand and formulate real world problems into mathematical statements.
2. Students will be able to develop solutions to mathematical problems at the level appropriate to the course.
3. Students will be able to describe or demonstrate mathematical solutions either numerically or graphically.

### Course Contents:

#### Unit I: Functions Limits and Continuity (5 Hrs.)

Functions and their graphs, combining functions; Shifting and Scaling Graphs, Trigonometric Functions, Graphing with Calculators and Computers, Exponential Functions, Inverse Functions and Logarithms, Rates of Change and Tangents to Curves.

#### Unit 2: Limits and Continuity (3 Hrs.)

Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity, Limits Involving Infinity; Asymptotes of Graphs.

#### Unit 3: Differentiations (5 Hrs.)

Tangents and the Derivative at a Point, the Derivative as a Function, The Derivative as a Rate of Change, Derivatives of trigonometric Functions, The Chain Rule, Implicit Differentiation, Derivatives of Inverse Functions and Logarithms, Inverse Trigonometric Functions, Related Rates.

#### Unit 4: Applications of Derivatives (5 Hrs.)

Extreme values of functions, The Mean value theorem, Monotonic functions and the first derivative test, Concavity and Curve sketching, Indeterminate forms and L'Hospitals rule, Applied optimization, Newton's method.

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

Antiderivatives, Area and estimating with finite sums, Sigma notation and Limits of finite sums, The definite integral, The Fundamental theorem of calculus, Indefinite integrals and the substitution method, Substitution and Area between curves.

**Unit 6: Applications of Definite Integrals (3 Hrs.)**

Volumes using cross-sections, Volumes using cylindrical shells, Arc length, Areas of surfaces of revolution, Work and fluid forces, Moments and centers of mass

**Unit 7: Techniques of Integrations (5 Hrs.)**

Integrations by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial functions, Integral tables and computer algebra systems, Numerical integrations, Improper integrals.

**Unit 8: First Order Differential Equations (4 Hrs.)**

Solutions, Slope Fields, and Euler's method, First order Linear equations, Applications, Graphical solutions of Autonomous equations, Systems of equations and phase planes.

**Unit 9: Infinite Sequence and Series (5 Hrs.)**

Sequences, Infinite series, The Integral test, Comparison tests, The Ratio and root tests, Alternating series, Absolute and Conditional convergence, Power series, Taylor and Maclaurin series, Convergence of Taylor series.

**Unit 10: Partial Derivatives (5 Hrs.)**

Functions of several variables,, Limits and continuity in higher dimensions, Partial derivatives, The Chain rule, Directional derivatives and gradient vectors, Tangent planes and differentials, Extreme values and saddle points Lagrange multipliers, Taylor's formula for tow variables, Partial derivatives with constrained variables.

**Text / Reference Books:**

Maurice D. Weir and Joel Hass, Thomas, Calculus, Early Transcendentals, 12<sup>th</sup> Edition, 2009