INSTRUCTOR
Max Jodeit, Jr., Vincent Hall 258, 625-3855, jodeit@math.umn.edu
Office Hours: 11:15am–12:05pm, MWF, or by appointment.

TEXT
Complex Analysis and Applications, by James Ward Brown and Ruel V. Churchill

MATERIAL COVERED
Our goal: Cover the first nine chapters. As we go, additional material of interest may be added from the last chapters or from elsewhere.

We need to cover about 10 pages, on average, for each "lecture" session (there will be some overlapping!). Our speed will depend on your need to ask extra questions, see more examples, or fewer. What you'll be asked to read "for next time" will be adjusted constantly. Tentative reading for the next week will be given each "Friday." The reading for the first 4 lectures is Chapter 1. Be sure to read all the Exercises, and read at least 4 new pages before each lecture, whether they are to be covered or not. You will probably have to make *many* readings of some pages!

GRADING

There will be homework, Special Problems, 2 Tests, and a Final Exam. *Tentative* **test dates** are Oct 14 and Nov 12. Each Test may involve material covered in lecture up to the Test. Thus, you are responsible for material covered in the lectures!

Your grade in this course will reflect what you did in it, not your ability or potential. It is very important, then, for you to be able to put your work on paper, under time pressure. If you have problems taking tests, there are people on campus who might be able to help you overcome them. Ask about it at an office hour!

You'll have a GPA grade for each Test, your homework, the Special Problems and the Final. The weighting of the grades, though subject to change, is, at present: 12% for each Test, 22% for homework, 20% for Special Problems, and 34% for the Final. Grades will perhaps amount to 80-85% for A, 65-70% for B, 50-55% for C, 40-45% for D. By following the description below, you can "track" your grade as the course progresses.

Each grading item will have "Gradelines" assigned to it. For example, if the B gradeline is 70, the A gradeline is 85, and your score is 80, then your GPA grade, G, for that item is $G := 3 + \frac{80-70}{85-70}$ "=" 3.67. Here, (G is rounded to 2 places after "."). In other words, your GPA grade is a B plus $2/3$ of the way between B and A. Your GPA grade, G, on *any* grading item is computed using your score on it, and numbers g (the grade corresponding to the highest gradeline smaller or equal to your score), glb (the highest gradeline smaller or equal to your score), gla (the lowest gradeline greater than your score):

$$G = g + \frac{\text{your score} \quad - glb}{gla - glb},$$

where glb is the gradeline just below your score, gla is the next gradeline - above your score and g is the grade number: 5 for a 100% score, 4 for the A gradeline, 3 for B, etc. If your score falls on a gradeline, then $G = g$. If your score is 100% on a Test, your $G = 5$.
When the G's are combined with their weights and added, the total is your GPA grade for the course. If that total is within 0.1 of an integer, your grade is "borderline." Case-by-case decisions are made, in borderline cases, whether to award the higher or the lower grade. An important factor then is the direction your grades have taken at course's end!

Be sure to talk to me in advance if you have to miss a Test! If you do and don't make arrangements in advance, your G for that Test is zero!

If, for documented reasons beyond your control, you're passing and you can't complete the course, the grade you have up to that point "stays with you" as part of an Incomplete; all I's must be issued according to department guidelines.

Scholastic Conduct
Please read the (appropriate for you) notices in the IT Bulletin, the CLA Bulletin, and so on. You are encouraged to work with others in understanding what problems say, setting up solutions, and so on, but you must submit as

YOUR work only what YOU have written up yourself. If you get ideas from a reference or from someone else, GIVE CREDIT! Do not simply copy another person's work. Graders will be asked to bring answers that look alike to my attention.

What is the course all about?
Math 5583 is primarily *proof oriented.* This means that the lectures consist of Definitions, Theorems, Proofs, Examples, Questions (for you to answer then and there), and your questions too. But we look at some applications of Complex Analysis in other fields as well.

Real numbers play an important role in Complex Analysis, especially the Completeness Axiom! The idea it expresses is that the real line (and hence the complex plane) has no holes in it. If a set of Real Numbers is non-empty and bounded above, it might not have a largest element (the open interval $(0, 1)$ does not) but among all the real numbers that are upper bounds for that set, there is (in the set of real numbers) a number that is the smallest upper bound. The Completeness Axiom is not a Theorem – it is an *assumption* we make about the Real Numbers. The Completeness Axiom does not hold for the system of Rational Numbers, and it does not make sense in the system of Complex Numbers because order as we know it does not work.

Visualization is important in Complex Analysis, but we cannot draw graphs of complex-valued functions of a complex variable, so we have to do so contrived imagining.

Differentiation is a key operation with the complex functions we will be most interested in, Analytic Functions. Differentiation in the complex sense is much, much different than differentiation in the real-variable sense! Functions that are differentiable in the complex sense in an open subset of the complex plane are automatically differentiable of all orders! This is definitely not true in the real-valued case!

Integration in Complex Analysis is not restricted to one-dimensional integrals, but we will mostly do one-dimensional integrals. We will do what amounts to line integrals – integrals over curves, over the boundaries of circles, triangles, squares (closed curves) integrals from one point to another along a path. But from the point of view of second-year calculus, they will be "vector-valued" integrals because they will involve dz rather than dx or dy or ds (arc length). We will also integrate over unbounded curves and families of bounded curves that tend to infinity in order to do som e "magic" integral evaluations: Contour Integrals, Residues.

The most natural "place" for the elementary functions and for power series to be examined is in the complex plane (or in certain parts thereof), and we will do a lot with these, especially the exponential function and its "close relatives."

We will be interested in the singularities of analytic functions. Singularities can be classified and used explain how certain functions "blow up."

Analytic functions have very interesting "mapping properties" that come about because it's harder for a *complex* derivative to exist than it is for a real one to exist. These are covered in Chapter 9, Conformal Mappings.

You might find page xvi (part of the Preface) interesting to glance at. Each Chapter begins with a brief (very!) introduction too.