Semester*	**: I**
Course Type	**:** DSC
Course Code**	**:** MATDSC102
Name of the Course	**:** Differential Calculus
Learning level***	**:** 150
Credits	**:** 3
Contact Hours	**:** 50
Total Marks	**:** 100
End Semester Marks	**:** 70
Internal Marks	**:** 30

Course Objective

The main objective of this course is to provide the learners with a detailed understanding of differential calculus and its applications.

Unit – I

Limit of a function, Fundamental theorems on limits, Some important limits, Cauchy's criterion, Problems on limits. Continuity of a function, Different classes of discontinuity, Properties of continuous functions, related problems. Differentiability of a function, Fundamental theorems on differentiation, problems involving derivatives of a function of a function, inverse circular functions, hyperbolic functions, logarithmic differentiation, implicit functions and parametric equations.

Unit – II

Significance of derivative and its sign, geometrical interpretation, derivative as a rate measurer and related problems. Successive Differentiation, nth derivatives of some special functions, nth derivatives of rational algebraic functions, related problems. Leibnitz's theorem and related problems. Indeterminate forms, L'Hospital's theorem, and related problems.

Unit – III

Rolle's theorem, Lagrange's Mean Value Theorem, Geometrical interpretation and related problems. Generalized mean value theorem (Taylor's series in finite form), Lagrange's form of remainder, Cauchy's form of remainder, Expansion of functions in infinite power series - Taylor's series and Maclaurin's series. Increasing and decreasing functions, Maxima and minima for functions of single variable and related problems.

Unit – IV

Tangents and normals - equation of tangent, tangent at the origin, equation of normal, angle of intersection of curves, related problems. Cartesian subtangent and subnormal, derivative of arc-length (cartesian form), angle between radius vector and tangent, derivative of arc-length (polar form), polar subtangent and subnormal. Radius of curvature of cartesian and polar curves.

Unit – V

Partial derivatives, related problems, homogeneous functions, Euler's theorem on homogeneous functions. Asymptotes, Concavity, Points of inflection, Tracing graphs of polynomial and rational functions.

Textbooks:

1. B.C. Das and B.N. Mukherjee, Differential Calculus, 55th ed., U.N. Dhur and Sons, 1949.
   [Unit – I to Unit – V (up to Euler's theorem)]
2. H. Anton, I. Bivens and S. Davis, Calculus, 10th ed., John Wiley & Sons, 2015.
   [Unit-V (Asymptotes, concavity, tracing of graphs)]

Reference books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytical Geometry, 9th ed., Pearson Education India, 2010
2. Shanti Narayan and P.K. Mittal, Differential Calculus, 15th ed., S. Chand, 1942

Course Learning Outcome

After completion of this course, the learners should be able to understand limits, continuity and differentiability and apply these to solve real life problems. The learners should also be able to grasp the concepts of tangents, normals, subtangents, subnormals and solve related problems. This course will also provide an overview of partial derivatives which will be helpful in further courses of study.