Department of Mathematics & Statistics
Concordia University

MATH 366
Complex Analysis I
Winter 2023

Preface: **This course will be taught in person at H-523 SGW. Lecture notes will be posted at the course's Moodle site as well as weekly homework assignment. All assignments should be submitted, as .pdf files, ONLINE, via Moodle.**

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Class Schedule: Wednesdays & Fridays, 11:45-1:00 PM., Jan. 11 – Apr. 17, 2023.

Office Hours: Fridays, 9:55-11:20 AM. (Starting Friday, Jan. 11, 2023)

Prerequisites: Math 264/265 or an equivalent multivariable calculus course.

Text: *Complex Variables and Applications*, 9th Edition (2014) by J. W. Brown and R. V. Churchill (McGraw-Hill Education).
The textbook will be available at:
https://www.bkstr.com/concordiastore/home
Note: Students should order textbooks as early as possible, especially for printed versions in case books are backordered or there are any shipping delays.

Assignments: Assignments, consisting of 8-10 problems (drawn mainly from the textbook) will be due weekly, submitted via Moodle. These are *very important* for the process of learning. They indicate the level of difficulty of the problems that students are expected to be able to solve. Every effort should be made to do this, and understand them *independently*. The submitted assignments will be viewed by the grader and a representative sample will be graded. Complete solution sets will be posted weekly, on the day of submission, so late submissions cannot be accepted. These grades, based on the 10 best grades received, are worth 10% of the total grade. The main purpose of grading is to provide helpful feedback to the students (and the professor) on how well they are keeping up with the course material.

Use of Computer Algebra System: It is optional but recommended to install and use Maple or Mathematica. These symbolic computational tools can be used to verify and illustrate any analytical results you get while doing your assignment problems.

Calculators: Only calculators approved by the Department (with a sticker attached as a proof of approval) are permitted for the class test and final examination. For a list of Approved and Not-approved calculators see www.concordia.ca/artsci/math-stats/services.html

Midterm exam: A **midterm exam**, covering the first seven weeks of the course, and evaluated as 30% of the total grade will be given in week 8.

Final Grade: 30% midterm, 10% assignments, and 60% final exam.

The grading scheme includes weekly assignments of which a representative subset will be graded. Students will not be told in advance which subset of the assigned problems will be marked and should try all assigned problems. Solutions to all assigned problem will be posted at the course's Moodle site on the same day as they are due.

Approximate schedule of topics

Week	Chapters	Topics	Assignments (Numbering: 9th edition)	Due date
1. Jan. 11 Jan. 13	Ch. 1. Secs. 1-12	Complex numbers: algebraic properties; complex plane; conjugates, polar form; roots; regions in the complex plane	**Notation: Sec 3, #5 = 3.5** **3.5, 5.3, 5.5(a,b,c), 6.9, 6.15, 9.5(a,c), 9.6, 9.9, 11.5, 11.7**	Jan. 20 (assignment 1)
2. Jan. 18, Jan. 20	Ch. 2. Secs. 13-24	Analytic functions 1: mappings, limits, continuity, derivatives, Cauchy-Riemann equations, CR equations in polar coordinates, examples		Jan. 27 (assignment 2)
3. Jan. 25, Jan. 27	Ch. 2. Secs. 25-29	Analytic functions 2: harmonic functions, reflection principle, analytic continuation		Feb. 3 (assignment 3)
4. Feb. 1, Feb. 3	Ch. 3. Secs. 30-40	Elementary functions: exponential, complex exponents, trigonometric functions, hyperbolic functions, inverses		Feb. 10 (assignment 4)
5. Feb. 8, Feb. 10	Ch. 4. Secs. 41-53	Integrals 1: Contours, contour integrals, branch cuts, Cauchy-Goursat theorem, antiderivatives, multiply connected domains		Feb. 17 (assignment 5)
6. Feb. 15, Feb. 17	Ch. 4. Secs. 54--59	Integrals 2: Cauchy integral formula, extensions for derivatives, Cauchy inequality, Liouville's theorem, maximal modulus principle, fundamental theorem of algebra.		Feb. 24 (assignment 6)

7. Feb. 22, Feb. 24	Ch. 5. Secs. 60-68	Series: convergence, Taylor series, negative powers, Laurent series		March 10 (assignment 7)
March 1 March 3	**Midterm break**			
8. March 8 March 10	**Midterm Exam: March 8** Ch. 5. Secs. 69-73	**March 8: Midterm exam** Open book. Chapters 1-4: all sections; Chapt. 5, Secs. 60-68. Absolute and uniform convergence. Continuity of power series. Integration and differentiation of power series; uniqueness; multiplication and division		March 17 (assignment 8)
9. March 15 March 17	Ch. 6. Sec. 74 -76 Ch. 6. Sec. 77 -84	Types of singular points, isolated singular points, poles, residues at poles, Cauchy residue theorem. Residues at infinity, zeros of analytic functions, behaviour near isolated singular points, examples.		March 24 (assignment 9)
10. March 22, March 24	Ch. 7. Sec. 85-93	Applications of residues, improper integrals, Jordan's lemma, indented paths, integration along a branch cut; definite integrals involving sines and cosines, argument principle. (Omit: Secs. 94, 95)		March 31 (assignment 10)
11. March 29, March 31	Ch. 8. Secs. 96-103, 107, 108, 110,111 (Omit all other sections.)	Mapping by elementary functions: linear transformations, inverse map, mappings of the upper half-plane, linear fractional transformations, w=e^z, z^2, z^(1/2). Riemann surfaces		Apr. 7 (assignment 11)

12. April 5, Apr. 7	Ch. 8. Secs. 96-103, 107, 108, 110,111 (Omit all other sections.)	Mapping by elementary functions: linear transformations, inverse map, mappings of the upper half-plane, linear fractional transformations, w=e^z, z^2, z^(1/2). Riemann surfaces		Apr. 14 (assignment 12)
13. Apr. 12 Apr. 14	Ch. 9. Secs. 112, 113, 114, 115, 116 (Omit all other sections)	Conformal maps: preservation of angles, examples, harmonic conjugates, transformations of harmonic functions Review and catch-up.		Final exam covers all listed course topics: Chapters 1-9.

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Use of Zoom
Note: Zoom is included as an institutionally-approved technology. This means we have been assured of the privacy protections needed to use freely within the classroom.

Zoom might be used in this course to facilitate learning at a distance. It may be used to record some or all of the lectures and/or other activities in this course. If you wish to ensure that your image is not recorded, speak to your instructor as soon as possible.

Also, please note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.

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Extraordinary circumstances

In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.