**Calculus-I**

**B.Tech. (First Semester)**

**(Syllabus for all Engineering Branches except BT and CSBS)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **2** |

**Preamble**

*This course is designed to impart knowledge on differentiation and integration of function, emphasizing their inter-relationship and applications to engineering.*

**Course Objectives:**

* To familiarize the students in the concepts the derivatives and its underlying concepts like limits and continuity.
* To explain the concept of derivative and calculation of extreme values of extreme values of various functions.
* To impart knowledge on integration for the computation of areas, arc lengths.
* To demonstrate various techniques of integrations.

**Unit-1: Limits and continuity of single and several variables (6 hours)**

Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity (Without proofs)

Functions of Several Variables, Limits and Continuity in Higher Dimensions (Without proofs)

**Learning Outcomes:**

At the end of this unit, the student will be able to

* define and calculate limits and one-sided limits of single variables
* define and calculate limits of several variables.
* define continuity and determine whether a function is continuous of single and several variables.

**Unit-2: Derivatives and applications (7 hours)**

The Derivative as a Function, Differentiation Rules, The Chain Rule, Extreme Values of Functions on Closed Intervals, Monotonic Functions (Without proofs)

**Learning Outcomes:**

At the end of this unit, the student will be able to

* know the definition of derivative and how to use the most common rules of derivatives
* apply various rules to obtain the derivatives of different functions.
* find the extreme values of various functions.

**Unit-3: Integrals and applications (7 hours)**

The Definite Integral, The Fundamental Theorem of Calculus, Indefinite Integrals and the Substitution Method, Definite Integral Substitutions and the Area between Curves, Arc Length (Without proofs)

**Learning Outcomes:**

At the end of this unit, the student will be able to

* know about anti-derivative and the Fundamental Theorem of Calculus and its applications
* apply concept of integration to evaluate geometric area and solve other applied problems
* apply substitution to compute definite integrals.

**Unit-4: Techniques of integration (6 hours)**

Using basic Integration Formulas, Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fractions (Without proofs)

**Learning Outcomes:**

At the end of this unit, the student will be able to

* evaluate integrals using integration by parts.
* evaluate indefinite and definite integrals using by the method of substitution.
* evaluate integrals of trigonometric and rational functions.

**Textbook:** Joel Hass, Christopher Heil, Maurice D. Weir, Thomas' Calculus, Fourteenth edition, Pearson Addison Wesley (2018).

**References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
4. Hyghes-Hallett, Gleason, McCallum et al. Single Variable Calculus (6th Edn) John Wiley and Sons New York, 2013.

**Course Outcomes:**

At the end of the course, the student will be able to

* determine limit, one sided limit, continuity of single and several variable functions.
* solve problems in a range of mathematical applications using the derivative or the integral.
* apply the Fundamental Theorem of Calculus.
* evaluate integrals using various techniques.