Foundations of Modern Math, Syllabus, Fall 2019

Class meets: Tuesday and Thursday 11:30 AM - 12:50 PM, Smith Hall B25, Newark

Instructor: Dr. Anastasiia Tsvietkova, Assistant Professor, office: Smith Hall 323; email: a.tsviet@rutgers.edu

Website: course documents and grades will be at Blackboard website.

Office hours: Tuesday and Thursday 12:50 -1:30 pm or by appointment, Smith Hall 323. For appointments, please email me in advance.

Textbook: *Book of Proof*, 2nd edition, by Richard Hammack. ISBN-10: 0989472108; ISBN-13: 978-0989472104. It can be downloaded for free from http://www.people.vcu.edu/~rhammack/BookOfProof/index.html

Grades: Grades are determined using the scale below. Keep your graded work and check records in Blackboard gradebook until final grades are posted. Being able to compute your expected course grade is a prerequisite for this course. There is usually no curving and no extra credit.

Grading scale

2 Midterm Exams for total of	50%
Quizzes and worksheets	20%
Final Exam	30%
Total Possible	100%

Letter grades:	90-100%	A
	80-89%	B+
	70-79%	B
	60-69%	C+
	50-59%	C
	40-49%	D
	< 40%	F

Final exam: All students are required to take the final exam. It is tentatively scheduled for Monday, December 16th, 3-4:30 pm, Smith Hall B25.

Make-up policy: There are no make-ups. In very special circumstances and when the explaining documentation is provided within a week from the exam date, final may be counted twice instead of a midterm. There are no make-ups for the final and for quizzes and worksheets. If you miss them, you receive 0. Two lowest quiz/worksheet grades are dropped.

Other exam policies: No books, calculators or notes are allowed on exams. Please no talking or leaving exam room without permission. Bring your ID to the exam and be ready to show it to the instructor. Students are responsible for ensuring they do not have conflicting exams.

Before exam, Review Worksheet is posted. You do not need to turn it in and may discuss the problems and solutions with the instructor and each other.

Quizzes and worksheets: Quizzes and worksheets can be given during any lecture without a prior notice.

Quizzes include homework or homework-like problems (after the homework was due), and are individual, timed, closed-book assignments. They help you prepare for exams and evaluate your strengths ahead of the exams. They may be given right after the class starts or in the end of the class. Being late for class or leaving early means 0 grade in such cases.

Worksheets include problems on recently discussed material. Worksheets are done in groups of 1-4 students. You may use the textbook or your notes, and may ask questions during the worksheets. Worksheets help you understand the recent material.

If you miss a quiz or a worksheet, you get 0 for it. Thus **attendance is important**. If you are **late for the lecture or leave early** without securing the permission ahead, the quiz/worksheet grade may be reduced.

Homework assignments are given in class. While homework is not collected, it is important to do all of the problems, since later they appear on quizzes and exams. Discussing homework problems with fellow students is allowed, but copying or allowing to copy the exact solution is not. Thus the recommendation is to write everything down individually after any discussions took place.

Add/Drop Dates: see the academic calendar
http://registrar.newark.rutgers.edu/office-registrar-fall-academic-calendar#add-drop

Students with disabilities: Any student with a documented disability who needs to arrange reasonable accommodations must contact the Office of Disability Services (ODS). If your request for reasonable accommodations is approved, you will receive a Letter of Accommodations (LOA), which you should present privately to the instructor as early in the semester as possible. Accommodations are not retroactive and are effective only upon submission of the LOA to the instructor. Instructor is authorized to provide only the accommodations requested by the ODS.

Classroom etiquette: Be considerate of the instructor and those around you. Come to class on time and stay the entire period. Turn off cell phones. Do not talk to classmates at inappropriate times. Refrain from reading newspapers or working on other coursework during class. No taping, filming, or photography in class without a prior permission. No listening to music during class. Etiquette violations might result in reducing quiz and worksheet grades.

Academic Standards of Conduct: All students are expected to follow Rutgers Code of Academic Conduct. Cheating and plagiarism will not be tolerated. More at
http://academicintegrity.rutgers.edu/academic-integrity-policy/

Tentative Schedule: The list of topics is in the second part of the syllabus below.

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FOUNDATIONS OF MODERN MATH

21:640:238 (3 credits)

COURSE DESCRIPTION:

Basic concepts on which modern mathematics is founded; language and logical structure of mathematics; elementary set theory, including set operations, relations, and mappings; the structure of the real number system and elements of real analysis. Proof techniques are stressed.

PREREQUISITE:

21:640:136 (Calculus II), or 156 21:640:155 (Honors Calculus I), or permission of instructor.

IMPORTANT NOTE:

Rutgers University requires that all its students complete two writing intensive courses. This course satisfies one of the writing intensive requirements needed for the Mathematics Major.

COURSE OBJECTIVES:

The lower level math courses such as calculus, linear algebra and probability and statistics, cover techniques which can be used in a variety of applications, with an emphasis on calculation. The upper level math courses are of a more abstract nature, and focus on formulating and proving theorems. In particular, they try to answer the question: Why does it all work? This course is a bridge between the lower and upper level courses, and our goal is to learn how to express mathematical ideas precisely and to learn how to understand and write correct mathematical proofs.

TEXTBOOK:

"Book of Proof" (2nd edition), by Hammak.

DEPARTMENT WEB SITE: http://www.ncas.rutgers.edu/math

THIS COURSE COVERS THE FOLLOWING CHAPTERS AND SECTIONS:

Chapter 1: In this chapter we study sets, which, together with functions form the basic building blocks of all mathematical theories. We start by introducing the notions of subset, intersection and union, and then we define partitions of sets (which will later be seen to be equivalent to the notion of an "equivalence relation") as well as Cartesian products of sets.

Chapter 2: We study logical statements, negation, disjunctions and conjunctions of statements. Then we introduce the concepts of implication, tautologies, contradictions and logical equivalence. These structures will allow us to state theorems precisely and, in certain simple cases, we will determine whether a given mathematical statement is true or false.

Chapter 3: We will learn two of the main proof techniques: that of "direct proof" as well as "proof by contradiction". We will learn how to prove certain statements using a "case by case" analysis.

Chapters 4,5 and 6: We begin to apply the proof techniques to elementary number theory (divisibility and congruences) set theory and we prove some elementary statements about the real number system. We show how to prove the irrationality of various algebraic numbers (such as the square root of two) and we solve logical puzzles using the method of "proof by contradiction".

Chapter 7. We study relations on sets in general, and equivalence relations in particular. Equivalence relations give us one of the most important way for construction new sets out of old sets. One key example, that of "equivalence modulo an integer n", is studied in detail.

Chapter 8. We define the all-important concept of "function" as a special kind of relation between two sets. The notions of injective, surjective and bijective are introduced, and are used to give criteria for the existence of an inverse function.

Chapter 9. We learn the technique of "mathematical induction" and apply it to proving various statements from number theory and analysis.

Chapter 12. We apply the proof techniques we've learned thus far to develop some of the basic concepts in real analysis: limits of sequences and series are studied, and several of their properties are established. We also give rigorous definitions of "continuity" and "differentiability" and prove some basic results in calculus.

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