

MODULE TITLE	Complex Analysis		CREDIT VALUE	15
MODULE CODE	MTH2009		MODULE CONVENER	Dr Henri Johnston (Coordinator)
DURATION: TERM	1	2	3	
DURATION: WEEKS	0	11	0	
Number of Students Taking Module (anticipated)	200			

DESCRIPTION - summary of the module content

The central object of study in analysis is the limit and related notions of convergence, continuity, differentiation, and integration. In this module, we carefully and rigorously develop an understanding of the analysis of functions of a complex variable. You will learn how to rigorously handle differentiation, integration, analyticity, contour integration, power series, and topology of the complex plane. Quite surprisingly, complex analysis is in many ways simpler than real analysis and has many practical applications. The material in this module provides foundations for the study of Analytic Number Theory (MTHM041) and MTHM041 (Analytic Number Theory), etc. in pure mathematics as well as being the basis for many techniques for solving practical problems in economics, science, and engineering. Hence it is highly recommended to all mathematics students.

Pre-requisite modules: MTH2008 (or equivalent)

AIMS - intentions of the module

The objective of this module is to provide you with a logically based introduction to complex analysis. The primary objective is to define all the basic concepts clearly and to develop them sufficiently to provide proofs of useful theorems. This enables you to see the reason for studying analysis, and develops the subject to a stage where you can use it in a wide range of applications.

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module, **you should be able to:**

Module Specific Skills and Knowledge:

- 1 state and prove key theorems in complex analysis using a rigorous approach;
- 2 understand properties of analytic functions over the complex numbers;
- 3 use contour integrals for computational and theoretical purposes;

Discipline Specific Skills and Knowledge:

- 4 apply fundamental mathematical concepts, manipulations and results in analysis;
- 5 formulate rigorous arguments as part of your mathematical development;

Personal and Key Transferable/ Employment Skills and Knowledge:

- 6 think analytically and use logical argument and deduction;
- 7 communicate your ideas effectively in writing and verbally;
- 8 manage your time and resources effectively.

SYLLABUS PLAN - summary of the structure and academic content of the module

- Epsilon-delta function limits; continuity; differentiability in the complex plane;
- Basic topology in the plane;
- Cauchy-Riemann equations; contrast to real analytic functions;
- Contour integrals; poles and singularities (isolated, removable, essential); residues; Cauchy's Theorem; Cauchy integral formulae; Taylor series and Laurent series;
- Maximum modulus principle, Liouville's theorem, fundamental theorem of algebra, meromorphic functions, residue theorem;
- Rouché's theorem, principle of the argument;
- Applications to definite integrals, summation of series and location of zeros.

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	38.00	Guided Independent Study	112.00	Placement / Study Abroad	0.00
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DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled Learning and Teaching Activities	33	Lectures including example classes
Scheduled Learning and Teaching Activities	5	Tutorials
Guided Independent Study	112	Lecture and assessment preparation; wider reading

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Exercise sheets	5 x 10 hours	All	Discussion at tutorials; tutor feedback on submitted answers

SUMMATIVE ASSESSMENT (% of credit)

Coursework	10	Written Exams	90	Practical Exams	0
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DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of Credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Written Exam – closed book	90%	2 hours (Summer)	All	Written/verbal on request, SRS
Coursework Exercises 1	5%	15 hours	All	Annotated script and written/verbal feedback
Coursework Exercises 2	5%	15 hours	All	Annotated script and written/verbal feedback

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-reassessment
Written Exam*	Written Exam (2 hours) (90%)	All	August Ref/Def Period
Coursework Exercises 1*	Coursework exercises (5%)	All	August Ref/Def Period
Coursework Exercises 2*	Coursework exercises (5%)	All	August Ref/Def Period

*Please refer to reassessment notes for details on deferral vs. Referral reassessment

RE-ASSESSMENT NOTES

Deferrals: Reassessment will be by coursework and/or exam in the deferred element only. For deferred candidates, the module mark will be uncapped.

Referrals: Reassessment will be by a single written exam worth 100% of the module only. As it is a referral, the mark will be capped at 40%.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

Web based and Electronic Resources:

ELE: <http://vle.exeter.ac.uk>

Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Stewart, I. & Tall, D.	Complex Analysis (the Hitchhiker's Guide to the Plane)		Cambridge University Press	1983	000-0-521-28763-4	[Library]
Set	Priestley, H.A.	Introduction to Complex Analysis		Oxford University Press	2003	000-0-198-53428-0	[Library]
Set	Howie, John M.	Complex Analysis		Springer	2003	000-1-852-33733-8	[Library]
Set	Spiegel, M.R.	Schaum's outline of theory and problems of complex variables: with an introduction to conformal mapping and its appreciation		McGraw Hill	1981	000-0-070-84382-1	[Library]
Set	Rudin, R.	Principles of Mathematical Analysis	3rd	McGraw-Hill Book Co.	1976		[Library]

CREDIT VALUE	15	ECTS VALUE	15
PRE-REQUISITE MODULES	MTH2008		
CO-REQUISITE MODULES			
NQF LEVEL (FHEQ)	5	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Wednesday 26 February 2020	LAST REVISION DATE	Wednesday 20 September 2023
KEY WORDS SEARCH	Complex numbers; analysis; series; functions; limits; continuity; derivatives; integration; residue; contour integral		