CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

# FACULTY OF ENGINEERING & TECHNOLOGY

**Effective from Academic Batch: 2025-26**

**Programme:** **B. TECH. (Mechanical Engineering)**

**Semester:** **I**

**Course Code:** **102000111**

**Course Title:** **Calculus**

**Course Group: Basic Science Course**

**Course Objectives:** The course is aimed to convey to the student a sense of continuum of higher secondary calculus and its applications to develop basic understanding of engineering subjects. This course is a cohesive one which unifies differential and integral calculus with approximations and their applications.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 3 | 1 | 0 | 4 | 50 / 18 | 50/18 | Choose an item. | Choose an item. | 100 /36 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. | Contents | Hours |
|---|---|---|
| 1 | Differentiation:<br>Successive Differentiation, Leibnitz's Rule (Without Proof) Indeterminate Forms, Expansion of Functions by using Taylor's, Maclaurin's Series and its application in approximation, Applications of differentiation: Curvature, Radius of Curvature. | 6 |
| 2 | Partial Differentiation and its Applications:<br>Functions of two or more Variables, Limits and Continuity, Partial derivatives, Which variable is to be treated as Constant, Homogeneous Functions, Euler's Theorem and its corollaries (Without Proof), Total derivative, Implicit Functions, Change of Variables.<br>Applications:<br>Jacobians, Tangent Planes and Normal Lines, Taylor's Theorem for functions of two Variables, Maxima and Minima of Functions of two Variables, Lagrange's Method of Undetermined Multipliers, Problems of Optimization. | 11 |
| 3 | Tracing of Curves:<br>Tracing of Cartesian, Parametric, Polar Curves (Standard Curves Only), Envelopes of Curves (Introductory level). | 5 |



Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

| | | |
|---|---|---|
| **4** | Integration:<br>Reduction Formulae (Without Proof), Beta-Gamma Functions, Improper Integrals of both kinds. | **4** |
| **5** | Multiple Integrals and its Applications:<br>Double Integrals, Change of Order of Integration, Double Integrals in Polar Coordinates, Change of Variables, Triple Integrals.<br>Applications:<br>Area, Heat and Fluid flow, Mass and Center of Gravity (Introductory problems) using Double Integrals, Volume as Triple Integral. | **8** |
| **6** | Infinite Sequence and Series:<br>Infinite Sequence, Infinite Series, Geometric Series and applications, Telescoping Series, The nth term test for a Divergent Series, The Integral Test, Comparison Tests, D Alembert's Ratio Test and Cauchy's Root Test, Alternating Series, Absolute and Conditional Convergence. | **8** |

**List of Practicals / Tutorials:**

| Sr. | Contents |
|---|---|
| **1** | Successive Differentiation, Leibnitz's Rule |
| **2** | Indeterminate Forms, Expansions of Functions- Taylor's, Maclaurin's Series and their applications, Curvature, Radius of Curvature |
| **3** | Limits and Continuity, Partial derivatives |
| **4** | Homogeneous Functions, Euler's Theorem and its corollaries |
| **5** | Tangent Planes and Normal Lines, Taylor's Theorem for functions of two Variables, Errors and Approximations |
| **6** | Maxima and Minima of Functions of two Variables, Lagrange's Method of Undetermined Multipliers and Optimization problems |
| **7** | Tracing of curves and Envelopes of curves |
| **8** | Reduction Formulae, Beta-Gamma Functions, Improper Integrals of both kinds |
| **9** | Double Integrals, Change of Order of Integration |
| **10** | Double Integrals in Polar Coordinates, Change of Variables |
| **11** | Area by using double integration, Mass and Center of Gravity using Double Integrals, Applications in Heat and Fluid Flow, Triple Integrals, Volume as Triple Integral |
| **12** | Infinite Sequence, Infinite Series, Geometric Series and applications, Telescoping Series, The nth term test for a Divergent Series |
| **13** | The Integral Test, Comparison Tests, D Alembert's Ratio Test and Cauchy's Root Test, Alternating Series, Absolute and Conditional Convergence |



Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

**Reference Books:**

| | |
|---|---|
| **1** | Thomas' Calculus George B. Thomas, Maurice D. Weir, Joel R. Hass, Pearson Education |
| **2** | Elementary Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers |
| **3** | Differential Calculus, Shanti Narayan, Dr P K Mittal, S Chand Publication |
| **4** | Introduction to Engineering Mathematics- Vol1 H K Dass, S Chand Publication |
| **5** | Calculus with Early Transcendental Functions James Stewart, Cengage Publication |

**Supplementary learning Material:**

| | |
|---|---|
| **1** | Lecture Note and Video lectures prepared by faculties of CVM University |
| **2** | NPTEL Engineering Mathematics I: https://nptel.ac.in/courses/111105121/ |
| **3** | https://www.classcentral.com/course/swayam-engineering-mathematics-i-13000 |

**Pedagogy:**

- Direct Classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment (Tutorials)
- Interactive methods
- Seminar/Poster presentation

**Internal Evaluation:**

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks | | | | | | **R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| 10% | 25% | 30% | 20% | 10% | 5% | |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

**Course Outcomes (CO):**

| Sr. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Understand and apply the concepts of differential calculus including Taylor's and Maclaurin's series, curvature and radius of curvature | **20** |
| **CO-2** | Analyze functions of several variables using partial differentiation, and solve problems involving optimization, Jacobians and transformation of variables | **20** |
| **CO-3** | Trace and interpret the behavior of standard mathematical curves in Cartesian, parametric and polar forms, including basic understanding of envelopes | **15** |
| **CO-4** | Solve problems involving definite and multiple integrals and apply them to compute area, volume, mass, center of gravity and heat flow | **25** |
| **CO-5** | Determine the convergence or divergence of infinite sequences and series using standard tests | **20** |

| **Curriculum Revision:** | |
|---|---|
| Version: | **1** |
| Drafted on (Month-Year): | Apr-25 |
| Last Reviewed on (Month-Year): | - |
| Next Review on (Month-Year): | Apr-27 |



Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in