MATH4023 Complex Analysis
L1 (Spring 2025) Course Outline

1. Instructor

Name: Dr. CHENG Kam Hang Henry
Office: Room 3486 (L25–26)
Email: keroc@ust.hk
Office hours: (Tentative) Wed 15:30 – 17:30;
You may also just drop in my office any time or make an email appointment beforehand to ensure I am there.

2. Teaching assistants

(T1A)
Name: Mr. ZHANG Ruilin
Email: rzhangdb@connect.ust.hk

(T1B)
Name: Ms. HUO Mengyu
Email: mhuoaa@connect.ust.hk

3. Meeting time and venue

Lectures:	(L1)	Tue & Thu 12:00 – 13:20	LG3009 (L10–12)	
Tutorials:	(T1A)	Wed 18:00 – 18:50	2304 (L17–18)	(Starting on **Feb 12**)
	(T1B)	Tue 18:00 – 18:50	4502 (L25–26)	(Starting on **Feb 11**)

Course website: https://canvas.ust.hk/courses/62312

4. Course description

This course is about the study of **functions of one complex variable**. Major topics include: point-set topology; limits and continuity; holomorphic functions; Cauchy-Riemann equations; power series; complex line integrals; Cauchy's theory and its consequences; Taylor series; isolated singularities and Laurent series; Cauchy's residue theorem; conformal mappings.

Credit points: 3
Prerequisite: **Multivariable calculus** (MATH2011/2023/3043) and **mathematical analysis** (MATH2033/2043)
For those who have not taken **real analysis** (MATH2043/3033): Although MATH3033 is not listed as an official prerequisite, it will be quite helpful if you are already familiar with the concept of **uniform convergence**.

5. Intended learning outcomes (ILOs)

Upon successful completion of this course, students are expected to be able to:

1. apply the concept of limits to analyze and solve problems related to continuity and approximation in the mathematical profession;
2. compute contour integrals of complex functions and Laurent series of meromorphic functions, and explain these computations clearly using concepts from complex analysis;
3. recognize the power of Cauchy's theory that made some difficult problems solvable, and apply logical reasoning to investigative mathematical work; and
4. develop mathematical maturity to undertake higher level studies in mathematics and related fields.

6. Assessment scheme

⦿ **Assignments (10% + Bonus 4%)**: Assessing ILOs 1, 2, 3 and 4

Homework will be assigned from time to time. You will be required not only to compute numerical answers, but also to write down full solutions in a rigorous manner. You are allowed to have peer discussion on the solutions, but you need to submit solutions that are individually written **on your own**. The use of ChatGPT or other generative AI tools are not allowed.

You should submit each homework in the form of either a clearly written and scanned or a neatly LaTeX-typed **PDF file** on the **Canvas** system before the deadline. Feedback will be given on your work within two weeks from the submission deadline, so that you can improve.

⦿ **Midterm Test (30%)**: Assessing ILOs 1, 2, 3 and 4

The mid-term test will be scheduled on **Thursday, March 27 from 19:15 to 21:15**. It will tentatively cover all materials from chapters 1 to 3 of the lecture notes.

⦿ **Final Exam (60%)**: Assessing ILOs 1, 2, 3 and 4

The final exam will take three hours, and will be scheduled in due course. All materials taught in the course will be tested in the final exam.

The mid-term test and the final exam will normally be **closed-book written tests**, and you will be allowed to use an **HKEAA-approved** handheld calculator during the tests. The exact exam arrangements may be modified in the event of unexpected emergencies.

Letter grades:

The assignment of letter grades is **criterion-referenced** according to the grade descriptors below. In particular, the grading scheme is neither "absolute" nor "on a curve". Although the exact "grade boundaries" vary due to the difficulty of the assessments, students should generally aim at getting a course total of 80% or above for A-/A/A+, and about 60% or above for B-/B/B+.

Grade descriptors:

Grades	Short description	Elaboration on subject grading description
A	Excellent	The student has mastered almost all concepts and techniques of complex analysis taught in the course, and has excellent and thorough understanding on the subject content.
B	Good	The student has mastered most computational techniques about functions of a complex variable taught in the course, yet the understanding of some challenging concepts may not be deep enough.
C	Satisfactory	The student meets the minimum expectation of the instructor, has acquired some basic computational techniques about functions of a complex variable, but some concepts were not clearly understood.
D	Marginal pass	The student is only able to recall some fragments of topics and is able to complete some of the most elementary computations about functions of a complex variable.
F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete elementary computations about functions of a complex variable.

7. Student learning resources

- Main reference: Lecture note by the instructor
  (Accessible via our course website https://canvas.ust.hk/courses/62312)

- Other reference texts:
  J. Bak and D. Newman, *Complex Analysis* (3rd ed.), Springer UTM.
  T. W. Gamelin, *Complex Analysis*, Springer UTM.
  E. M. Stein and R. Shakarchi, *Complex Analysis*, Princeton Uni. Press. (Ch. 1 – 3 only)
  Y. K. Kwok, *Applied Complex Variables for Scientists and Engineers* (2nd ed.), Cambridge Uni. Press. (this is a reference containing many applications suitable for engineers)

8. Tentative course schedule

Week	Lecture dates	Topics
1	Feb 4, Feb 6	Complex number arithmetics Sequences and series of complex numbers
2	Feb 11, Feb 13	Point-set topology in $\mathbb{C}$: open sets, closed sets Compactness, connectedness
3	Feb 18, Feb 20	Functions in a complex variable, Limits and continuity
4	Feb 25, Feb 27	Holomorphic functions, Cauchy-Riemann equations Complex exponential and trigonometric functions
5	Mar 4, Mar 6	Sequences and series of complex functions Power series
6	Mar 11, Mar 13	Line integrals in the complex plane Antiderivatives, Cauchy-Goursat Theorem
7	Mar 18, Mar 20	Cauchy integral formula Complex logarithms
8	Mar 25, Mar 27	Taylor series of a holomorphic function Morera's Theorem
9	Apr 8, Apr 10	Maximum modulus principle, Schwarz lemma Liouville's Theorem
10	Apr 15, Apr 17	Isolated singularities Laurent series
11	Apr 22, Apr 24	Residues
12	Apr 29	Argument principle, Rouché's Theorem
13	May 6, May 8	Any other selected topic(s) and/or Final review