MATH0013 (Analysis 3: Complex Analysis)

Year: 2018–2019
Code: MATH0013
Old code: MATH2101
Level: 5 (UG)
Normal student group(s): UG: Year 2 Mathematics degrees
Value: 15 credits (= 7.5 ECTS credits)
Term: 1
Structure: 3 hour lectures and 1 hour problem class per week.
Assessment: 85% examination, 5% coursework, 5% in-course test and 5% project.
Weekly assessed coursework.
For information about the project please see Maths webpage Second Year Project. In order to pass the module you must have at least 40% for both the examination mark and the final weighted mark and you must complete the project.
Normal Pre-requisites: MATH0003 (previously MATH1101) (MATH0004 recommended [previously MATH1102])
Lecturer: Prof M Singer
Problem class teacher: Prof M Singer

Course Description and Objectives

This is a course on complex functions. The treatment is rigorous. Starting from complex numbers, we study some of the most celebrated theorems in analysis, for example, Cauchy’s theorem and Cauchy’s integral formulae, the theorem of residues and Laurent’s theorem. The course lends itself to various applications to real analysis, for example, evaluation of definite integrals and finding the number of zeros of a complex polynomial in a region.

Recommended Texts


Detailed Syllabus

The complex numbers and topology in \( \mathbb{C} \)

Functions on the complex plane
Continuous, holomorphic functions, Cauchy–Riemann equations, and power series. Harmonic functions.

Elementary functions \( e^z, \sin z, \cos z, \log z, z^\alpha \) and conformal mapping. Linear fractional transformations.

Cauchy’s Theorem and its applications
Integration along curves. Goursat’s theorem, Cauchy’s theorem in the disc, Cauchy’s integral formulas. Taylor’s theorem, Laurent’s theorem, Liouville’s theorem, Morera’s theorem. The Fundamental theorem of algebra.

**Meromorphic functions**
Zeros, poles, residue theorem, standard examples of integrals with consideration of the needs of methods courses, the argument principle, Rouché’s theorem, Casorati–Weierstrass’ theorem, the identity theorem. Maximum modulus principle.