MATH20142

Complex Analysis

Unit code:	MATH20142
Credit Rating:	10
Unit level:	Level 2
Teaching period(s):	Semester 2
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

Prerequisite

- MATH10111 - Sets, Numbers and Functions B (Compulsory)
- MATH10131 - Calculus and Vectors B (Compulsory)
- MATH20111 - Real Analysis (Compulsory)

Additional Requirements

MATH20142 pre-requisites

Aims

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

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'.

Assessment methods

- Other - 20%
- Written exam - 80%

Assessment Further Information

- Coursework; Weighting within unit 20%
- 2 hours end of semester examination; Weighting within unit 80%

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]

Recommended reading

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

Feedback methods

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

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 67 hours

Teaching staff

Nikita Sidorov - Unit coordinator