MAT 185A: Complex Analysis

Temple, Winter Term 2022

Class: MAT-185A-001, MWF 12:10-1:00pm

Instructor: Professor Blake Temple
Research Interests: General Relativity, Shock-Wave Theory, Appl. Math
Webpage: https://www.math.ucdavis.edu/ temple/
Office Hours: WF 1:30-2:30PM (Or by Appt.)
TA: Cooper Jacob Office Hour Mondays 5-6pm on Zoom, see Canvas for Zoom access link.

Course/Homework/Exams: Based on Class Notes which will be posted after each lecture. Homework (not collected) consists of problems from Class Notes and from Previous Exams posted posted on Professor's webpage.

Supplemental Textbook: Basic Complex Analysis, 3rd Edition by Marsden & Hoffman; W. H. Freeman Publisher; Search by ISBN Amazon: 978-0716728771. (Solutions from text posted on class webpage.)

Prerequisites: Completion of courses MAT 67 and MAT 125A

Midterm 1: Wed, February 2, Class Notes I-IV
Midterm 2: Mon, February 25, Class Notes VI-VII
Final Exam: Wednesday, March 16, 10:30 a.m.-12:30 p.m.

Exams Will Cover Professor's Class Notes labelled I-X, posted on Class Webpage after topic is covered in class.

Subject: This is an introductory course on the basic concepts and theory of functions of a complex variable and their applications. Complex variables is the theory of how to incorporate $i = \sqrt{-1}$ into Calculus. In this class we extend the definition of the derivative and the integral to functions of a complex variable $z = x + iy$, and show that the Fundamental Theorem of Calculus which relates these two notions, extends to this setting (miraculously) almost unchanged. As an application, we end with the Residue Theorem. The Residue Theorem is based on the fact that integrals of a complex variable can be easier to evaluate than real integrals, and this can be used, (seemingly by magic), to evaluate important real integrals which appear otherwise hopelessly unsolvable.

Syllabus:

DAY	Topic
MO – Jan 3 :	I – Cauchy Riemann Eqns and the Fundamental Theorem of Calculus
WE – Jan 5 :	I – CR and FTC
FR – Jan 7 :	I – CR and FTC
MO – Jan 10 :	I – CR and FTC
WE – Jan 12 :	I – CR and FTC
FR – Jan 14 :	I – CR and FTC
MO – Jan 17 :	**Martin Luther King Day**
WE – Jan 19 :	II – Proof of the Cauchy Riemann (hard way)
FR – Jan 21 :	III – Complex Exponential and Logarithm
MO – Jan 24 :	III – Complex Exponential and Logarithm
WE – Jan 26 :	IV – Complex Exponents and the Inverse Function Theorem
FR – Jan 28 :	IV – Complex Exponents and the Inverse Function Theorem
MO – Jan 31 :	IV – Complex Exponents and the Inverse Function Theorem
WE – Feb 2 :	**Midterm I**
FR – Feb 4 :	V – Topology of the Complex Plane
MO – Feb 7 :	V – Topology of the Complex Plane
WE – Feb 9 :	VI – Cauchy Goursat Theorem
FR – Feb 11 :	VI – Cauchy Goursat Theorem
MO – Feb 14 :	VI – Cauchy Goursat Theorem
WE – Feb 16 :	VII – Consequences of the Cauchy Goursat Theorem
FR – Feb 18 :	VII – Consequences of the Cauchy Goursat Theorem
MO – Feb 21 :	**President′s Day**
WE – Feb 23 :	VII – Consequences of the Cauchy Goursat Theorem
FR – Feb 25 :	**Midterm II**
MO – Feb 28 :	VIII – The Residue Theorem
WE – Mar 2 :	VIII – The Residue Theorem
FR – Mar 4 :	VIII – The Residue Theorem
MO – Mar 7 :	IX/X – Calculating Residues/Four Examples
WE – Mar 9 :	IX/X – Calculating Residues/Four Examples
FR – Mar 11 :	IX/X – Calculating Residues/Four Examples

Parallel Topics from Text (Different Order From Notes)

Lecture(s)	**Sections**	**Comments/Topics**
$1-2$	$1.1-1.3$	Complex number system
$3-4$	1.4	Review continuous functions
$5-6$	1.5	Basic properties of analytic functions
7	1.6	Differentiation of elementary functions
8	2.1	Contour Integrals
$9-10$	$2.2-2.3$	Cauchy′s Theorem
$11-12$	2.4	Cauchy′s Integral Formula
$13-14$	2.5	Maximum Modulus Principle and harmonic functions
15	3.1	Convergent series of analytic functions
$16-17$	3.2	Power series and Taylor′s Theorem
$18-19$	3.3	Laurent series and classification of singularities
$20-21$	4.1	Calculation of residues
$22-23$	4.2	Residue Theorem
$24-25$	4.3	Evaluation of definite integrals
$26-27$	4.4	Evaluation of infinite series

Practice Problems From Marsden/Hoffman

(Solutions Posted on Webpage)