Lectures on

Mathematical Analysis

Semester 2 (spring semester), 15h (15 x 1h)

Prof. dr hab. Kazimierz Nikodem

Contents:

1. Functions - general properties. Review of linear, quadratic, polynomial, exponential, logarithmic and trigonometric functions.
2. Sequences of real numbers. The limit of a sequence – basic properties and examples.
3. The limit of a function at a point. Continuous functions – properties. Asymptotes.
4. The derivative of a function at a point. Rules of differentiation, basic formulas.
5. Applications of derivatives. Local minima and maxima. Monotonicity and the first test for local extrema. Indeterminate forms – L'Hospital's Rule.
6. Higher-order derivatives. Convexity, concavity and points of inflections. Second test for local extrema. Taylor's formula with reminder – approximate polynomials.
7. Indefinite integrals – antiderivatives, basic integration formulas, integration by parts and by substitution.
8. The definite integral – Riemann sums, the fundamental theorem of calculus, the Newton-Leibniz formula.
9. Applications of definite integrals (area of regions in the plane, volumes of solids of revolution, arc length and surface area). Improper integrals.
10. Infinite series – convergence tests. Geometric series.
11. Function series; Taylor and Maclaurin series.
12. Differential calculus of functions of several variables - partial derivatives, local extrema .
13. Conditional and absolute extrema.
14. Double integrals - techniques of integration, applications.
15. Introduction to differential equations – basic concepts; equations with separable variables and linear equations.

References:

1. R.Hunt, *Calculus with analytic geometry*, Harper & Row Publ., New York, Cambridge, Sydney, 1998.
2. D. A. McQuarrie, *Mathematical Methods for Scientists and Engineers*, Univ. Sc. Books, Sausalito, CA, 2003.
3. D. Stancel, M. Stancel, *Calculus for Management and the Life and Social Sciences*, IRWIN, Illinois, 1988.