

B.Sc. DEGREE PROGRAMME
MATHEMATICS (CORE COURSE)
FIFTH SEMESTER
MM5B05 : VECTOR CALCULUS

5 hours/week

4 credits

30 weightage

Text Book: Thomas / Finney : Calculus, 9th ed., LPE, Pearson Education.

Module I (20 hrs)

(A quick review of Section 10.1 to 10.4)

- 10.5 Lines and planes in space.
- 10.6 Cylinders and Quadric surfaces
- 10.7 Cylindrical and spherical coordinates
- 11.1 Vector valued functions and space curves.
- 11.3 Arc length and Unit tangent vector
- 11.4 Curvature, torsion and TNB frame

Module II – Multivariable functions and Partial Derivatives (20 hrs)

- 12.1 Functions of several variables
- 12.2 Limits and Continuity
- 12.3 Partial derivatives
- 12.4 Differentiability linearization and differentials
- 12.5 Chain rule
- 12.6 Partial derivatives with constrained variables
- 12.7 Directional derivatives, gradient vectors and tangent planes
- 12.8 Extreme value and saddle points
- 12.9 Lagrange multipliers
- 12.10 Taylor's formula

Module III (20 hrs)

- 13.1 Double Integrals
- 13.3 Double integrals in polar form
- 13.4 Triple integrals in Rectangular Coordinates
- 13.6 Triple integrals in cylindrical and spherical co-ordinates.
- 13.7 Substitutions in multiple integrals.

Module IV – Integration in Vector Fields (30 hours)

- 14.1 Line integrals
- 14.2 Vector fields, work circulation and flux
- 14.3 Path independence, potential functions and conservative fields
- 14.4 Green's theorem in the plane
- 14.5 Surface area and surface integrals
- 14.6 Parametrized surfaces
- 14.7 Stokes' theorem (statement only)
- 14.8 Divergence theorem and unified theory (no proof).

References

1. Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.
2. H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.

Seminar topics

- Modelling projectile motion (11.2)
- Planetary motion and Satellite (11.5)
- Area, moments and Centre of mass (13.2)
- Masses and Moments in three dimension (13.5)