ACE Network Subject Information Guide

Complex Analysis

Semester 2, 2022

Administration and contact details

Host Department	School of Mathematics
Host Institution	Monash University
Name of lecturer	Greg Markowsky
Phone number	03 9905 4487
Email Address	greg.markowsky@monash.edu
Homepage	http://users.monash.edu.au/~gmarkow/
Name of Honours coordinator	Dr Julie Clutterbuck
Phone number	03 9905 4462
Email Address	julie.clutterbuck@monash.edu

Subject details

Handbook entry URL	TBA
Subject homepage URL	TBA
Honours student hand-out URL	TBA
Start date:	August 2022
End date:	October 2022
Contact hours per week:	4
Lecture day and time:	TBA
Description of electronic access arrangements for students (for example, WebCT)	Students will have access to Moodle webpage

Subject content

1. Subject content description

Complex analysis is one of the most beautiful and important subjects in classical mathematics, and remains an active area of research today. We will explore many advanced topics in the subject. It is hoped that students will have some familiarity with the basics of the field, such as analytic functions, contour integration, and power series, however the first few lectures will be spent in review if necessary. Time allowing, the topics will include: conformal mapping, including Mobius transformations and the Schwarz-Christoffel transformation; boundary behavior of conformal maps; the maximum modulus principle, uniqueness principle, Schwarz's Lemma, the argument principle, the Phragmen-Lindelof principle, Picard's theorems, and Rouche's Theorem; Schwarz's reflection principle and consequences; Infinite products, including Weierstrauss' Theorem; convergence of sequences of analytic functions and normal families; Hardy spaces; special functions; Riemann surfaces; applications of complex analysis to other fields.

2. Week-by-week topic overview

1. Review of undergraduate complex analysis
2. Conformal mapping
3. Conformal mapping, including boundary behaviour
4. The maximum modulus principle, uniqueness principle, and Schwarz's Lemma
5. The argument principle and and Rouche's Theorem
6. The Phragmen-Lindelof principle, Picard's theorems
7. Schwarz's reflection principle and consequences
8. Infinite products, Weierstrauss' Theorem
9. Convergence of sequences of analytic functions and normal families
10. Hardy spaces
11. Special functions and Riemann surfaces
12. Riemann surfaces and applications of complex analysis

3. Assumed prerequisite knowledge and capabilities

It would be good if the student has some familiarity with the subject, but we will also spend some time reviewing in the first week.

4. Learning outcomes and objectives

1. Learn the core of the subject, including an understanding of the interrelatedness of the topics covered.
2. Understand the relation of the advanced topics covered in this unit with the standard undergraduate complex analysis syllabus.
3. Be able to use the powerful theorems of complex analysis in order to perform calculations.
4. Appreciate the importance of complex analysis in other fields, including physics and engineering, through seeing applications of the theory

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
1	K1, S1, S2, S3, S5
2	K1, K2, S2, S3, S5
3	K1, K2, S1 S3, S4, S5
4	A1, A2, A3, A4

Learning Outcome Descriptors at AQF Level 8
Knowledge
K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines
K2: knowledge of research principles and methods
Skills
S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence
S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas
S3: cognitive skills to exercise critical thinking and judgement in developing new understanding
S4: technical skills to design and use in a research project
S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences
Application of Knowledge and Skills
A1: with initiative and judgement in professional practice and/or scholarship
A2: to adapt knowledge and skills in diverse contexts
A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters
A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

The main resource will be lecture notes, which will be provided. The following texts are not required, but are good references.

Real and Complex Analysis, Walter Rudin
Complex Analysis, Lars Ahlfors
Functions of One Complex Variable, John Conway
Complex Variables (Schaum's Outlines series), Murray Spiegel

6. Assessment

Exam/assignment/classwork breakdown					
Exam	60%	**Assignment**	15%+15%	**Class work**	10%
Assignment due dates			TBA		TBA
Approximate exam date				November 2020	

Institution Honours program details

Weight of subject in total honours assessment at host department	8.3%
Thesis/subject split at host department	31.25%
Honours grade ranges at host department:	
H1	80-100%
H2a	70-79 %

H2b	60-69 %
H3	50-59 %