MA1505 – Mathematics I

This is an introductory course in advanced calculus. After a detailed revision of elementary calculus, we shall study the basic computational techniques in multi-variable calculus with an introduction to vector calculus.

Syllabus

1. Sets, functions (up to 2 variables) and graphs (including graph of real valued function on 2 variables) , polynomials and rational functions, inequalities in one variable, logarithmic and exponential functions, trigonometric functions, sequences and series.

2. Differential calculus of one variable, derivatives, differentiability, rules and properties, differentiation of transcendental functions, higher order derivatives, increments and differentials, differential of arc length, curve sketching, extreme values and points of inflection. Maxima and Minima.

3. Integration as antidifferentiation, fundamental theorem of calculus, basic rules of integration, integration of polynomial, trigonometric, exponential and logarithmic functions, inverse functions, integration by substitution, integration by parts.

4. Vectors and operations on vectors, lines in R^2 and in R^3, planes in R^3, vector product, projections. Simple vector calculus and its contextualization.

5. Operations on complex numbers, geometric representation of complex numbers, De Moivre's formula, roots of complex numbers.

6. Parametric differentiation, implicit differentiation, l'Hopital's rule, optimization problems, techniques of integration, application to areas and volumes of revolution.

7. Sequences and series. Tests of convergence and divergence, power series in one variable, interval of convergence, Maclaurin and Taylor series.

8. Differential calculus for functions of several variables. Geometric interpretation, partial derivatives, chain rule, directional derivatives, gradient vector, higher order derivatives, normal lines and tangent planes to surfaces, extrema of functions: second derivative test.

9. Multiple integrals. Iterated integrals, double integrals, domains of type A and type B, change of variables formula for polar coordinates, triple integrals for rectangular domains.

10. Vector calculus. Curves, tangents and arc length, vector fields, conservative vector fields, divergence and curl, line, surface and volume integrals.

Recommended Texts:

- Main Reference: Thomas' Calculus by Weir, Hass and Giordano; 12th edition; Pearson.
- Supplementary Reference: Calculus by James Stewart; 7th edition; Brooks Cole.