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Course Description – MATHEMATICS (Course 3)

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1 Introduction

The document provides a description of a training course on mathematics.

2 Overview

The course includes practical tasks on multiple integrals, elements of theory of analytic functions of one complex variable, Laplace transforms. The course of mathematics is based on the knowledge and practical skills obtained by students during Basic Course 1 and Basic Course 2. The issues addressed are the basis for exploring the subsequent sections of the course.

3 Course objectives

By the end of the semester students should be able to understand:

- the main concepts of multiple integrals, elements of theory of analytic functions of one complex variable, Laplace transforms
- differentiation and integration of functions of several variables
- solution of differential equations with the help of Laplace transforms
- applications of functions of several variables

4 Course duration

191 hours:

Lectures – 48 hours
Practical classes – 48 hours
Independent work – 95 hours

5 Prerequisites

Knowledge of Basic Course 1 of mathematics is required.

6 Teaching and learning methods

The course is organized as a combination of lectures, practical tasks (problem solving), individual work of a student.

	Topics	Lecture(in-class hours)	Practice(in-class hours)
1.	**Multiple integrals**	14	14
2.	**Elements of the theory of functions of a complex variable**	22	22
3.	**Laplace transforms**	12	12
Total hours		48	48

7 Course content

Lecture 1-7.Multiple integrals.

Double Integrals Over Rectangles. Iterated Integrals. Double Integrals in Polar Coordinates. Applications of Double Integrals. Triple Integrals. Triple Integrals in Cylindrical Coordinates. Triple Integrals in Spherical Coordinates. Line Integrals

Lecture 6-16 Elements of the theory of functions of a complex variable.

The complex number system. Fundamental operations with complex numbers. Graphical representation of complex numbers. Polar form of complex numbers. Euler's formula. Polynomial equations. Roots of complex numbers. Functions of complex variable. The elementary functions. Limits. Continuity. Derivatives. Analytic functions. Cauchy–Riemann equations. Geometric interpretation of the derivative. Differentials. Rules for differentiation. Derivatives of elementary functions. Higher order derivatives. L'Hospital's rule. Singular points. Complex line integrals. Cauchy's integral formulas. Series of functions. Power series. Taylor's theorem. Laurent's theorem. Classification of singularities. Residues. Calculation of residues. The Residue theorem. Evaluation of definite integrals.

Lecture 17-24.Laplace transforms.

Definition and existence of the Laplace transform. Linearity, shifting and scaling. Differentiation in the time domain and in the p-domain. Integration in the time domain. Convolution. The inverse Laplace transform. Applications of the Laplace transform.

8 Method of evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
attendance		20%	80% of the classes
midterm exam			
final exam	1	30%	
final report			
homework		20%	
test	2	30%	

Basic Grading Scale

$\geq 90\% : 9$
$\geq 80\% : 8,7$
$\geq 60\% : 6,5$
$\geq 50\% : 4$
$< 50\% : 1-3$

References

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3 Stewart James Calculus Early Transcendental. 2008. pp. 1308.

4 R.J. Beerends, H.G. terMorsche, J.C. van der Berg Fourier and Laplace Transforms / Cambridge university press. 2003. pp.447.