MAT 185A: Complex Analysis

Temple, Winter Term 2024

Class: MAT-185A, 1320 WALKER Hall, MWF 4:10-5:00pm

Instructor: Professor Blake Temple
Research Interests: General Relativity, Shock-Wave Theory, Appl. Math
Office Hours: WF 2:10-3:20PM
Webpage: https://www.math.ucdavis.edu/ temple/

TA: Rodriguez Lopez, Angel Manuel: Office Hours TBA

Textbook: (None required-Professor will post notes)
Ref: Basic Complex Analysis, 3rd Edition by Marsden & Hoffman; W. H. Freeman Publisher; Search by ISBN
On Amazon: 978-0716728771

Prerequisites: Completion of courses MAT 67 and MAT 127AB

Midterm 1: Fri, February 2, Through IV-Complex Exponents
Midterm 2: Fri, March 1, Through VIII-Residue Theorem
Final Exam: Fri, March 22, 8:00am-10:00am, 1320 WALKER Hall

Exams will cover Professor's hand written lecture notes labelled I-X, posted on 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 8 :	I – Cauchy Riemann Eqns and the Fundamental Theorem of Calculus
WE – Jan 10 :	I – CR and FTC
FR – Jan 12 :	I – CR and FTC
MO – Jan 15 :	**Martin Luther King Day**
WE – Jan 17 :	I – CR and FTC
FR – Jan 19 :	II – Proof of the Cauchy Riemann Theorem (hard way)
MO – Jan 22 :	III – Complex Exponential and Logarithm
WE – Jan 24 :	III – Complex Exponential and Logarithm
FR – Jan 26 :	IV – Complex Exponents and the Inverse Function Theorem
MO – Jan 29 :	IV – Complex Exponents and the Inverse Function Theorem
WE – Jan 31 :	IV – Complex Exponents and the Inverse Function Theorem
FR – Feb 2 :	**Midterm I**
MO – Feb 5 :	V – Topology of the Complex Plane
WE – Feb 7 :	V – Topology of the Complex Plane
FR – Feb 9 :	VI – The Cauchy Goursat Theorem
MO – Feb 12 :	VI – The Cauchy Goursat Theorem
WE – Feb 14 :	VI – Cauchy Goursat Theorem
FR – Feb 16 :	VII – Consequences of the Cauchy Goursat Theorem
MO – Feb 19 :	**President′s Day**
WE – Feb 21 :	VII – Consequences of CG
FR – Feb 23 :	VII – Consequences of CG
MO – Feb 26 :	VIII – The Residue Theorem
WE – Feb 28 :	VIII – The Residue Theorem
FR – Mar 1 :	**Midterm II**
MO – Mar 4 :	VIII – The Residue Theorem
WE – Mar 6 :	IX/X – Calculating Residues/Four Examples
FR – Mar 8 :	IX/X – Calculating Residues/Four Examples
MO – Mar 11 :	IX/X – Calculating Residues/Four Examples
WE – Mar 13 :	IX/X – Calculating Residues/Four Examples
FR – Mar 15 :	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