Department of Mathematics & Statistics
Concordia University

MATH 366
Complex Analysis I
Winter 2021

Preface: **Due to exceptional circumstances, this course will be taught and all assessments will be done completely ONLINE**.

Instructor: Dr. J. Harnad
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Class Schedule: Wednesdays & Fridays., 11:45-1:00 PM., Jan. 13 – Apr. 16, 2021.

Zoom Sessions: (via Moodle)
Zoom ID: 843 1510 9656 (on Wed., Jan. 13 only)
Zoom ID: 856 2557 2667 (from Friday, Jan. 15)

Office Hours: Fridays, 10:00-11:30 AM. (via Moodle/Zoom)
Zoom ID: 827 5391 3752

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 all 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 "Faculty approved calculators" (**SHARP EL-531** or **CASIO FX-300MS**) are permitted in examination during midterm and final exams. See for the list of approved calculators:
https://www.concordia.ca/artsci/math-stats/services.html#calculators

Test: A **midterm test**, covering the first seven weeks of the course, and evaluated as 30% of the total grade will be given in week 9.

Final Grade: The highest of the following:

- 100% final exam
- 30% midterm, 10% assignments, and 60% final exam.

The grading scheme for this course includes graded assignments of which a reasonable and representative subset will be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Approximate schedule of topics

Week	Chapters	Topics	Assignments (Numbering: 9th edition)	Due date
1. Jan. 13, Jan. 15	Ch. 1. Secs. 1-12	Complex numbers: algebraic properties; complex plane; conjugates, polar form; roots	**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. 20, Jan. 22	Ch. 2. Secs. 13-24	Analytic functions 1: mappings, limits, continuity, derivatives, Cauchy-Riemann equations, CR equations in polar coordinates, examples	**14.6 …**	Jan. 27, (assignment 2)
3. Jan. 27, Jan. 29	Ch. 2. Secs. 25-29	Analytic functions 2: harmonic functions, reflection principle, analytic continuation	**26.2(a,c)…**	Feb 3, (assignment 3)
4. Feb. 3, Feb. 5	Ch. 3. Secs. 30-40	Elementary functions: exponential, complex exponents, trigonometric functions, hyperbolic functions, inverses	**30.3,…**	Feb. 10, (assignment 4)
5. Feb. 10, Feb. 12	Ch. 4. Secs. 41-53	Integrals 1: Contours, contour integrals, branch cuts, Cauchy-Goursat theorem, antiderivatives, multiply connected domains	**42.2 (a,c)…**	Feb. 17, (assignment 5)
6. Feb. 17, Feb. 19	Ch. 4. Secs. 54-57 Ch. 4. Secs. 58-9	Integrals 2: Cauchy integral formula, extensions for derivatives, Cauchy inequality 4. Liouville's theorem, maximal modulus principle, fundamental theorem of algebra.	**57.3, … Supplementary Problems: 5.1, 5.2., 5.3,5.4**	Feb. 24, (assignment 6)

7. Feb. 24, Feb. 26	Ch. 5. Secs. 60-65	5. Series: convergence, Taylor series, negative powers.	**59.1, ...**	March 10, (assignment 7)
March 1-March 7		**Mid-term break**		
8. March 10, March 12	Ch. 5. Secs. 65-73	5. Laurent series, absolute and uniform convergence, integration and differentiation of power series; uniqueness; multiplication	**68.5...**	March 17 (assignment 8)
9. March 17 March 19	**Midterm:** March 17 Ch. 6. Sec. 74 -84	**March 17: Midterm test** Closed book. Chapters 1-4: all sections; Chapt. 5, Secs. 60-65. ========== Types of singular points, isolated singular points, poles, residues at poles, Cauchy residue theorem	**68.5, ...**	March 24 (assignment 8)
10. March 24, March 26	Ch. 6. Sec. 74 -84	6. Cauchy residue theorem (cont'd), residues at infinity, zeros of analytic functions, behaviour near isolated singular points, examples.	**77.2(c,d), ...** **Supplementary problems: 9.1, 9.2, 9.3**	March 31 (assignment 9)
11. March 31	Ch. 7. Sec. 85-93	7. 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)	**86.4,...**	Apr. 7 (assignment 10)
12. April 7 Apr. 9	Ch. 8. Secs. 96-103, 107, 108, 110,111 (Omit all other sections.)	8. 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	**96.5, ...**	Apr. 14 (assignment 11)
13. Apr. 14 Apr. 16	Ch. 9. Secs. 112, 113, 114, 115, 116 (Omit all other sections)	9. Conformal maps: preservation of angles, examples, harmonic conjugates, transformations of harmonic functions	No further assignments. Exam includes all listed course topics: Chapters 1- 9.	Final exam (take-home): Wed-Fri, April 21-23,

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