

Department of Mathematics, IIT Kharagpur

MA11003 – Advanced Calculus

Autumn -2020

Module 1 - Differential Calculus

Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorem. Functions of several variables: Limit, continuity, partial derivatives and their geometrical interpretation, total differential and differentiability, derivatives of composite and implicit functions, derivatives of higher order and their commutativity; Euler's theorem on homogeneous functions, Taylor's expansion of functions, maxima and minima, constrained maximum/minimum problems using Lagrange's method of multipliers.

Module 2 - Differential Equations

First order exact differential equations, general linear differential equations with constant coefficients, method of variation of parameters, Cauchy-Euler equations.

Module 3 - Integral Calculus

Improper integrals and tests for convergence, Beta and Gamma functions and their elementary properties. Differentiation under integral sign including variable limits - Leibnitz rule. Double and triple integrals, changing the order of integration, change of variables - Jacobian of a transformation, computation of surface area and volume.

Module 4 - Vector Calculus

Definition of vector and scalar fields, level surfaces, limit, continuity, differentiability of vector functions. Directional derivative, gradient, curl, divergence and their geometrical interpretation. Line integral, path independence of line integrals; Green's theorem, Gauss' divergence theorem and Stokes' theorem.

Text books

1. **Thomas' Calculus** by **George B. Thomas, Joel Hass, Christopher Heil, Maurice D. Weir**
2. **Advanced Engineering Mathematics** by **Erwin Kreyszig**
3. **Integral Calculus** by **Shanti Narayan, P.K. Mittal**