University of Manitoba
Department of Mathematics, Faculty of Science
September–December 2013

Course Number and Title: MATH 3700 Applied Complex Analysis

Number of Credit Hours: 3

Pre-requisites: MATH 2720 and MATH 2730

Class Times and Location: Tues and Thurs, 10:00-11:15, 419 Machray Hall

Instructor information: D. Trim, Office MH410A, Telephone 474-8760,
Email- Donald.Trim**@ad.umanitoba.ca**

Office hours: Posted on office door

I will endeavour to be in my office at these times, but unforeseen circumstances may sometimes prevent me from being there, and I apologize for this. If these hours do not fit your schedule, I am willing to discuss an alternative time for an appointment. If my door is open at any time outside official office hours, feel free to ask me any questions concerning the course. If the door is closed, I am either not in, or prefer not to be disturbed. When you have difficulty with a certain exercise, and you wish to discuss it with me, bring whatever attempts you have made to solve the problem. This makes it much easier for me to diagnose what is troubling you. It is my practice to read my email first thing each morning (and sometimes at other times during the day). I will endeavour to answer any inquiries within 24 hours.

Web Page: The web page for the course can be found at home.cc.umanitoba.ca/~dtrim/

Follow the links to this course.

Web Page for Old Tests and Exams: www.math.umanitoba.ca/courses

Past examinations are for practice only. There is no guarantee that your examinations in this course will be similar to examinations from previous years.

Calendar Description of Course:

Concepts and techniques of complex variable theory in the context of applied mathematics.

A more Detailed Description of the Course:

Cartesian and exponential forms for complex numbers; differentiation of complex rational, root, exponential, logarithmic, trigonometric, and hyperbolic functions and the Cauchy-Riemann equations; complex contour integrals and the Cauchy integral formulas; Taylor and Laurent series; residues and their uses.

Goals: The course has five main goals:

1. extend rational, root, exponential, logarithmic, trigonometric, and hyperbolic functions from the real line to the complex plane
2. illustrate that although the rules for differentiation of complex functions are the same as for their real counterparts there are essential differences in the two situations
3. introduce various techniques for evaluation of complex contour integrals and use them to develop properties of analytic functions
4. extend Maclaurin and Taylor series to the complex functions, and introduce Laurent series
5. use residues of complex functions to evaluate complex contour integrals and real trigonometric and improper integrals

Instructional Objectives: At the completion of the course, the student is expected to be able to:

1. find zeros and singularities of complex functions
2. determine regions of analyticity of complex functions
3. calculate contour integrals of complex functions
4. derive properties of analytic functions based on contour integrals
5. find the Maclaurin, Taylor, and Laurent series for complex functions
6. use residues to evaluate complex contour integrals and real trigonometric and improper integrals

Textbook: *Introduction to Complex Analysis and its Applications* by D. Trim
Optionally, the solutions manual for the textbook
Not all sections of the text will be covered. Information about which sections are required material will be given in lectures.

Evaluation: Two components contribute to the final grade in the course.

1. Two 60-minute tests for 40% of the final grade in the course. They will be conducted outside of class on dates to be decided. Material that you will be responsible for on the tests will be announced in class. There are no make-up tests if you miss one. If you miss a test and can provide an acceptable reason for doing so, accompanied by supporting evidence, marks will be redistributed between the other test and the final examination.

2. A three-hour final exam counting 60% scheduled by Student Records.

   Notes, books, calculators or other computing devices are not allowed on the tests or the final exam.

Grading: The following can be used as a guide in changing numerical grades to letter grades. It is only a guide, however, as fluctuations in grade lines may occur.

Numerical Grade	Letter Grade
90-100	A+
80-89	A
74-79	B+
68 -73	B
61-67	C+
55-60	C
50-54	D
0-49	F

Voluntary Withdrawal Date: Voluntary withdrawal date is **November** 13, 2013.

Academic Dishonesty:

The Department of Mathematics, the Faculty of Science and the University of Manitoba all regard acts of academic dishonesty in quizzes, tests, examinations or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.

Acts of academic dishonesty include bringing unauthorized materials into a test or exam, copying from another student, plagiarism and examination personation. Students are advised to read section 7 (Academic Integrity) and section 4.2.8 (Examinations: Personations) in the General Academic Regulations and Requirements of the current Undergraduate Calendar. Note, in particular, that cell phones and pagers are explicitly listed as unauthorized materials, and hence may not be present during tests or examinations.

Penalties for violation include being assigned a grade of zero on a test or assignment, being assigned a grade of "F" in a course, compulsory withdrawal from a course or program, suspension from a course/program/faculty or even expulsion from the University. For specific details about the nature of penalties that may be assessed upon conviction of an act of academic dishonesty, students are referred to University Policy 1202 (Student Discipline Bylaw) and to the Department of Mathematics policy concerning minimum penalties for acts of academic dishonesty.

All students are advised to familiarize themselves with the Student Discipline Bylaw, which is printed in its entirety in the Student Guide, and is also available on-line or through the Office of the University Secretary. Minimum penalties assessed by the Department of Mathematics for acts of academic dishonesty are available on the Department of Mathematics web-page.

Class Schedule: Below is a plan for each week. It is subject to change due to unforeseen difficulties in presentation of material. Some **even-numbered** exercises have been suggested for you to do. They represent a minimum number of exercises that should be attempted. The more exercises that you do, the better, so try doing some of the odd-numbered exercises also. Doing the minimum does not guarantee a pass in the course.

Week of	Chapter.Section	Suggested Exercises
Sept 10	1.1 (Review)	2-4
	1.2 (Review)	2-42
	1.3	2-16
	1.4	2-22
	1.5	2-30
	2.1	2-12
Sept 17	2.2	2-26
	2.3	2-38

Sept 24	2.4	2-16
	2.5	2-10
	3.1	2-22
Oct 1	3.2	2-28
	3.3	2-28
	3.4	2-18
Oct 8	3.5	2-38
	3.6	2-42
	4.1	2-20
Oct 15	4.3	2-12
	4.4	2-20
Oct 22	4.5	2-20
	4.6	2-14
Oct 29	5.1	2-8
	5.2	2-22
	5.3	2-40
Nov 5	5.4	2-34
	5.5	2-12
Nov 12	5.6	2-26
	6.1	2-26
Nov 26	6.2	2-34

This is what you can expect of me:

- plan the course and each class so that learning will be maximized
- arrive five minutes early and begin class at precisely the appointed time
- conduct classes, and not give lectures. I will explain this under my expectations of you.
- be patient when you struggle with ideas (most of us struggle with new ideas in mathematics)
- be open to suggestions (suggestions can lead to improvements in a course)
- treat you as adult learners, with related respect
- provide you with plenty of office hours for consultations. I encourage you to see me during office hours as soon as you encounter difficulties. Do not delay.

This is what I expect of you:

- be punctual. The first few moments of a class are the most important. There is often a quick review of the main ideas from the last class and how they

lead into the present class. General ideas and the "big picture" are often discussed in the first few moments. You are doing yourself a disservice by missing these discussions (as well as perhaps disturbing me and the rest of the class by being tardy).

- participate in class, which includes both speaking up and listening. Learning begins in class but most of it takes place when you study. Learning will begin here only if you contribute to the class; what you put into a class is directly related to what you get out. I will ask you many questions in the course of a class and for many different reasons. Your learning is substantially enhanced if you offer an answer, or at least formulate one. Do not come to class for the sole purpose of taking notes; that does not contribute to your learning. In order to answer many of the questions that I will pose, it is necessary for you to be familiar with what has transpired in recent classes. Try to keep up.
- be courteous when others are speaking. Only one person should be speaking at any given time during class. If you repeatedly have conversations with your neighbour while others are discussing course material, I will ask you to leave the room.
- complete all requirements of the course.
- use college-level, mathematical writing, legible and with correct format. There are many worked out examples in the notes and solutions manual; these should guide you on how to write solutions to problems on tests.
- be honest. Test and examination submissions must be your own work.
- have the courage to ask questions in class if something is not clear. If you have a problem, it is quite possible that someone else has the same problem. I will attempt to clear the difficulty immediately. Should I not be able to do so, I may ask you to see me after class for further clarification.
- discuss difficulties that you are having with course material as quickly as possible. The longer you leave a difficulty unresolved, the more unbearable it becomes, and the further and further behind you become. I have plenty of office hours, or you can see me immediately before or after class to set up a special appointment.
- turn off cell phones when entering class.