# MATH 302 Introduction to Mathematical Analysis II

# Section 0101 Fall 2011

- Instructor: Dr. Jinglai Shen
- E-mail: shenj@umbc.edu
- Office: Math/Psyc 417
- Phone: (410) 455–2402
- Lectures: Mon and Wed, 5:30–6:45 pm, at BioSci 120
- Office hours: Mon and Wed, 4:30–5:30 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: Math 251 and 301
- Text: *Elementary Classical Analysis* by J.E. Marsden and M.J. Hoffman, 2nd Edition, W.H. Freeman, Inc., 1993

- **Tentative exam dates**:
  - Exam I: Wed, Oct. 12 (in class)
  - Exam II: Wed, Nov. 16 (in class)
  - Final Exam: Mon, Dec. 19
- **Tentative in-class quiz dates**:
  - Quiz I: Wed, Sept. 21
  - Quiz II: Wed, Oct. 26

  *These dates are subject to change.*

**Course Description and Objectives** This course, as a continuation and an extension of Math 301 (*Introduction to Mathematical Analysis I*), is concerned with the Euclidean space, metric spaces, the spaces of continuous functions, and their fundamental analytic and topological properties, such as completeness, compactness, connectedness, and continuity of functions on these spaces. The course focuses on rigorous, logically sound reasoning (known as proofs) for solving problems. The proof skills and mathematical knowledge developed in this class will prepare you for advanced mathematical courses and will benefit you in various areas of pure and applied mathematics, such as topology, geometry, differential equations, scientific computing, and optimization.

**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.

**Exams and Quizzes** There will be two (2) mid-term exams, one (1) final exam, and two (2) 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 previous weeks of each quiz. Calculators and other computing devices are *not* allowed for all the tests.

**Grading Policy** The grading scheme is as follows:

- homework: 20%
- quizzes: 15%
- mid-term exams: 40% (20% 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. 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**

- Analysis is a *challenging and tough* class and demands a great deal of time and effort. You are expected to spend 3-4 hours per week going over class materials and other 3-4 hours (or even more) working on homework problems.
- Problem solving is critical to learning analysis. Simply reading definitions, theorems, and examples is far from enough to grasp problem solving skills. You must try to work problems out by your own effort.
- Be critical about your results; make sure that each step in your argument is well justified by given conditions. Always ask more why's.
- If you have already done your best but sill have questions about materials, either see the instructor or get helps from other sources right away. If you are left behind at certain point, it may take you much more time and effort to catch up.

**Tentative Schedule and Topics** (the topics and dates in the list are subject to change, depending on class progress)

| No. | Week | Topic | Section(M&H) |
|---|---|---|---|
| 1 | Aug. 29-Sept. 2 | Introduction, Euclidean space | 1.6 |
| 2 | Sept. 5–Sept. 9 | Euclidean space, norms, metrics | 1.6, 1.7 |
| 3 | Sept. 12–Sept. 16 | Open/closed sets, interior | 2.1-2.3 |
| 4 | Sept. 19–Sept. 23 | Accumulation points, closure and boundary | 2.4-2.6 |
| 5 | Sept. 26–Sept. 30 | Sequences, completeness | 2.7-2.8 |
| 6 | Oct. 3–Oct. 7 | Compactness, Heine-Borel Theorem | 3.1-3.3 |
| 7 | Oct. 10–Oct. 14 | Path-connectedness, Exam I | 3.4 |
| 8 | Oct. 17–Oct. 21 | Connectedness, continuity | 3.5, 4.1 |
| 9 | Oct. 24–Oct. 28 | Consequences of continuous mappings | 4.2-4.3 |
| 10 | Oct. 31–Nov. 4 | Continuous functions on compact sets, Uniform continuity | 4.4-4.5, 4.6 |
| 11 | Nov. 7–Nov. 11 | Pointwise and uniform convergence, M-test | 5.1-5.2 |
| 12 | Nov. 14–Nov. 18 | Integration/differentiation of series, Exam II | 5.3 |
| 13 | Nov. 21–Nov. 25 | Elementary functions | 5.4 |
| 14 | Nov. 28–Dec. 2 | Space of continuous func, Arzela-Ascoli Thm | 5.5-5.6 |
| 15 | Dec. 5–Dec. 9 | Contraction mapping principle, Inverse/implicit function theorems | 5.7, 7.1-7.2 |
| 16 | Dec. 12–Dec. 16 | Review | |