UNSW Course Outline

MATH2621 Higher Complex Analysis - 2024

Published on the 29 Aug 2024

General Course Information

Course Code : MATH2621
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

[Handbook](#) [Class Timetable](#)

Course Details & Outcomes

Course Description

This is a first course in the theory and applications of complex functions, taught at the Higher level. Topics covered include analytic functions, Taylor and Laurent series, integrals, Cauchy's theorem, residues, evaluation of certain real integrals, Laplace transforms, conformal mappings

and applications to differential equations.

The course is part of the Advanced Mathematics degree and the Advanced Science degree with a mathematics major of choice.

The course includes 4 lectures and 1 tutorial every week. All activities will be held in person on campus.

Course Aims

The aim of this course is to extend students' understanding of differential and integral calculus from functions of a single real variable to functions of a complex variable. The differences between the two are often unexpected and very surprising. The theory of complex valued functions will give students many new insights into the real variable theory.

Complex analysis has applications to pure mathematics, physics, and engineering.

Relationship to Other Courses

Assumed knowledge / Pre-Requisite: MATH1231 or MATH1241 or MATH1251 or DPST1014 each with a mark of at least 70

Exclusions: MATH2069, MATH2521

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the main properties and examples of complex analytic functions and examine the relationship between complex function theory and the theory of functions of a real variable.
CLO2 : Compute and manipulate series expansions for analytic functions.
CLO3 : Formulate and prove the major integral theorems and apply them to calculate both complex and certain real improper and trigonometric integrals.
CLO4 : Identify and classify zeroes and poles of functions and find their residues.
CLO5 : Select and apply theorems from analysis to complex function settings to demonstrate an understanding of how complex analysis arises in applications of mathematics.

Course Learning Outcomes	Assessment Item
CLO1 : Describe the main properties and examples of complex analytic functions and examine the relationship between complex function theory and the theory of functions of a real variable.	• Class test • Final exam • Weekly lessons
CLO2 : Compute and manipulate series expansions for analytic functions.	• Class test • Final exam • Weekly lessons
CLO3 : Formulate and prove the major integral theorems and apply them to calculate both complex and certain real improper and trigonometric integrals.	• Class test • Final exam • Weekly lessons
CLO4 : Identify and classify zeroes and poles of functions and find their residues.	• Final exam • Weekly lessons
CLO5 : Select and apply theorems from analysis to complex function settings to demonstrate an understanding of how complex analysis arises in applications of mathematics.	• Class test • Final exam • Weekly lessons

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

Lectures, Tutorials and Assessment Tasks will be held on campus and in person. Lectures will be recorded through Echo360 an made automatically available on Moodle after processing time (usually a couple of hours later).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Class test Assessment Format: Individual	25%	Start Date: Not Applicable Due Date: Week 8
Final exam Assessment Format: Individual	60%	Start Date: Not Applicable Due Date: Exam Period
Weekly lessons Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details
Class test

Assessment Overview

Class Test is designed to assess your knowledge of the topics covered in lectures in the lectures and tutorials preceding the test. Class Test will be typically scheduled in Week 8 and feedback will be provided before the end of the term.

The test will take up to 1 hour, with specific details provided on the Moodle page. Questions will assess problem solving skills, sound logical reasoning, and proofs.

Course Learning Outcomes

- CLO1 : Describe the main properties and examples of complex analytic functions and examine the relationship between complex function theory and the theory of functions of a real variable.
- CLO2 : Compute and manipulate series expansions for analytic functions.
- CLO3 : Formulate and prove the major integral theorems and apply them to calculate both complex and certain real improper and trigonometric integrals.
- CLO5 : Select and apply theorems from analysis to complex function settings to demonstrate an understanding of how complex analysis arises in applications of mathematics.

Detailed Assessment Description

If you miss this test and have special consideration granted, then the weight of the test will be shifted on the final exam. There will be no additional test for this task.

Assessment information

Please refer to timetable for time and place of the test

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

Final exam

Assessment Overview

The final exam is designed to summarise your learning on all topics delivered across all weeks of the term, including material from lectures and tutorials. The exam is supervised on campus, and it is typically 2hrs 10 minutes. It includes questions in the theory and practice of complex analysis.

Sample exams will be available on Moodle. The examination will occur during the official university examination period. Feedback is available through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Describe the main properties and examples of complex analytic functions and examine the relationship between complex function theory and the theory of functions of a real variable.
- CLO2 : Compute and manipulate series expansions for analytic functions.
- CLO3 : Formulate and prove the major integral theorems and apply them to calculate both complex and certain real improper and trigonometric integrals.
- CLO4 : Identify and classify zeroes and poles of functions and find their residues.
- CLO5 : Select and apply theorems from analysis to complex function settings to demonstrate an understanding of how complex analysis arises in applications of mathematics.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

Weekly lessons

Assessment Overview

Every week, you will complete an online quiz using Mobius. You will receive instant feedback and have unlimited attempts. The quizzes will cover basic material from previous lectures and help establish the foundational knowledge needed for the weekly tutorial classes.

During the tutorials, you will work in small groups to solve more advanced questions with the help of a tutor. Your assessment will be based not on the correctness of your solutions but on the effort and engagement you and your team demonstrate.

You can earn 10% of your total mark from the best 7 out of 9 weekly Mobius quizzes and an additional 5% for actively engaging in problem-solving in at least 7 out of 9 weekly tutorial classes.

Course Learning Outcomes

- CLO1 : Describe the main properties and examples of complex analytic functions and examine the relationship between complex function theory and the theory of functions of a real variable.
- CLO2 : Compute and manipulate series expansions for analytic functions.
- CLO3 : Formulate and prove the major integral theorems and apply them to calculate both complex and certain real improper and trigonometric integrals.
- CLO4 : Identify and classify zeroes and poles of functions and find their residues.
- CLO5 : Select and apply theorems from analysis to complex function settings to demonstrate an understanding of how complex analysis arises in applications of mathematics.

Detailed Assessment Description

There will be plenty of opportunity to engage in this activity. Since only 7 out of 9 items will count towards the final grade, special consideration for this task is not applicable.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see here.

General Assessment Information

The mid-term test will take place at 5pm on Thursday of Week 8. More information about the exact length and topics covered will be announced on Moodle.

<u>Grading Basis</u>

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Revision, basic topology, complex functions
Week 2 : 16 September - 22 September	Lecture	Limits, continuity, and differentiation; Cauchy-Riemann equations
Week 3 : 23 September - 29 September	Lecture	Power series; analytic and harmonic functions
Week 4 : 30 September - 6 October	Lecture	Exponentials, logarithms, roots, and related functions
Week 5 : 7 October - 13 October	Lecture	Contour integrals; antiderivatives; the Cauchy-Goursat theorem
Week 7 : 21 October - 27 October	Lecture	The Cauchy integral formula; Morera's theorem
Week 8 : 28 October - 3 November	Lecture	Taylor and Laurent series; singularities, residues
	Assessment	Class Test
Week 9 : 4 November - 10 November	Lecture	Evaluating integrals, winding number
Week 10 : 11 November - 17 November	Lecture	Theorem of Rouche, Fourier and Laplace transformation

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

Lecture notes will be provided. A skeleton version of the Lecture Slides will be uploaded on Moodle at the beginning of every week. Students should download them before coming to the lecture and fill the gaps by taking notes on them.

At the end of week 1 I will announce consultation times (online or in person). You are strongly encouraged to take advantage of that.

There will be a Forum on Moodle for Questions and Answers. I will monitor the forum regularly, but you are also encouraged to help each other by answering questions of your peers.

Recommended Resources

The course does not follow any particular book. Nonetheless, the topics covered are all classical

and available in several books. The library has several texts in Complex Analysis that you can use. For example, any edition of

J.W. Brown and R.V. Churchill, Complex Variables and Applications; McGraw Hill,

covers many of the topics of the course.

Course Evaluation and Development

Student's feedback through MyExperience surveys has informed the development in design of the course throughout the years. For example, the online Forum allows students to ask questions at any time they wish. Students are encouraged to fill the MyExperience survey.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Alessandro Ottazzi		Anita B. Lawrence Centre - Room 6103		Announced on Moodle by the end of Week 1	Yes	Yes
	Alessandro Ottazzi		Anita B. Lawrence Centre - Room 6103		Announced on Moodle by the end of Week 1	Yes	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines

School-specific Information

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students

in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: [The School of Mathematics and Statistics assessment policies](#)

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the [computing facilities webpage](#). Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School Contact Information

Please visit the [School of Mathematics and Statistics website](#) for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.**