DATA SCIENCETECH INSTITUTE

Applied MSc in Data Science

"Applied Mathematics for Data Science – Didier Auroux"

Volume of classes hours: 25 hrs *(± some personal work expected)*

Course summary:

This course covers the basic notions of applied mathematics required to study optimization and then data science problems: calculus, linear algebra and complex numbers.

Course Objectives:

The subject aims to provide the student with an understanding of:

- Differentiation of functions of multiple variables, concept of gradient and derivatives
- Linear algebra through vectors and matrices, link with linear systems, diagonalization
- Complex numbers and roots of polynomials

Theoretical background used:

Basic concepts of mathematics, including basic calculus in dimension 1.

Technologies Used:

Pen, paper and brain. Scilab for verifying computations.

Course evaluation:

Written exam, ~ 2 hours.

Part 1: Calculus (~ 5 hours)

Introduction to functions
Differentiation in dimension 1 (1st order, higher order, general rules)
Taylor series expansion
Extension to dimension n (partial derivatives)
Introduction of optimization
Integration

Part 2: Linear algebra (~ 17 hours)

Notions of vectors and matrices, vector spaces
Matrix operations (algebra, transpose, trace, determinant, inverse)
Linear systems
Diagonalization (eigenvalues, eigenvectors)
Application to quadratic forms

Part 3: Complex numbers (~ 3 hours)

Introduction to complex numbers and notations
Complex arithmetic (multiplication, division)
Cartesian and polar coordinates
Circular functions and trigonometric relations