MATH 301 Introduction to Mathematical Analysis I
Section 0201 Spring 2010

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- Lectures: Mon and Wed, 5:30–7:20 pm, at MP 102
- Office hours: Mon and Wed, 4:00–5:00 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: Math 142 or 152 and Math 221
- Text: *Introduction to Real Analysis* by Bartle and Sherbert, 3rd Edition, John Wiley & Sons, Inc., 2000.
- **Tentative exam dates**:
  - Exam I: Wed, Mar. 3 (in class)
  - Exam II: Wed, Apr. 7 (in class)
  - Final Exam: Mon, May 17
- **Tentative in-class quiz dates**:
  - Quiz I: Mon, Feb. 15
  - Quiz II: Mon, Mar. 29
  - Quiz III: Mon, Apr. 26

  These dates are subject to change.

Course Description and Objectives This course is concerned with real analysis, which studies fundamental properties of the set of real numbers and functions of a real variable using limiting techniques. Typical concepts include sequences, limits, continuity, differentiation and so on. These concepts form a foundation of calculus and play an extremely important role in both pure and applied mathematics.

This course has two major goals:

- learn the mathematical foundations of real numbers and basic analytic properties of functions of a real variable;
- learn how to read, construct, and write rigorous mathematical proofs.

The topics to be covered in this course may overlap with those in calculus courses your have taken before, e.g., sequences and limits. However, this class emphasizes on a rigorous mathematical reasoning based upon well accepted assumptions (or axioms) rather than on computations. In this sense, the second goal is more important than the first. The techniques and skills of rigorous proofs and mathematical knowledge in this class will prepare you for higher-level mathematical courses and will benefit you in various areas of mathematics, such as topology, geometry, differential equations, scientific computing, and optimization, just to name a few.

Homework Weekly homework will be assigned. The homework is usually collected in Monday's class unless a due date change is announced. No late homework will be accepted. Please present your answers neatly and show all your work; answers without supporting work may not receive full credit.

Exams and Quizzes There will be two (2) mid-term exams, one (1) final exam, and three (3) in-class quizzes (see the tentative dates on Page 1). Each mid-term exam mainly focuses on topics covered in the month before the exam, but the final exam will be comprehensive. The quizzes will consist of a few proofs that cover materials from the previous weeks of each quiz. Please be alerted that calculators and other computing devices are *not* allowed for quizzes, mid-term exams and final exam.

Grading Policy The grading scheme is as follows:

- homework: 20%
- quizzes: 15%
- mid-term exams: 40% (20% for each)
- final exam: 25% (the final is comprehensive)

The letter grade will be computed based upon the numerical grade:

$A : \geq 90; \quad B : 89 - 80; \quad C : 79 - 65; \quad D : 64 - 50; \quad F :< 50$

Academic Integrity

- The UMBC Academic Integrity Statement:

  "*By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory [or for graduate courses, the Graduate School website]*".

- All work in a homework, a quiz or an exam must be your own; collaborating on a quiz or an exam is *not* permitted. Discussions with other students on homework problems are allowed, but you should present your own work in the final turn-in; simply copying other people's work is a violation of UMBC's academic integrity code.

- If you wish to contest a graded exam/quiz, you must make an appeal within *one week* of the return date to the class. All appeals should be made in writing to the instructor with a signed and dated note on the exam or quiz. End of the semester appeals for earlier exams or quizzes will be ignored.

- If you must miss a quiz or an exam due to a prior obligation, you must speak to the instructor *in advance* of the quiz/exam. If you must miss a quiz or an exam due to an unforseen but valid reason (e.g. illness), you must submit a written excuse. Failing to do so may result in loss of substantial points off the top in your make-up.

Some Suggestions While intuitive thinking is important in analysis, this course focuses more on reading and writing formal proofs, which could be challenging for many beginners. In most parts of this course, the challenge does not come from comprehending mathematical results, which may seem intuitive and straightforward at the first glance, but rather from establishing logically sound arguments (known as proofs) from given conditions (e.g., axioms and/or definitions) and presenting these arguments nicely. Please be prepared to rely more on logic instead intuition.

The course will provide you ample opportunities to develop this deductive thinking and analyzing ability as well as formal proof writing capability. Here are a few suggestions that will help you grasp materials efficiently:

- Be critical about your results; make sure that each step in your argument is well justified by given conditions. Always ask more why's.

- Read the scheduled materials before going to class. If you have difficulty in understanding any concepts or results, bring them to the class.

- Review notes and the textbook before doing homework. Though discussions are allowed for homework problems, try your best to solve them with your own effort.

- If you have already done your best but sill have questions about materials, do not put them aside. Either see the instructor at office hours or get helps from other sources right away. If you are left behind at certain point, it could take you much more time and effort to catch up.

Tentative Schedule and Topics

Here is a list of the tentative schedule and topics we will be covering in chronological order with text citations:

No.	Week	Topic	Section(B&S)
1	Jan. 25–Jan. 29	Introduction, logic and proofs	Appendix A
2	Feb. 1–Feb. 5	Logic and proofs, sets and functions	Appendix A, 1.1
3	Feb. 8–Feb. 12	Math induction, finite and infinite sets	1.2, 1.3
4	Feb. 15–Feb. 19	Algebraic and order properties of $\mathbb{R}$, Absolute value and real line	2.1, 2.2
5	Feb. 22–Feb. 26	Completeness property of $\mathbb{R}$, Application of completeness property	2.3, 2.4
6	Mar. 1–Mar. 5	Sequences and limits, Exam I	3.1
7	Mar. 8–Mar. 12	Limit theorems	3.2
8	Mar. 15–Mar. 19	No class (spring break)	
9	Mar. 22–Mar. 26	Monotone sequences, Subsequences & Bolzano-Weierstrass Thm	3.3, 3.4
10	Mar. 29–Apr. 2	Cauchy criterion, Properly divergent sequences	3.5, 3.6
11	Apr. 5–Apr. 9	Limits of functions, Exam II	4.1
12	Apr. 12–Apr. 16	Limit theorems	4.2
13	Apr. 19–Apr. 23	Continuous functions, Combination of continuous functions	5.1, 5.2
14	Apr. 26–Apr. 30	Continuous functions on intervals	5.3
15	May 3–May 7	Uniform continuity, derivative	5.4, 6.1
16	May 10–May 14	Mean-value theorem, review	6.2

Please notice that the topics and dates in the list are subject to change, depending on the class progress.