ThinkBS 410 Introduction to Real and Complex Analysis (Advanced)

Offered in University of Debrecen

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Course Objectives:

To provide an introduction to the techniques of differential and integral calculus of real and complex functions applied in engineering problems and methods.

Course Contents:

Real sequences and series, Limits and differentiation of real functions of one and several variables, Least squares method, Extremum problems, Indefinite and definite integrals, Complex numbers, Analytic functions, Integral transformations.

Learning Outcomes of the Course Unit:

1. To solve engineering problems with tools from calculus.  
2. To describe scientific problems by appropriate mathematical models in order to get sufficiently accurate solutions.  
3. To develop skills for analyzing applied mathematical problems with the proper methods of calculus.

Bibliography:

1. Bernard R. Gelbaum: Problems in Real and Complex Analysis, Springer, 1992.  
2. Margaret L. Lial, Raymond N. Greenwell, Nathan Ritchey: Calculus with applications, Pearson, 2012.  
3. Walter Rudin: Real and complex analysis, McGraw-Hill Education, 1987.  
4. George B. Thomas: Thomas’ Calculus, Addison Wesley, 2004.

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES:

Week Subjects

1 Real valued functions and their applications in real life. Economical and engineering problems.

2 Sequences and series. Important examples. Applications in engineering problems.

3 Limits of functions. Introduction to differentiation. Kinematics and kinetics of a particle. Description of the motion.

4 Applications of the least squares method.

5 Differential calculus in economics. Marginal cost, marginal revenue.

6 Extremum problems in geometry, engineering methods and economics.

7 Partial derivatives and extrema of functions of several variables. Applications in economical sciences.

8 Indefinite integrals. Techniques for the calculation of primitive functions. Applications in economical problems.

9 Riemann integral and its application for producers’ surplus and consumers’ surplus. The application of Riemann integral for determining the center of mass.

10 Area between the graphs of two functions. Volume of solids of revolution. Surface area of solids of revolution.

11 Complex numbers and their applications for alternating currents.

12 Analytic functions, Cauchy-Riemann equations.

13 Fourier transformation and its applications in digital signal processing.

14 Laplace transformation and its application in the theory of differential equations and in circuit analysis.