

**Calculus and Analytical Geometry (MTH 104)**  
**Tribhuvan University**  
**Institute of Science and Technology**  
**Bachelor of Science in Computer Science and Information Technology**

**Course Title:** Calculus and Analytical Geometry

**Course no:** MTH-104 ----- Full Marks: 80+20

**Credit hours:** 3 ----- P.M: 32+8

**Nature of Course:** Theory

**Course Synopsis:** Preliminaries revision of differentiation and integration; Techniques of integration infinite series; Vectors and analytical geometry in space (differential geometry). Vector valued functions. Multivariable functions and partial derivatives. Multiple integrals and integration in vector fields. Partial derivatives; Equations of First Partial Derivatives.

**Goal:** This course aims at providing students with some advanced topics in undergraduate calculus and fundamental concepts of partial differentiation and P.D.E of second order. It is assured that a student who has done Certificate Level papers in mathematics will be able to study this course.

**Course Contents:**

**Unit 1. Topics in Differential Calculus and Integral Calculus ----- 8 Hrs.**

1.1 Functions and Graphs

1.2 Extreme values of functions; graphing of derivatives

1.3 Mean value integers

1.4 Definite integers, Properties and application, Mean value theory for definite integers

1.5 Fundamental theory of Integral Calculus and application, Improper integrals

**Unit 2. Infinite Series ----- 5 Hrs.**

2.1 Infinite sequence and sequence of convergence and divergence

2.2 Integral test, comparison test, ratio and root test

2.3 Absolute and conditional convergence Power series, Taylor and Maclaurin series, convergence of Taylor series

**Unit 3. Conic Section ----- 3 Hrs.**

3.1 Classifying conic sections by eccentricity

3.2 Plane curves, parametric and polar equations, integration in polar coordinates

**Unit 4. Vectors and Vectors Valued Functions ----- 6 Hrs.**

4.1 Vectors in the space

4.2 Lines and planes in space

4.3 Cylinders and Quadric surfaces

4.4 Cylindrical and Spherical Coordinates

4.5 Vector valued functions and space curves

4.6 Unit tangent vector, curvature and torsion and TNB system

**Unit 5. Multiple Integrals ----- 5 Hrs.**

5.1 Double integrals in rectangular polar coordinates

- 5.2 Finding areas, moments and centre of mass
- 5.3 Triple integrals in rectangular coordinates and application
- 5.4 Substitutes in multiple integrals

**Unit 6. Multivariate Calculus** ----- 9 Hrs.

- 6.1 Functions, limits and continuity of two or more variables
- 6.2 Partial derivatives
- 6.3 Differentiability, Differentials, Total Differential Coefficients
- 6.4 Directional derivatives and gradient vectors
- 6.5 Extreme values
- 6.6 Lagrange Multipliers

**Unit 7. Partial Differential Equations** ----- 9 Hrs.

- 7.1 Review of Ordinary Differential Equations
- 7.2 Analysis of P.D.E of 1st and 2nd order
- 7.3 Linear equations of the 1st order and the general solutions
- 7.4 P.D.E of 2nd order, its derivation and basic concepts
- 7.5 Solution of general P.D.E with constant coefficients, complimentary solution and integral solution
- 7.6 Wave equations and heat equations and their solutions (Chapter II, Section 11.1, 11.2, 11.4, 11.5). Erwin and Kreyszig. 8th edition, John-Wiley Publications

**Text Books:**

Thomas and Fenns: Calculus and Analytical Geometry, 9th Edition, 2004. (Thomas, Jr. G. B., and Finney, Ross L. Publisher: Pearson Education Pvt. Ltd.  
Kreyszig, Erwin, Advanced Engineering Mathematics, John- Wiley & Sons (1991). 5th Edition.

**References**

E.W. Swokowski, Calculus with Analytical Geometry, Second Alter Edition.  
Sneddan Ian- Elements of Partial Differential Equations.