DMA-SAP-241 Multivariable Calculus

SEMESTER: Fall

CREDITS: 6 ECTS (4 hrs. per week)

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

The distinct feature of this part of the course is its focus on the multi-dimensional analysis, as opposed to one-dimensional analysis. The most important topics of this course are Vectors and coordinate geometry in 3-space; vector functions and curves; partial differentiation; applications to partial derivatives; multiple integration. The ideas of the vector calculus apply to numerous areas of human knowledge such as engineering, physics, pure mathematics, biology, and many others. Mathematical software will be used during the lectures.

Prerequisites

Basic knowledge of linear algebra and one real variable calculus.

Course contents and methodology

Methodology

Lecture, solving calculation problems during exercises.

Contents

1. **Parametric Equations and Polar Coordinates**
   1.1 Parametric Curves
   1.2 Calculus with Parametric Curves
   1.3 Polar Coordinates
   1.4 Areas and Lengths in Polar Coordinates

2. **Vectors and the Geometry of Space**
   - 2.1 Three-Dimensional Coordinate Systems
   - 2.2 Vectors
   - 2.3 The Dot Product
   - 2.4 The Cross Product
   - 2.5 Equations of Lines and Planes
   - 2.6 Cylinders and Quadric Surfaces
   - 2.7 Vector Functions and Space Curves
   - 2.8 Arc Length and Curvature

3. **Partial Derivatives**
   - 3.1 Functions of Several Variables
   - 3.2 Limits and Continuity
   - 3.3 Partial Derivatives
   - 3.4 Tangent Planes and Linear Approximations
   - 3.5 The Chain Rule
   - 3.6 Directional Derivatives and the Gradient Vector
   - 3.7 Maximum and Minimum Values
   - 3.8 Lagrange Multipliers

4. **Multiple Integrals**
   - 4.1 Double Integrals over Rectangles
   - 4.2 Double Integrals over General Regions
   - 4.3 Double Integrals in Polar Coordinates
   - 4.4 Applications of Double Integrals
   - 4.5 Triple Integrals

5. **Vector Calculus**
   - 5.1 Vector Fields
   - 5.2 Line Integrals
   - 5.3 The Fundamental Theorem for Line Integrals
   - 5.4 Green's Theorem
   - 5.5 Surface Integrals
   - 5.6 Divergence Theorem
   - 5.7 Stokes's Theorem

Textbook

- *Multivariable Calculus*, Stewart, J., 7th edition, 2011, Cengage Learning.

Grading

The grade will be determined by two midterms (25% each), homework (10%), and a final examination (40%). The exams are all closed notebook, closed textbook and no calculator. The course will not be graded on a curve, i.e., there is no bound on the numbers of A's, B's, C's, etc.

Students will have the chance to retake the exam. The resulting grade will be computed as follows: 30% of midterms and 70% of the final exam.