MA 641 - Mathematical Analysis II
Spring 2025

December 17, 2024

- **Instructor:** Professor Atanas Stefanov
- **Office:** UH 4049, Phone: (205) 934-8551.
- **Class meetings:** MW 8:00- 9:50, UH 4002
- **Office Hours:** Friday 10:00-11:00, UH 4049.
- **Email:** stefanov@uab.edu
- **Prerequisite**: MA 640, Minimum Grade of B.
- **Text:** Basic Analysis I, II; by Jiří Lebl, I have uploaded this on CANVAS. They are also available for **free download** at
  `https://www.jirka.org/ra/realanal.pdf`
  `https://www.jirka.org/ra/realanal2.pdf`
- **Add/Drop and Course Withdrawal**
  - Drop/Add: Deadlines for adding, dropping, or withdrawing from a course and for paying tuition are published in the Academic Calendar available online. Students may drop and add courses online after they have registered and until the drop/add deadline online using BlazerNET.
  - Withdrawal: To avoid academic penalty, a student must withdraw from a course by the withdrawal deadline shown in the academic calendar and receive a grade of W (withdrawn). Failure to attend class does not constitute a formal drop or withdrawal. The official course withdrawal must be completed online in BlazerNET.
- **Topics:**
  - Sequences of functions - point-wise and uniform convergence. Interchange of limits, Integral/derivative of limits, Chapter 6.1, 6.2

- Uniform convergence of series of functions (M - test, Dirichlet test), integration and differentiation of series of functions - Chapter 11.2.
- Basics of power series/real analytic functions, Chapter 11.3.
- Differentiation of integrals with respect to parameters, Chapter 9.1
- Metric spaces - basic properties, examples; open, closed, connected sets. Chapters 7.1, 7.2.
- Sequences and convergence, completeness and compactness, Chapters 7.3, 7.4.
- Continuous functions and fixed point theorems, Chapters 7.5, 7.6.
- Compactness of sets in $C(K)$, the Arzela-Ascoli theorem, Chapter 11.6.
- Intro to Fourier series - Chapter 11.8.

- **Learning outcomes:** Upon successful completion of the course, a student
  - will be able to analyze, at an advanced level, problems arising in the theory of series - specifically pointwise vs. uniform convergence.
  - will be able to solve problems involving integrals and derivatives of limit functions in a rigorous way (i.e. with proofs)
  - will be able to study advanced topics in improper integrals and differentiation with respect to parameters, a prime and indispensable tool in further mathematical explorations
  - will be able to extract important information about a global behavior of function spaces, by utilizing the methods of metric spaces.
  - will be able to recognize and analyze functions in terms of its Fourier series, in a rigorous way. As this is the theoretical foundation of signal analysis, students will have a broader understanding of the underlying issues arising in these application (de-blurring, curse of dimensionality etc.)
  - Communicate abstract mathematical results to a wider audience.

- **Important Dates**

  First day of classes: January 13.

  Last Day to drop (without paying full tuition): January 21.

  Spring break: March 10-16.

  Last Day of class: April 25.

- **Class organization:** This class will employ a hybrid delivery. Specifically, for every two hours class meetings, the first half will be in the usual lecture format, while during the second half students chosen at random will take turns to present their rigorous solutions to problems from the HW, answer questions from the audience and myself. Non-presenting students are encouraged to participate with ideas and suggestions for improvements of the arguments/proofs.

- **Exams:** There will be one midterm exam and a final exam. If you have a valid reason for missing the exam (essentially medical reasons), you should contact me BEFORE the exam to discuss alternative arrangements. There will be absolutely NO MAKEUP EXAMS! The final exam will be cumulative, i.e. it will test on the entirety of the material.

  The exams are scheduled as follows:

Midterm Exam	Wednesday, March 5^{th}, in class.
Final Exam	Monday, April 28^{th}, 8:00 p.m. - 10:30 p.m., UH 4002

- **Grades:** Your grade for this course will be determined by the number of points that you accumulate. The points will be distributed in the following way:

Presentations	300 points	30 %
Midterm Exam	300 points	30 %
Final Exam	400 points	40 %

  A total of 900 points will guarantee an A, 800 a B, 700 a C, and 600 a D. I may, solely at my discretion, lower these thresholds.

- **DSS Accessibility Statement** Accessible Learning: UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under the Americans with Disabilities Act (ADA) and/or Chapter 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff. If you are registered with Disability Support Services, please contact me to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call (205) 934-4205 or visit the DSS website.

- **Title IX Statement** The University of Alabama at Birmingham is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident. UAB provides several avenues for reporting. For more information about Title IX, policy, reporting, protections, resources and supports, please visit the UAB Title IX webpage for UAB's Title IX Sex Discrimination, Sexual Harassment, and Sexual Violence Policy; UAB's Equal Opportunity and Discriminatory Harassment Policy; and the Duty to Report and Non-Retaliation Policy.