

Course ID 021727

# **Complex Analysis**

Unit coordinator: Nikita Sidorov

**MATH 20142**  
**Credit rating 10**  
*ECTS credits 5*

**Semester 2**

**School of Mathematics**  
*Undergraduate*

**Level 2**

***FHEQ level ' Middle part of Bachelors'***

## **Marketing course unit overview**

This course introduces the calculus of complex functions of a complex variable. It turns out that complex differentiability is a very strong condition and differentiable functions behave very well. Integration is along paths in the complex plane. The central result of this spectacularly beautiful part of mathematics is Cauchy's Theorem guaranteeing that certain integrals along closed paths are zero. This striking result leads to useful techniques for evaluating real integrals based on the 'calculus of residues'.

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## **Aims**

The course unit aims to introduce the basic ideas of complex analysis, with particular emphasis on Cauchy's Theorem and the calculus of residues.

## **Learning outcomes**

On completion of this unit successful students will be able to:

- understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations;
- evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem;
- compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues;
- use the Cauchy Residue Theorem to evaluate integrals and sum series.

## Syllabus

- 1.Series. Complex series, power series and the radius of convergence. [2 lectures]
- 2.Continuity. Continuity of complex functions [2]
- 3.The complex plane. The topology of the complex plane, open sets, paths and continuous functions. [2]
- 4.Differentiation. Differentiable complex functions and the Cauchy-Riemann equations. [2]
- 5.Integration. Integration along paths, the Fundamental Theorem of Calculus, the Estimation Lemma, statement of Cauchy's Theorem. [4]
- 6.Argument and Logarithm. [2]
- 7.Taylor and Laurent Series. Cauchy's Integral Formula and Taylor Series, Zeros and Poles, Laurent Series. [3]
- 8.Residues. Cauchy's Residue Theorem, the evaluation of definite integrals and summation of series. [5]

## Assessment methods

Other	20%
Written exam	80%

Coursework; Weighting within unit 20%

2 hours end of semester examination; Weighting within unit 80%

## Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and to provide feedback on their understanding.

## Requisites

MATH10111	Foundations of Pure Mathematics B	Pre-Requisite	Compulsory
MATH10131	Calculus and Vectors B	Pre-Requisite	Compulsory
MATH20111	Real Analysis	Pre-Requisite	Compulsory

**Available as free choice?** N

## Recommended reading

Ian Stewart and David Tall, Complex Analysis, Cambridge University Press, 1983.

## Scheduled activity hours

Lectures

22

Tutorials	11
<b>Independent study hours</b>	<b>67 hours</b>

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