MATH4023 Complex Analysis
L1 (Spring 2022) Course Outline

1. Instructor

Name: Dr. CHENG Kam Hang Henry
Office: Room 3486 (L25–26)
Email: keroc@ust.hk
Office hours: (Tentative) Wed 14:30 – 16:30;
A Zoom meeting will be held during my office hours, so you may join the meeting and ask questions online. If you would like to meet in person, you may also just drop in my office any time or make an email appointment beforehand so as to ensure I am there.

2. Teaching assistants

Name:	Mr. FUNG Cheuk Yan	Name:	Mr. FEI Zetao
Email:	cyfungao@connect.ust.hk	Email:	zfei@connect.ust.hk

3. Meeting time and venue

Lectures:	(L1)	Mon & Wed 12:00 – 13:20	Zoom meeting	
Tutorials:	(T1A)	Fri 16:30 – 17:20	Zoom meeting	(Starting on **Feb 11**)
	(T1B)	Wed 9:30 – 10:20	Zoom meeting	(Starting on **Feb 16**)

Please check out our course website https://canvas.ust.hk/courses/41723 for the Zoom links.

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 machinery of uniform convergence.

5. Intended learning outcomes (ILOs)

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

1. recognize the power of Cauchy's theory that made some difficult problems solvable, and apply logical reasoning to investigative mathematical work;
2. apply the concept of limits to analyze and solve problems related to continuity and approximation in the mathematical profession;
3. explain clearly concepts from complex analysis, e.g. compute contour integrals of complex functions and Laurent series of meromorphic functions; 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** (either in hard-copy or as a scanned PDF document). I will give feedback on your work so that you can improve.

- **Midterm Test (30%)**: Assessing ILOs 1, 2, 3 and 4
  The mid-term test will be scheduled on **Wednesday, March 30 from 19:30 to 21:30**. 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 be scheduled on **Monday, May 23 from 16:30 to 19:30**. All materials taught in the course will be tested in the final exam.

Exam arrangements, including the format as well as the policy on the usage of calculators, will depend on the situation of the current pandemic and will be announced in due course.

7. Student learning resources

- Main reference: Lecture note by the instructor
  (Accessible via our course website https://canvas.ust.hk/courses/41723)

- 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)
  J. W. Brown and R. V. Churchill, *Complex Variables and Applications* (9th ed.), McGraw-Hill.
  (this is a reference suitable for engineers)

8. Tentative course schedule

Week	Dates	Topics
1	Feb 7, Feb 9	Complex number arithmetics Sequences and series of complex numbers
2	Feb 14, Feb 16	Point-set topology in $\mathbb{C}$: open sets, closed sets Compactness, connectedness
3	Feb 21, Feb 23	Functions in a complex variable, Limits and continuity
4	Feb 28, Mar 2	Holomorphic functions, Cauchy-Riemann equations Complex exponential / trigonometric functions
5	Mar 7, Mar 9	Sequences and series of complex functions Power series
6	Mar 14, Mar 16	Line integrals in the complex plane Antiderivatives, Cauchy-Goursat Theorem
7	Mar 21, Mar 23	Cauchy integral formula Complex logarithms
8	Mar 28, Mar 30	Taylor series of a holomorphic function Morera's Theorem
9	Apr 4, Apr 6	Maximum modulus principle, Schwarz lemma Liouville's Theorem
10	Apr 11, (Apr 13*)	Isolated singularities, Laurent series
11	Apr 20, Apr 25	Residues
12	Apr 27, May 4	Argument principle, Rouché's Theorem
13	May 11	Any other selected topic(s) and/or Final review

* An extra lecture may need to be held on **Wednesday, April 13**, depending on the progress.