COURSE CODE	COURSE TITLE	L	T	P	C
MA1039	**Mathematics I** **B.Tech. CSE**	**3**	**1**	**0**	**4**

OBJECTIVES

The objective of this course is to enable the student to

- Introduce the concepts of limits, continuity, and differentiation, including an introduction to partial derivatives and gradients.
- Cover techniques of integration and their applications.
- Familiarize with sequences, series, and power series.
- Introduce the basic concepts, classifications, and methods for solving first-order ordinary differential equations.
- Cover methods for solving higher-order ordinary differential equations and introduce optimization with constraints using Lagrange multipliers.

UNIT I Calculus   12

Limits, Continuity, Increment Theorem, Chain Rules, Extreme Values, Antiderivatives - The Definite Integral - The Fundamental Theorem of Calculus - Techniques of Integration (Substitution, Partial Fractions, Integration by Parts, Bernoulli's formula), Applications of Integration (Area, Volume, Arc Length), Surface Area of solids of Revolution - Improper Integrals.

UNIT II Vector Calculus   12

Vectors in 2-space and 3-space, Scalar product, Vector product, Scalar and vector functions, Curl and Divergence of a vector field, Level curves and surfaces, Directional Derivative, Normal to Level Curve and Tangent Planes, Line Integral, Line Integral of Vector Fields, Conservative Fields, Green's Theorem, Surface Integral of a Vector Field, Stokes' Theorem, Gauss' Divergence Theorem.

UNIT III Sequences and Series   12

Sequences - Convergence and Divergence - Series - geometric series, Convergence Tests (Integral Test, Comparison Tests, Ratio Test, Root Test) - Alternating Series - Absolute and Conditional Convergence - Power Series - Taylor and Maclaurin Series.

UNIT IV First-Order Differential Equations   **12**

Introduction to Differential Equations - Classification of Differential Equations (Order, Linearity) - Solutions of Differential Equations - Initial Value Problems - First-Order ODEs: Separable Equations, Linear Equations, Exact Equations, - Applications of First-Order ODEs.

UNIT V Functions of Several Variables   **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

OUTCOMES

Upon successful completion of this course, students will be able to:

CO1: Understand and apply fundamental concepts of differential and integral calculus.

CO2: Apply the concepts of integration to analyse the vector fields.

CO3: Understand functions of two variables and apply to solve optimization problems.

CO4: Apply various test methods to study the convergence of sequences and series.

CO5: Solve various types of first order ordinary differential equations.

References:
1. Stewart, J. (2015). *Calculus*. Cengage Learning.
2. Thomas, G. B., Weir, M. D., & Hass, J. (2014). *Thomas' Calculus*. Pearson.
3. Zill, D. G., & Wright, W. S. (2017). *Differential Equations with Boundary-Value Problems*. Cengage Learning.
4. Boyce, W. E., DiPrima, R. C., & Meade, D. B. (2017). *Elementary Differential Equations and Boundary Value Problems*. Wiley.