Comments on Complex Variables:

The theory of functions of a complex variable originated with a desired solution to the simple equation x^2=-1. That solution could not be found among real numbers and someone, took the bold and imaginative step to write down that there is a solution where x=i is an "imaginary" number solution. The Wikipedia says: Although Greek mathematician and engineer Heron of Alexandria is noted as the first to have conceived these numbers,[5][6] Rafael Bombelli first set down the rules for multiplication of complex numbers in 1572. The concept had appeared in print earlier, for instance in work by Gerolamo Cardano. At the time imaginary numbers, as well as negative numbers, were poorly understood and regarded by some as fictitious or useless, much as zero once was. Many other mathematicians were slow to adopt the use of imaginary numbers, including René Descartes, who wrote about them in his *La Géométrie*, where the term *imaginary* was used and meant to be derogatory.[7][8] The use of imaginary numbers was not widely accepted until the work of Leonhard Euler (1707–1783) and Carl Friedrich Gauss (1777–1855).

Well, today the theory of complex valued analytic functions is of tremendous importance in the mathematical sciences. This is in spite of the fact that a WVU student published in the Daily Atheneum an article in which he warned students and the public against being taught fictitious useless theories and he especially advised against imaginary numbers. A good friend of mine also expressed his reservations from fictitious numbers. So what conclusions should one draw from the above? Cutting to the chase...

The important goals of this course are learning concepts and applications of:

I) The equivalent conditions (at least 4) that makes a function analytic

II) The theoretical and computational power of representations of analytic functions and analytic continuation

The methods and techniques that lead to the residuum theorem

The application of the residuum theorem

Taylor and Laurent expansions

The geometric series, their circle of convergence and their central relevance to analytic functions

III) Basic Topological concepts

All this from adopting a fictitious solution to x^2=-1.

H. Gingold

SYLLABUS COMPLEX VARIABLES-MATH 555 [FALL 2018]

INSTRUCTOR: H. Gingold, Armstrong Hall 406A, phone 293-2011 (EX2334). E-MAIL: gingold@math.wvu.edu.

Prerequisites: Calculus 1 to 3. Also preferably a rigorous course of real analysis that is equivalent to Math 451 at WVU.

TIME: M W F, 9:30-10:20am, (08/15 to12/06**), Location: 313-ARM-D.**

Office hours: M W F, 10:30-11:30am and by appointment.

Grading Policy: Grades; 0 to 50=F, 51 to 60= D, 61 to 75=C, 76 to 89=B, 90 to 100=A. **Final grade is based on averaging over: I) Two midterm tests, 40%. [20% each] II) Homework and quizzes, 25%, III) Final, 35%. The Final and Tests are comprehensive.**

Test 1: Monday 09/24.
Test 2: Wednesday 10/31.
FINAL: Tuesday 12/11, 2:00pm-4:00pm.
All tests take place in the classroom.

Homework submission dates will be announced in class meetings. Normally, submission is expected after the completion of a chapter.

Solutions to homework problems (tests and quizzes) must be accompanied by a proper derivation or justification in order to get credit.

To make up for a midterm test that you missed, you must have a rigorous justification and requires prior approval of the instructor. All make up tests for any midterm test will take place on Wednesday, November 28, 2018, at 10:30AM, in the Mathematics Learning Center, in Armstrong Hall on the Third floor. Please see me a week before the make up test.

If you are disabled in any way and feel that there is anything I need to know to improve your learning environment in this class, please contact me by e-mail by phone or in person during my office hours.

TEXTBOOK: COMPLEX VARIABLES and APPLICATIONS, by J.BROWN & R.V.CHURCHILL. 8th Edition, Mc Graw Hill, New York, NY 2009. Available at https://www.abebooks.com/servlet/StoreFrontDisplay?cid=61015169

We plan to cover the topics in Chapters 1 to 8. Other topics from chapters 9 to 12, relevant to applications, may be covered if the time permits.

Some of the important goals of this course are learning conceptually and the applicability of:

I) The equivalent conditions (at least 4) that makes a function analytic

II) The theoretical and computational power of representations of analytic functions and analytic continuation

The methods and techniques that lead to the residuum theorem

The application of the residuum theorem

Taylor and Laurent expansions

The geometric series and their circle of convergence

III) Basic Topological concepts

Some of the topics like sections 33,34, 86,87,88,89,90,91,94,95,96 will be assigned as independent study material. You will be asked to make up exercises on some topics or choose some on your own from a textbook. Of course you are expected to solve exercises on these topics.

Proving rigorously propositions, theorems or results are a stated goal of this course.

Collateral Reading:

COMPLEX ANALYSIS, by L. V. Ahlfors, McGraw-Hill, N.Y.,

E. Hille, Analytic Function Theory, Vol. 1,2, Chelsea Publishing Co., NY, N.Y., 1959.

M.R. Spiegel, Theory and Problems of Complex Variables. SHAUM OUTLINE SERIES. McGraw Hill, NY, 1964.

RECOMMENDED EXERCISES FROM THE TEXT BOOK

Chapter 1

SEC. 2, p. 5: NO. 1,2,4,7,11

SEC. 3, P. 8: NO. 1,2,5,6,8

SEC. 4, P.12: NO. 1,3,4,6

SEC. 5, P. 14: NO. 1,2,4,6,9,10,12,13,15

SEC. 8, P. 22: NO. 1,2,4,5,9,10

SEC. 10, P. 29: NO. 1,2,3,6,7

SEC. 11, P.33: NO. 1,2,4,5,6,7,10

Chapter 2, Sections 12 to 28 all odd numbered exercises in each section.

Chapter 3

SEC. 29 NO. 1 (a) ,2, 7,13, SEC. 31 NO. 1,3,7,9,10, SEC. 32 NO. 1,2

SEC. 33 NO. 1 (a), 8,9

Summarize sections 34,35,36

Chapter 4

SEC. 38, NO> 1,2(a), (c) ,3,5 , SEC.39, NO. 1,2,5,6,

SEC. 42 NO. 1,3,6,8,10, SEC. 43 NO. 1,3,4,5,7

SEC. 45 NO. 1,2,3,5, SEC. 49 NO. 1(a),(c),(f), 2(a),(c),3,4,6

SEC.52 NO. 1(a),(c),(e), 3,5,7,9,10, SEC. 54 NO. 1,3,5,9

Chapter 5

SEC. 57 NO. 1,2,3, SEC. 59 NO. 1,2,3,7

SEC. 62 NO. 1,2,5,6,7, SEC. 66 NO. 1,2,4

SEC. 67 NO. 1,2,4

Chapter 6

SEC. 71, NO. 1(a),(b),(d),2 (a),(c),3(a),5,6

SEC. 72, NO. 1,4 SEC. 76 NO. 1,3,5,6