Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year	AY2022-2023
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Juan-Pablo Ortega
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Course Title	COMPLEX ANALYSIS
Course Code	MH3101
Academic Units	4
Contact Hours	51
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	MH1101 and MH2100
Co-requisites	
Pre-requisite to	
Mutually exclusive to	MH2801
Replacement course to	
Remarks (if any)	

Course Aims

This is the only courses on complex analysis and is compulsory for students of mathematical sciences tracked in pure and applied mathematics. The course aims to present an introduction to the theory of functions of a complex variable that is useful in many branches of pure and applied mathematics and computer engineering as well. This course carefully treats the principal topics, such as limits, continuity, differentiability of complex-valued functions of a complex variable, complex integral, Taylor series, singularity, Laurent series, calculus of residues, analytic functions as geometric mappings, and to illustrate the power of the subject through a variety of applications. After learning this course, you will be able to make connections between the complex-valued functions and real-valued functions of two real variables studied in Calculus III, as well as advantages of complex-valued functions in solving several problems in real analysis.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Explain the setting of the concepts of complex-valued functions of a complex variable
ILO 2	Translate between problems in complex analysis and problems in real analysis using different approaches, as well as what have already been studied in MH1100, MH1101, MH2100
ILO 3	Prove the mathematical statements in Complex Analysis.
ILO 4	Apply methods of Complex Analysis to solve problems in real analysis, computer science and engineering involving complex numbers

Course Content

Analytic functions of one complex variable; Complex derivative; Elementary functions; Cauchy-Riemann equations
Contour integrals; Cauchy's theorem and Cauchy's integral formula; Liouville's theorem,
Fundamental Theorem of Algebra
Taylor series, Laurent series, Singularities of analytic functions
Residue theorem, Calculus of residues, Applications
Analytic functions as geometric mappings, Maximum modulus principle, Schwarz lemma,
Conformal mappings

Reading and References (if applicable)

* Textbook
J.W. Brown & R.V. Churchill, Complex Variables and Applications, McGraw-Hill, Ninth Edition, 2014 ISBN-13: 978-0073383170, ISBN-10: 0073383171

* Reference-book
E.B. Saff, A.D. Snider, Fundamentals of Complex Analysis: Engineering, Science, and Mathematics, Pearson, Third Edition, 2014
ISBN: 0-13-907874-6

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Complex numbers; topology of the complex plane	1-4	Annotated lecture slides	In-person	
2	The complex derivative; Cauchy-Riemann equations	1-4	Annotated lecture slides	In-person	
3	Elementary functions; multi-valued functions	1-4	Annotated lecture slides	In-person	
4	Complex integral	1-4	Annotated lecture slides	In-person	
5	Complex integral	1-4	Annotated lecture slides	In-person	
6	Complex integral	1-4	Annotated lecture slides	In-person	
7	Power series	1-4	Annotated lecture slides	In-person	
8	Singularities and Laurent series. Midterm exam	1-4	Annotated lecture slides	In-person	
9	Singularities and Laurent series	1-4	Annotated lecture slides	In-person	
10	Calculus of residues	1-4	Annotated lecture slides	In-person	
11	Analytic functions as geometric mappings	1-4	Annotated lecture slides	In-person	
12	Analytic functions as geometric mappings	1-4	Annotated lecture slides	In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
13	Revision	1-4	Annotated lecture slides	In-person	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Examples and Explanation - Motivates the concepts in the learning objectives through examples. The general theory and principles are then explained. Problem solving - Develops competence in solving a variety of problems and gaining familiarity with mathematical proofs.
Tutorials	Examples and Explanation - Motivates the concepts in the learning objectives through examples. The general theory and principles are then explained. Problem solving - Develops competence in solving a variety of problems and gaining familiarity with mathematical proofs. Peer Instruction - You will work together to gain experience in explaining concepts to others and presenting solutions.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Assignment(Assignment)	1, 2, 3	1. a, b, c 2. a, b, c 3. a	25		Individual	Analytic	Multistructural
2	Continuous Assessment (CA): Others(Short Answer Questions)	1, 2, 3	1. a, b, c 2. a, b, c 3. a	25		Individual	Analytic	Multistructural
3	Summative Assessment (EXAM): Final exam(Short Answer Questions)	1, 2, 3, 4	1. a, b, c 2. a, b, c 3. a	50		Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

Formative Feedback

Feedback will be given to students through the weekly problem tutorial sets that are covered in tutorial. Common mistakes in the assignment and the midterm test will be discussed in the provided solution sets.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Creative Thinking	Intermediate
Curiosity	Intermediate
Learning Agility	Intermediate
Problem Solving	Advanced
Sense Making	Advanced

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

Policy (Absenteeism)

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that

goes against this or have any other concerns, please speak to your instructors or a faculty member.

Advice for students:
1.This course is not easy, so get with it from the start or you'll have great difficulty later
2.The more you work in August, the less you have to worry in November
3.Ask questions and consult with your classmates
4.Do the assigned questions and go to the tutorial sessions
5.Review your notes before coming to class and make sure you understand the last lecture

Assessments:
1.A late submission for an assignment is not accepted
2.No make-up midterm test will be arranged
3.A student who is absent from a Midterm test without valid Leave of Absence will be given zero mark.
4.In case of a valid reason for absence, the total course marks would subsequently be rescaled to a base of 100%.

Appendix 1: Assessment Rubrics

Rubric for Tutorials: Assignment (25%)

Point-based marking (not rubrics based)

Rubric for Mid-semester Quiz: Short Answer Questions (25%)

Point-based marking (not rubrics based)

Rubric for Examination: Short Answer Questions (50%)

Point-based marking (not rubrics based)