**Foundations of Higher Mathematics**

Time:        MW 4:30 – 5:45
Room:       ACR 206

Instructor:  Eric Funasaki
Office:       ACR 109C (MW afternoons) and BAB 210 (MTWRF mornings and TRF afternoons)
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**Office hours:**

MW 11 – 12:30, MW 3 – 4:30, or by appointment.

**Textbook:**

*Mathematical Proofs: A Transition to Advanced Mathematics*, 3rd edition, by Gary Chartrand, Albert D. Polimeni, and Ping Zhang.
ISBN:   978-0-321-79709-4

**Course Description:**

A transition course to higher mathematics.  Students learn how to organize and structure their mathematical thoughts, how to read and manipulate abstract definitions, and how to prove or refute proofs by effectively evaluating them.  Topics such as propositional logic, set theory, and techniques of proving will be the basis for discussions on functions, sequences, relations, limits, cardinality, divisibility, real numbers, and complex numbers.

**Prerequisite:**

Math 2414 Calculus II

**Mathematics Program Learning Objectives:**

The student should be able to:
1.  Apply knowledge of basic mathematics principles;
2.  Identify and provide valid proofs or solutions for theorems or problems; and
3.  Recognize and dispute invalid mathematical statements using counterexamples.

**Course Objectives:**

The student will be able to:
1.  Work with sets, subsets, set operations, indexed collection of sets, partitions of sets, and Cartesian products of sets;
2.  Work with concepts from mathematical logic; and
3.  Write and recognize a direct proof, proof by contrapositive, proof by contradiction, proof by counterexample, and proof using mathematical induction.

**EC-6 Core Teacher Competencies:**

1. Competency 013 (Mathematics Instruction):  The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize, and implement instruction and assess learning.
2. Competency 014 (Number Concepts and Operation):  The teacher understands concepts related to numbers, operations and algorithms, and the properties of numbers.
3. Competency 015 (Patterns and Algebra):  The teacher understands concepts related to patterns, relations, functions, and algebraic reasoning.
4. Competency 016 (Geometry and Measurement):  The teacher understands concepts related to principles of geometry and measurement.
5. Competency 017 (Probability and Statistics):  The teacher understands concepts related to probability and statistics and their applications.
6. Competency 018 (Mathematical Processes):  The teacher understands mathematical processes and knows how to reason mathematically, solve mathematical problems, and make mathematical connections within and outside of mathematics.

**Course Assessment:**

Your grade will be based on the following components:
10%     In-class problems and participation
25%     Homework assignments and quizzes
45%     Exams
20%     Final Exam

The grading scale will be:
90 – 100 A     80 – 89 B     70 – 79 C     60 – 69 D     0 – 59 F

**Course Schedule (tentative):**

<u>Week 1</u>
    1/17     W     1.1 Describing a Set, 1.2 Subsets, 1.3 Set Operations

<u>Week 2</u>
    1/22     M     1.3 Set Operations, 1.4 Indexed Collections of Sets
    1/24     W     1.5 Partition of Sets, 1.6 Cartesian Products of Sets

<u>Week 3</u>
    1/29     M     2.1 Statements, 2.2 The Negation of a Statement
    1/31     W     2.3 The Disjunction and Conjunction of Statements, 2.4 The Implication

<u>Week 4</u>
    2/5     M     2.5 More on Implications, 2.6 The Biconditional
    2/7     W     2.7 Tautologies and Contradictions, 2.8 Logical Equivalence

<u>Week 5</u>
    2/12     M     2.9 Some Fundamental Properties of Logical Equivalence
                        2.10 Quantified Statements
    2/14     W     Review for Exam 1

Week 6
  **2/19**  **M**  **Exam 1**
  2/21  W  3.1 Trivial and Vacuous Proofs, 3.2 Direct Proofs

Week 7
  2/26  M  3.3 Proof by Contradiction, 3.4 Proof by Cases
  2/28  W  4.1 Proofs Involving Divisibility of Integers

Week 8
  3/4  M  4.2 Proofs Involving Congruence of Integers
  3/6  W  4.3 Proofs Involving Real Numbers, 4.4 Proofs Involving Sets

Week 9
  **3/11**  **M**  **Spring Break (no class)**
  **3/13**  **W**  **Spring Break (no class)**

Week 10
  3/18  M  4.5 Fundamental Properties of Set Operations
              4.6 Proofs Involving Cartesian Products of Sets
  3/20  W  Review for Exam 2

Week 11
  **3/25**  **M**  **Exam 2**
  3/27  W  5.1 Counterexamples, 5.2 Proof by Contradiction

Week 12
  4/1  M  5.2 Proof by Contradiction, 5.3 A Review of Three Proof Techniques
  4/3  W  5.4 Existence Proofs

Week 13
  4/8  M  5.5 Disproving Existence Statements
              6.1 The Principle of Mathematical Induction
  4/10  W  6.2 A More General Principle of Mathematical Induction

Week 14
  4/15  M  6.3 Proof by Minimum Counterexample
              6.4 The Strong Principle of Mathematical Induction
  4/17  W  Review for Exam 3

Week 15
  **4/22**  **M**  **Exam 3**
  4/24  W  10.1 Numerically Equivalent Sets, 10.2 Denumerable Sets

Week 16
  4/29  M  10.3 Uncountable Sets, 10.4 Comparing Cardinalities of Sets
  5/1  W  Review for Final Exam
  **5/3**  **F**  **Final Exam (3 pm – 5 pm)**

**Attendance:**

Role will be taken. You are responsible for all material covered in class as well as any assignments and announcements that are made. If you miss an assignment, exam, or quiz you will receive a grade of zero unless the instructor has been notified in advance.

Sul Ross State University policy is to drop a student with a grade of W or F when 9 hours of class are missed. For this course that is when you miss **6** classes.

**Cheating:**

Cheating will not be tolerated. Anyone caught cheating will receive a grade of zero on that assignment, exam, or quiz. This includes homework assignments where the student who copied another student's work and the student who allowed their work to be copied will both receive a grade of zero.

**Cell Phones and Other Electronic Devices:**

Your cell phone must be **off** while you are in class. You may not read or send text messages while class is in session. If there is an unusual situation where you simply must be able to read and send a message without delay, please place your phone in vibrate mode and leave the room before reading and responding. No other electronic devices may be used during class without the permission of the instructor.

**ADA Statement:**

Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Alpine students seeking accessibility/accommodations services must contact Mary Schwartze Grisham, M.Ed., LPC, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and we'll get back to you as soon as we can during working hours), or email mschwartze@sulross.edu. Our office is located on the first floor of Ferguson Hall (Suite 112) and our mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832.

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