Pedagogic case and specific course in which designed tasks and units are used

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Pedagogic case:	• Inquiry-Based Teaching of selected topics in Complex Analysis within a mathematics course Mathematics 2

Description (including temporal scheme for design, development and implementation)	• Introduction of inquiry-based tasks in Complex Analysis during the second semester of study for first year Electrical Engineering students
	• Temporal scheme:
	  ○ Design: December 2018
	  ○ Development: January – April 2019
	  ○ Implementation: February – May 2019

Aim of pedagogic case	• To bring more inquiry into teaching selected topics in Complex Analysis to Electrical Engineering students • To find out which inquiry-based pedagogic arrangements are realistic for tutorials with larger groups of students
Mathematical concepts	• Complex number and function • Holomorphic function • Path integral • Singular point of a function • Residue at a singular point • Transformation of a function
Addressed practice	• Tutorials for groups of up to 52 students with support of digital technology
Place in specific course Course name Place of units	• Course name: Mathematics 2 • 3-4 inquiry-based units/tasks during the semester, starting at week 4
Learners profile orientation, year, age, prior knowledge, other such as math anxiety, special needs, ..	• Electrical Engineering students • 1st year students (age 18-21), spring semester • Diverse high school mathematics knowledge, eventually unified by a special (non-mandatory) course Mathematical Seminar • Students should have passed Mathematics 1 and have the following Calculus knowledge: limit of a sequence and a function, derivative of a function, basic integration methods, proper and improper integral, infinite series of numbers and functions • Mathematics content is new to the vast majority of students, but there may be some repeating students • Mathematics is not an attractive subject for a large number of students and many appreciate to see applications
Organization of specific course study credits/hours, location, group size	• 6 ECTS credits course • Course is taught each week during 13-week semester (usually first week of February – first week of May) • Course week: 150 min lecture in a large lecture hall (capacity 200-300 students) + 100 min tutorial in a seminar room/computer lab (capacity 75/52 students) • Cohort about 500 students is divided into 2 groups for lectures and into (up to) 10 groups for tutorials
Expected learning outcomes	Students are expected to: • Identify real and imaginary part of a complex function • Determine where a complex function is holomorphic

	• Calculate the value of a complex path integral • Determine type of a singular point of a complex function and calculate a residue at a singular point • Apply transformations to solving differential and difference equations
Envisioned use of digital technology	• Maplets – executable files running under CAS Maple available in PCs in the computer lab • Wolfram Alpha (online) • Possibly Matlab (available in PCs in the computer lab)
Planning of tasks	• Analysis of the current content of the course • Discussion of the persons involved • Design of inquiry-based activities and tutorial arrangements • Choice of particular tutorials where inquiry-based activities will be tested • Development of inquiry-based tasks • Implementation of the IB activities in tutorials, monitoring the course of each tutorial • Reflection and discussion of the course of each tutorial • Getting feedback from students (polls, interviews)
Names of persons involved	• Josef Rebenda • Hanna Demchenko • David Staněk
Course:	Mathematics 2
Learning objectives	• To extend the student knowledge to methods of functions of several variables and to application of partial derivatives • To acquaint students with some elementary methods for solving the ordinary differential equations • To make possible a deeper insight into the theory of functions of a complex variable • To equip students with the ability to solve usual tasks by the Laplace, Fourier and Z transforms.
Learning contents	• Function of several variables, partial derivative, tangent plane • Differential equations of first order • Linear differential equations of higher order • Complex numbers, complex functions (C.F.), differentiability of C.F., holomorphic functions • Integral of C.F., Cauchy Theorem and Formula • Laurent series, Residue Theory • Laplace Transform, Fourier Transform, Z-Transform, difference equations

Teaching /learning activities	• Lectures
	• Homework - 2 projects (solving given pseudo-randomized standard numerical examples)
	• Tutorials
	  ○ problem solving at white board
	  ○ using online material
	  ○ calculations using Maplets (see below) offline
	  ○ work on the projects supported by possibility of discussion with tutor
	  ○ project defense

Media	• Online: Course material in PDF format (lecture slides, textbook, tutorials book) • Offline: Maplets
Evaluation	• At the end of semester: a written exam • During semester: 2 written tests + 2 assessed and defended projects
Instructor role	• Developing tutorial content (inquiry-based tasks/problems) • Introducing inquiry-based material • Encouraging students' activity and discussion • Monitoring learning process/progress and providing support and feedback • Reflecting and discussing the course of each tutorial, adjusting the content
Student roles	• Active participation in tutorials • Engaging in inquiry-based mathematics tasks • Reasoning methods of solution and discussing ideas with peers/tutors • Reflecting on their learning
Other aspects	•