MATH 509: Real Analysis

Fall 2016 **Section 001** **3 Credit Hours**

Instructor:	**Dr. Kristen Abernathy**	**Instructor Teaching Schedule:**	MWF: 9:30-10:45am MW: 11:00 am – 12:15 pm TR: 9:30 – 10:45 am
Office:	Bancroft 148		
Office Phone:	803-323-4681	**Office Hours:**	M: 2:00-4:00 W 12:30-2:30
Math Department:	803-323-2175		
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Instructor Website:	http://faculty.winthrop.edu/abernathyk/		

The instructor reserves the right to make modifications to this syllabus. Students will be notified in class & by email.

A complete syllabus and schedule is available at: www.winthrop.edu/cas/math/syllabus.

Winthrop University is dedicated to providing access to education. If you have a disability and require specific accommodations to complete this course, contact the Office of Disability Services (ODS) at 323-3290. Once you have your official notice of accommodations from the Office of Disability Services, please inform me as early as possible in the semester.

Course Content

Throughout the semester, we will develop a rigorous formulation of single-variable calculus on the real line. We will begin by reviewing relevant preliminaries concerning functions, countability, and induction. Next, we will develop the completeness property of the reals which will lead to a formal treatment of sequences and their limits. Sequences will then inform our study of limits of functions and continuous functions. The latter portion of the course will be devoted to the fundamentals of differentiation and Riemann integration.

Grades

We will have various homework assignments, two course projects, three tests, and a final exam. The homework will be worth 35% of the final grade, the projects will be worth 5% each, tests will be worth 15% each, and the final exam will be worth 10%. Grades will be assigned as follows:

92-100 A	90-91.99 A-	87-89.99 B+	82-86.99 B	80-81.99 B-	77-79.99 C+
72-76.99 C	70-71.99 C-	67-69.99 D+	62-66.99 D	60-61.99 D-	

Assignments/Assessments

Homework will be assigned regularly, and selected homework problems will be graded in detail. The homework should be handed in at the beginning of class on the due date. Late homework will be accepted for one week after the due date at a five point penalty for each day it is late. Make-up tests are not given. **An unexcused absence will result in the grade of zero for any missed test.** Excused absences from tests will be dealt with at the end of the term and may depend on individual circumstances. Anticipated absences should be reported and verified in advance, and emergency absences must be verified within one week after returning to class. The test and final exam dates are listed below:

Test 1: 9/14, Test 2: 10/24, Test 3: 12/5 Final Exam: 8:00am, Thursday, 12/8

Text, Materials, and Resources

- Required Text: *Introduction to Real Analysis,* 4th Ed. Robert G. Bartle and Donald R. Sherbert, 2011, ISBN: 978-0-471-43331-6.
- Students are encouraged to use office hours as a way to receive extra help.

Policies

1. Review the student code of conduct for university polices on academic misconduct. Academic misconduct will not be tolerated and will result in a failing grade on the assignment and/or in the course. The full handbook is available online at: http://www2.winthrop.edu/studentaffairs/handbook/StudentHandbook.pdf.
2. All electronic devices (including cell phones) other than a calculator should be on silent and kept in your book bag or purse throughout class time unless otherwise instructed. (Note if you have some educational, health, or physical reason for an electronic device you must work with your professor to inform them of the accommodation.)

3. Any questions concerning grading of assignments must be resolved within one week after the assignment is returned.

Attendance Policy

The University attendance policy is stated in the current catalog (http://www.winthrop.edu/recandreg/default.aspx?id=7380).

Departmental Goals

1. Communicate mathematical ideas, demonstrate mathematical reasoning skills, and create and evaluate mathematical conjectures at various levels of formality.
2. Apply fundamental mathematical concepts and techniques to solve problems and evaluate results.
3. Demonstrate the ability to apply appropriate technologies to the study of mathematics and effectively use such technologies to investigate and develop an understanding of mathematical ideas.

Course Goals

1. Communicate formal mathematical reasoning through proof writing assignments.
2. Further develop the ability to think deductively, analyze mathematical situations, and extend ideas to graduate level mathematics.
3. Demonstrate knowledge and understanding of, and construct and analyze proofs of theorems involving: the completeness property of the reals, sequences and their limits, functions and their limits, continuous functions, differentiation, and Riemann integration.
4. Demonstrate knowledge and understanding of, and construct and analyze proofs of theorems involving one of the following advanced topics: generalized Riemann integration, measureable functions, uniform convergence.

Tentative Course Schedule

Date		Section	Subject
W	8/24	1.1	Sets and Functions
M	8/29	1.2-1.3	Mathematical Induction, Finite and Infinite Sets
W	8/31	2.1-2.2	Algebraic/Order Properties, Absolute Value
W	9/7	2.3	The Completeness Property of the Reals
M	9/12	2.4-2.5	Suprema/Infima, Intervals
W	9/14		Test 1
M	9/19	3.1	Sequences and Limits
W	9/21	3.2	Limit Theorems
M	9/26	3.3	Monotone Sequences
W	9/28	3.4	The Bolzano-Weierstrass Theorem
M	10/3	3.5	The Cauchy Criterion
W	10/5	3.6-3.7	Properly Divergent Sequences, Infinite Series
M	10/10	4.1	Limits of Functions
W	10/12	4.2	Limit Theorems
W	10/19	4.3	Extensions of the Limit Concept
M	10/24		Test 2
W	10/26	5.1	Continuous Functions
M	10/31	5.2-5.3	Combinations of Continuous Functions, Intervals
W	11/2	5.4	Uniform Continuity
M	11/7	5.6	Monotone and Inverse Functions
W	11/9	6.1	The Derivative
M	11/14	6.2	The Mean Value Theorem
W	11/16	6.3	L'Hospital's Rules
M	11/21	6.4	Taylor's Theorem
M	11/28	7.1-7.2	The Riemann Integral, Integrable Functions
W	11/30	7.3	The Fundamental Theorem
M	12/5		Test 3

Drop/Add: Through F 8/26 **S/U and Course Withdraw Date:** F 10/21
Fall Break: F 10/14 and M 10/17 **Final Exam:** R 12/8 8:00am