



B. Tech.

**CE / IT / AI & DS / CYBER SECURITY / CE (SE) / CSE / CSE (CC) /
CSE (AI&ML) / CSE (CS)**

Semester I

CALCULUS

MT3037

EFFECTIVE FROM July-2024

Syllabus version: 1.00

| Subject Code | Subject Title |
|--------------|---------------|
| MT3037 | Calculus |

| Teaching Scheme | | | | Examination Scheme | | | |
|-----------------|-----------|---------|-----------|--------------------|----------|-----------------|-------------|
| Hours | | Credits | | Theory Marks | | Practical Marks | Total Marks |
| Theory | Practical | Theory | Practical | Internal | External | CIE | |
| 3 | 0 | 3 | 0 | 40 | 60 | - | 100 |

Objectives of the course:

- To study the fundamental ideas of calculus required as mathematics for computations.
- To apply knowledge of calculus for real world computational engineering problems.

Course outcomes:

Upon completion of the course, the student shall be able,

CO1: To obtain the expansion of the function of two variables by Taylor's and Maclaurin series for two variables and learn the concept of various integrals.

CO2: To familiar with the ideas of partial derivatives and its applications.

CO3: To learn to trace the cartesian, polar and parametric curves.

CO4: To acquire multiple integrals as a natural extension to the function of two variables in the case of double and triple integrations.

CO5: To understand relation between surface, line intervals, volume integrals via applications.

CO6: To solve the first order ODE by using different methods and applications of first order ODE.

| Sr. No. | Topics | Hours |
|------------------|--|-------|
| Unit – I | | |
| 1 | Differentiation Calculus: Maclauri' s series, Taylor's series, Indeterminate forms, Introduction of various infinite series, Tests for convergence of Infinite series, Improper integral, Riemann integral. | 8 |
| Unit – II | | |
| 2 | Partial Differentiation and its Applications: Basic of partial differentiation, Functions of several variables, Limit and Continuity in higher derivatives, Partial derivative, Higher order partial derivatives, Homogenous functions and Euler's theorem, Total differentiation, Jacobians, Maxima and minima of two variables, Lagrange's method of undetermined multipliers. | 8 |

| | | |
|-------------------|--|----------|
| | Applications of partial differentiation. | |
| Unit – III | | |
| 3 | Curve Tracing: Important points for curve tracing, Method of tracing a curve, Tracing of Cartesian curves, Tracing of polar curves, Tracing of parametric curves. | 6 |
| Unit – IV | | |
| 4 | Multiple Integrals: Basic of multiple integral, Double integral, Triple integral, Applications of multiple integrations. | 7 |
| Unit – V | | |
| 5 | Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl, Line integrals, Surface integrals, Volume integrals, Green's theorem, Stoke's theorem, Gauss divergence theorem. | 8 |
| Unit – VI | | |
| 6 | First Order Differential Equations: Introduction, Slope fields, separable variable method, homogeneous differential equation, linear differential equation, Exact differential equation, Applications of first order and first-degree differential equation. | 8 |

Text books:

1. George B. Thomas Jr., "Thomas's Calculus – Early Transcendentals", Thirteenth Edition, Pearson.
2. Ravish Singh and Mukul Bhatt, "Engineering Mathematics - A Tutorial approach", Tata McGraw-Hill.

Reference books:

1. E. Kreyszing, "Advanced Engineering Mathematics" - 8th Edition, John Wiley (Indian Edition).
2. B. V. Ramana, "Higher Engineering Mathematics" - 11th Edition, Core Engineering Series, Tata McGraw Hill.
3. James Stewart, "Calculus", Cengage Publishing.

Course objectives and Course outcomes mapping:

- To study the fundamental ideas of calculus required as mathematics for computations: C01, C02, C03, C04, C05, C06.
- To apply knowledge of calculus for real world computational engineering problems: C01, C02, C03, C04, C05, C06.

Course units and Course outcomes mapping:

| Unit No. | Unit Name | Course Outcomes | | | | | |
|----------|--|-----------------|-----|-----|-----|-----|-----|
| | | C01 | C02 | C03 | C04 | C05 | C06 |
| 1 | Differentiation Calculus | ✓ | | | | | |
| 2 | Partial Differentiation and its Applications | | ✓ | | | | |
| 3 | Curve Tracing | | | ✓ | | | |
| 4 | Multiple Integrals | | | | ✓ | | |
| 5 | Vector Calculus | | | | | ✓ | |
| 6 | First Order Differential Equations | | | | | | ✓ |

Programme outcomes:

- PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.
- PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.
- PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.
- PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.
- PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.
- PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.
- PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.
- PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
- PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

| Programme Outcomes | Course Outcomes | | | | | |
|--------------------|-----------------|-----|-----|-----|-----|-----|
| | C01 | C02 | C03 | C04 | C05 | C06 |
| P01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| P02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| P03 | ✓ | | | ✓ | ✓ | ✓ |
| P04 | ✓ | ✓ | | ✓ | ✓ | ✓ |
| P05 | | | | | | |
| P06 | | | | | | |
| P07 | | | | | | |
| P08 | | | | | | |
| P09 | | | | | | |
| P010 | | | | | | |
| P011 | | | | | | |
| P012 | | | | | | |