WELCOME TO MAT 342
Applied Complex Analysis

Fall 2015

Class Mondays, Wednesdays and Fridays at 10:00am in the Main Library, Room W4525

Introduction: This is a mathematically rigorous course and most statements will come with complete proofs. Topics covered will include properties of complex numbers, analytic functions with examples, contour integrals, the Cauchy integral formula, the fundamental theorem of algebra, power series and Laurant series, residues and poles with applications, conformal mappings with applications and other topics if time permits.

Text Book: Complex Variables and Applications by James Ward Brown and Ruel V. Churchill, ninth edition, McGraw-Hill, 2009

Instructor: Prof. David Ebin
Math Tower 5-107
tel. 632-8283
E-mail: *ebin@math.sunysb.edu*

Office hours: Monday, Wednesday and Friday 11:00-12:00 or by appointment

---

Grader: Ms. Zhongshan An

Physics D-101
E-mail: zan@math.stonybrook.edu

Office Hours: Wednesdays 9:00-10:00

Grading Policy: The overall numerical grade will be computed by the formula **20% Homework + 30 % Midterm Exam+ 50% Final Exam**

Homework: Homework will be assigned every week. Doing the homework is a *fundamental* part of the course work.

1st assignment: Page 5, Prob. 2,11; page 13, prob. 2,4; page 16, prob. 2ab, 7, 13,

14; page 24, problems 8, 9; Due Sept. 2
2nd assignment: Page 31, prob. 5, 7; Page 34, prob. 4, 5, 6, 8, 10 Due Sept. 9
3rd assignment: Page 43, prob. 1cd, 5, 6, 7; page 54, prob. 1abc, 2c, 5, 8, 9, 11ab Due Sept. 16
4th assignment: Page 61, prob. 1, 2bd, 3, 4, 6a, 7; page 70, prob. 2ac, 6, Due Sept. 23

5th assignment: Page 70, prob. 7, 8; page 76, prob. 1ab, 2ab, 5, 6, 7, Due Sept. 30

6th assignment: Page 79, prob. 1, 3; page 84, prob. 1, 4, 5; page 89, prob. 1abc, 3, 6, 7, 13 Due Oct. 7
7th assignment: Page 95, prob.1, 3, 6, 10; Page 99, prob. 1, 4, 5; page 103, prob. 5, 8, 9 Due Oct. 21

8th assignment: Page 107, prob. 3, 5, 10; Page 111, prob. 5, 8, 9; page 114, prob. 2, 3, 4, 5 Due Oct. 28
9th assignment: Page 119, prob. 3; Page 123, prob. 1, 2, 5, 6; Page 132, prob. 3, 9, 10; Page 138, prob. 2, 6 Due Nov. 4

10th assignment: Page 147, prob. 1, 3, 4; Page 159, prob. 1def, 2b, 3, 6, 7; Page170, prob. 3, 4 Due Nov. 11

11th assignment: Page 177, prob. 2, 3, 4, 8; Page 185, prob. 3, 4, 9a; Page 195, Prob. 1, 6, 8, Due Nov. 18

12th assignment: Page 205, prob. 6, 10; page 218, prob. 3, 4, 6, 8, 11; page 224, prob. 4, 6, 8a, Due Nov. 30 ��

Midterm Exam: Wednesday, Oct. 14

MIDTERM EXAM REVIEW: Exam Review

Final Exam: Tuesday, December 15, 2:15pm-5:00pm

FINAL EXAM REVIEW: Exam Review

N. B. Use of calculators is not permitted in any of the examiniations.

Disability Support Services (DSS)

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All

information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities

Academic Integrity

Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management>

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

>

Review for MAT342 Midterm
October 2015

Definition of complex numbers, their real and imaginary parts and absolute value and argument
Complex Conjugate, Complex numbers in polar form, Euler's formula
Exponential function and its property $\exp(z+w) = \exp(z)\exp(w)$
ϵ-neighborhood of a complex number and deleted neighborhoods, ϵ-neighborhood of ∞
Open and closed sets, boundaries and accumulation points
Convex and connected sets, domains and regions
Functions of a complex variable, polynomials and rational functions, mappings
Limits and derivatives, continuity, limits at ∞, Analytic functions, Entire functions, Cauchy-Riemann equations
Theorem: A bounded sequence has a convergent subsequence.
Corollary: A continuous real-valued function on a closed bounded set assumes a maximum and a minimum.
Rules for differention: derivatives of sum, difference, product and quotient of functions. Chain rule
Theorem: If a function has real and imaginary parts that have continuous partial derivatives and satisfy the Cauchy-Riemann equations, then it is analytic.
Harmonic functions, The real and imaginary parts of an analytic function are harmonic. harmonic conjugates
Logarithm function and trig. functions of complex variables and their derivatives and inverses, hyperbolic functions, complex exponents

Review for MAT 342 Final
December, 2015

Everything on the midterm review sheet

The absolute value of a contour integral is bounded by the length of the contour times the maximum absolute value of the integrand.
Using Anti-derivatives of analytic functions to evaluate contour integrals
The Cauchy-Goursat theorem and the the Cauchy integral formula including the formula for derivatives of analytic functions
The complex log function. Branches
Liouville's theorem and the fundatmental theorem of algebra
The maximum modulus principle
Morera's theorem
Series: geometric series, power series and Taylor series, especially for analytic functions
Radius of convergence of power series
Laurent series
Absolute and uniform convergence of power series. Differentiating and integrating power series term by term
Multiplication and division of power series
Isolated singular points: removable singularities, poles and essential singularities
An isolated singularity of a bounded function is removable
Residues and Cauchy's residue theorem
Zero's and poles of analytic functions
Using residues to evaluate integrals
Fractional linear transformations: Prove that they take lines and circles into lines or circles
Prove that given two sets of three points in the plane, there exists a fractional linear transformation that takes one set into the other
Describe all fractional linear transformations that take the upper half place into the unit disc about the origin.
Harmonic functions and harmonic conjugates. Show that on a simply connected region, every harmonic function has a harmonic conjugate
Proof that the composition of a harmonic function with an analytic function is harmonic.