

# UNIVERSITY OF DELHI

## DEPARTMENT: MATHEMATICS

**COURSE NAME: Bachelor in Multidisciplinary Courses with 3 core Disciplines**

**(SEMESTER - I)**

based on

Undergraduate Curriculum Framework 2022 (UGCF)

(Effective from Academic Year 2022-23)



University of Delhi

Course name: **Bachelor in Multidisciplinary Courses with 3 core Disciplines**

Course Title	Nature of the Course	Total Credits	Components			Eligibility Criteria/ Prerequisite	Contents of the course and reference is in
			Lecture	Tutorial	Practical		
Topics in Calculus	Discipline-1	4	3	1	0	<b>12<sup>th</sup> with Mathematics</b>	<b>Annexure-I</b>

**Bachelor in Multidisciplinary Courses of Study with 3 Core Courses (Sem I)**  
**Discipline A-1: Topics in Calculus**

**Total Marks: 100** (Theory: 75, Internal Assessment: 25) **Examination: 3 Hrs.**

**Workload: 3 Lectures, 1 Tutorial (per week) Credits: 4**

**Course Objectives:** The primary objective of this course is to introduce the basic tools of calculus which are helpful in understanding their applications in many real-world problems. Students will be able to understand/create various mathematical models in everyday life.

**Course Learning Outcomes:** This course will enable the students to:

- i) Understand continuity and differentiability in terms of limits and graphs of certain functions.
- ii) Describe asymptotic behaviour in terms of limits involving infinity.
- iii) Use of derivatives to explore the behaviour of a given function locating and classify its extrema and graphing the function.
- iv) Apply the concepts of asymptotes, and inflexion points in tracing of cartesian curves.
- v) Compute the reduction formulae of standard transcendental functions with applications.

**Unit 1: Limits, Continuity and Differentiability**

Limit of a function,  $\varepsilon-\delta$  definition of a limit, Infinite limits, Continuity and types of discontinuities; Differentiability of a function, Successive differentiation: Calculation of the  $n$ th derivatives, Leibnitz theorem; Partial differentiation, Euler's theorem on homogeneous functions.

**Unit 2: Mean Value Theorems and its Applications**

Rolle's theorem, Mean value theorems and applications to monotonic functions and inequalities; Taylor's theorem, Taylor's series, Maclaurin's series expansions of  $e^x$ ,  $\sin x$ ,  $\cos x$ ,  $\log(1+x)$  and  $(1+x)^m$ ; Indeterminate forms.

**Unit 3: Tracing of Curves and Reduction Formulae**

Asymptotes (parallel to axes and oblique), Concavity and inflexion points, Singular points, Tangents at the origin and nature of singular points, Curve tracing (cartesian and polar equations). Reduction formulae for  $\int \sin^n x dx$ ,  $\int \cos^n x dx$ , and  $\int \sin^m x \cos^n x dx$  and their applications.

**References:**

1. Prasad, Gorakh (2016). *Differential Calculus* (19th ed.). Pothishala Pvt. Ltd. Allahabad.
2. Prasad, Gorakh (2015). *Integral Calculus*. Pothishala Pvt. Ltd. Allahabad.

**Additional Readings:**

- i. Apostol, T. M. (2007). *Calculus: One-Variable Calculus with An Introduction to Linear Algebra* (2nd ed.). Vol. 1. Wiley India Pvt. Ltd.
- ii. Ross, Kenneth. A. (2013). *Elementary Analysis: The Theory of Calculus* (2nd ed.). Undergraduate Texts in Mathematics, Springer. Indian reprint.