B.Sc. (Mathematics) (Part I) (Level 4.5)(Semester – I)
(NEP-2020)
Syllabus to be implemented from Academic Year 2024-25

Course type	:	DSC – II
Title of course	:	Calculus
Credit	:	02

Course Learning Outcomes: Upon successful completion of the course students will able to:

CO 1. find higher derivatives of product two differentiable functions using Leibnitz theorem.

CO 2. learn conceptual variations while advancing from one variable to several variables in calculus.

CO 3. understand the consequences of mean value theorems for differentiable functions.

CO 4. apply L' Hôpital's rule to various indeterminate forms.

Unit – 1: Differentiation   (15 hrs.)
1.1. Successive Differentiation
   1.1.1. Higher order derivatives: notations.
   1.1.2. Calculation of nth derivative: Standard results
   1.1.3. Determination of nth derivative of rational functions: Examples.
   1.1.4. The nth derivative of product of the powers of sine and cosines: Examples.
   1.1.5. Leibnitz's Theorem. The nth derivative of product of two functions.
   1.1.6. Examples on Leibnitz's Theorem.
1.2. Partial differentiation
   1.2.1. Introduction to functions of two and more variables
   1.2.2. Partial derivative: first order and higher order – examples.
   1.2.3. Geometrical interpretation of partial derivatives of first order.

Unit – 2: Mean Value Theorems and Indeterminate forms   (15 hrs.)
2.1. Mean Value Theorems
   2.1.1. Rolle's Mean Value Theorem, Geometrical interpretation.
   2.1.2. Lagrange's Mean Value Theorem, Geometrical interpretation.
   2.1.3. Meaning of sign of derivative
   2.1.4. Cauchy's Mean Value Theorem.
   2.1.5. Examples on 2.1.1, 2.1.2, 2.1.3 and 2.1.4
2.2. Indeterminate forms
   2.2.1. Indeterminate forms: L' Hôpital's rule for $\frac{0}{0}$ and $\frac{\infty}{\infty}$ form (Statement only).
   2.2.2. The indeterminate forms $0 \times \infty, \infty - \infty, 0^0, 1^\infty, \infty^0$
2.3. Expansion of functions
   2.3.1. Maclaurin's theorem (statement only): Examples.
   2.3.2. Taylor's theorem (statement only): Examples.

Recommended Books:

1. **Differential Calculus,** Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016).

Scope: Unit 1 – **1.1**: Chapter 5: 5.1 to 5.5

                       1.2: Chapter 11: 11.6, 11.6.1, 11.7.1

           Unit 2 – **2.1**: Chapter 8: 8.1, 8.2, 8.3, 8.5

                       2.2: Chapter 10: 10.1 to 10.6

                       2.3: Chapter 6: 6.1, 6.2

Reference Books:

1. **Differential Calculus,** Gorakh Prasad, Pothishala Pvt. Ltd., 19th edition (2016).
2. **Aspects of Calculus,** Gabriel Klambauer, Springer-Verlag (1986).
3. **Differential Calculus,** Hari Kishan, Atlantic Publishers & Dist. (2007).
4. **Calculus,** George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir, Pearson Education, 14th edition (2018).