Math 451 - Introduction to Real Analysis, Fall 2019
Course Syllabus

Instructor: Brian Leary
Email: Brian.Leary1@mail.wvu.edu
Office: Learning Resource Center 323K
Office hours: Mon: 9:30-10, Tue: 9:30-10 & 1-2, Wed: 9-10 & 2-3, Thurs: 1-3, Fri: 9-10
Class Room/Time: INN 212, MWF 1:00-1:50 pm
Course website: community.wvu.edu/∼bal0018/math451F19.html

Homework assignments and course announcements may be posted on the website or sent via email. Please be sure to check the website regularly, and to regularly check the email address you have on record. You are responsible for any information posted on the course website.

Textbook: There are no required textbooks for the course. However, the material in Analysis I textbooks is reasonably consistent, so most Analysis I textbooks you can find will be good resources. My notes will be roughly based on *Introduction to Analysis*, 5th edition, by Edward D. Gaughan, and *Calculus, Volume I* by Tom Apostol, although I do not follow the order of topics presented in either. I can also give other recommendations for real analysis books upon request, both more advanced and less advanced than this course.

Catalog Data: MATH 451. Introduction to Real Analysis 1. (3-0) Credits 3. A study of sequences, convergence, limits, continuity, definite integral, derivative, differentials, functional dependence, multiple integrals, sequences and series of functions.
Prerequisite: MATH 283 or instructor permission based on prior proof-writing experience.

Course material: This course is more or a less a retread of topics learned in Calculus I and Calculus II, but viewed through the rigorous scope of proof-writing, which illuminates the material in a new and exciting way. The initial part of the course will be to review logic and proof preliminaries, which may include set proofs, proofs of injectivity/surjectivity of functions, proof by induction, countable/uncountable sets, and the axiomatization of the real numbers. The following sections of the course will cover, in order, limits of functions, continuity/uniform continuity of functions, differentiation, and Riemann/Darboux integration, and sequences of real numbers. If time permits, we will cover series of real numbers, perhaps followed by sequences and series of functions.

Course Objective: This course is designed to introduce the rigorous foundation for the basic topics of analysis to the students majoring in mathematics.

Course Outcomes: Upon successful completion of the course, the student will be able to:

1. Outline the axiomatic definition of the real number system and use the axioms of real numbers to prove theorems about the real number system.
2. Write ε-based proofs to establish continuity of a function, Riemann-integrability of a function, the limit of a function at a point, or the derivative of a function at a point.
3. Use existing theorems such as the Mean Value Theorem to aid in the construction of proofs of other results.
4. Write ε-based proofs to establish limits of sequences of numbers.
5. Enter a higher level or first-year graduate level analysis course with the appropriate degree of preparation.

Topics:

1. Preliminaries on Logic and Proofs
2. Limits of Functions
3. Continuity/Uniform Continuity of Functions
4. Differentiation of Functions
5. Riemann/Darboux Integration
6. Sequences of Numbers
7. Series of Numbers (if time permits)
8. Sequences and Series of Functions (if time permits)

Grading: Your final grade will be based on homework, attendance, two exams during the semester, and the final exam, which will not be cumulative. Your final course score will be computed via the following grading scheme:

- 20% Homework + 5% Attendance + 25% Exam 1 + 25% Exam 2 + 25% Final Exam

Letter Grade Cutoffs: A: 90%, B: 80%, C: 70%, D: 60%, F: below 60%

Homework: Homework assignments will be posted on the course website. There will likely be about 8-10 total assignments, and your lowest homework score will be dropped from grade computation. The homework is the most important part of this class. To be more precise, not knowing how to do the homework is the most important part of this class. At this level, mathematics is learned by trying to solve problems and failing over and over again. Therefore, you should be prepared to spend many hours each week in frustration, finding flaws in your arguments, or simply stuck not knowing what to do next! To that end, every student is expected to write out their own solutions for the homework problems. Any verbatim copying of solutions, either from another student or from a textbook or online resource, is prohibited and is considered plagiarism. However, you are permitted and even encouraged to collaborate with each other, as long as each student writes up a final copy of their solutions on their own.

Exams: There will be two exams, details TBA. The final exam will be Monday, December 16 from 1:00 pm to 2:50 pm. Make-up exams will only be given to students with excused absences, and such make-up exams must be scheduled within 24 hours of the missed exam.

Attendance: There should be roughly 45 lectures. If you miss 0-7 lectures, you will receive the full 5 attendance points for the semester. If you miss 8 lectures or more, you will lose an attendance point for each lecture missed, so that missing 12 lectures or more will result in a 0 for attendance. (Note: Excused absences such as participation in athletics or clubs will not count toward your total of absences.)

Getting Help: Please feel free to come to office hours or email me if you have questions about the course material. If you are unable to make it to my regularly scheduled office hours, I am willing to make an appointment to meet at another time if possible. Additionally, you can get help in the Math Tutoring Lab in LRC 323 from 8 AM to 4:30 PM. Free tutoring is also available through Student Support Services, located in Benedum 130, and the Student Success Center, located in the library on the second floor of LRC. Finally, I would also encourage the formation of study groups, to learn from each other and help each other learn.

Class policies:

- Graphing calculators will never be allowed during any exams. Scientific calculators may be permitted, but will never be particularly useful in this class. You may use any calculator to help you do the homework if you wish, but you should keep in mind that you may be required to solve similar problems without a calculator on the quizzes and exams.
- If you believe a problem on a homework assignment or exam has been graded incorrectly, you must notify the instructor of your complaint within 7 days of the date the exam is handed back. If you are unable to retrieve your graded material at the time it is handed back, it is your responsibility to make arrangements with the instructor to retrieve the material at another time.

Institutional Policies: Students are responsible for reviewing policies on inclusivity, academic integrity, incompletes, sale of course materials, sexual misconduct, adverse weather, as well as student evaluation of instruction, and days of special concern/religious holiday statements. For these detailed policies of West Virginia University, please review:
https://tlcommons.wvu.edu/syllabus-policies-and-statements.