MATH 5120 – Complex Function Theory I – Spring 2023

- **Instructor:** Alexander (Sasha) Teplyaev,
https://alexander-teplyaev.uconn.edu/ office: MONT429, email: teplyaev@uconn.edu

  Lecture times and locations: TuTh 8:00am–9:15am MONT 414

- **Office hours:** TuTh 9:30am–10:15am or by appointment. Please send me an email. Office hours can be online or in person.

- **Textbook:** Complex Analysis (Princeton Lectures in Analysis, No. 2) Illustrated Edition by Elias M. Stein and Rami Shakarchi ISBN: 978-0691113852

- **HW:**

  * **Homework will be given (almost) each Thursday and due next Thursday. The HW will be collected in HuskyCT. Starting with the 3rd week of the semester, all the homework must be typed in LaTeX.**

  * **Final Exam will be optional and intended as a preparation for a Complex Analysis PhD prelim exam.**

- **Preliminary grading policy:** Each grade will be determined individually. Students doing most of problems, with possible corrections, will receive at least an A-.

- For the final grade, HW will weight 10% and each of three in-class test will weight 30%.

- **Tentatively, in-class Tests will be scheduled on the 6th, 10th and 14th weeks on Tuesdays (February 21, March 28, April 25)**. Preliminary schedule (subject to change):

  Week 1, January 17, 19: Section 1.1
  Week 2, January 24, 26: Sections 1.2, 1.3
  Week 3, January 31, 2: Sections 2.1, 2.2
  Week 4, February 7, 9: Sections 2.3, 2.4
  Week 5, February 14, 16: Section 2.5, review
  Week 6, **February 21: Test 1**; February 23: review
  Week 7, February 28, 2: Sections 3.1, 3.2, 3.3, review
  Week 8, March 7, 9: Sections 3.4, 3.5
  Week 9, March 21, 23: Sections 3.6, 3.7, review
  Week 10, **March 28: Test 2**; March 30: review
  Week 11, April 4, 6: Section 8.1
  Week 12, April 11, 13: Section 8.2
  Week 13, April 18, 20: Section 8.3, review
  Week 14, **April 25: Test 3**; April 27: review

Standard syllabus:

Holomorphic (analytic) functions:
(1) Statement of the Jordan curve theorem and the notion of simple rectifiable curves.
(2) The Riemann sphere.
(3) The Cauchy-Riemann equations.
(4) Power series and the disk of convergence.
(5) Linear fractional (Möbius) transformations and conformal mappings.
Integration theory:
(1) Integration along simple rectifiable curves.
(2) The Cauchy-Goursat theorem.
(3) The Cauchy integral formula, Cauchys estimate.
(4) Moreras theorem and the maximum principle.
(5) The Argument Principle, winding numbers and Rouches theorem.
(6) The residue theorem and its use in evaluating real-valued integrals.
Representation Theorems:
(1) Taylor and Laurent series.
(2) The maximum modulus, Liouvilles theorems, and the Fundamental Theorem of Algebra.
(3) Singularities and their classification.
Harmonic functions:
(1) The mean value theorem, the maximum principle.
(2) Their relation to holomorphic (i.e. complex analytic) functions.
(3) Harmonic conjugates.
Miscellaneous:
(1) The inverse function theorem.
(2) The Schwarz Lemma.
(3) The Schwarz reflection principle.
(4) Normal families.
(5) The Riemann mapping theorem.