TEXAS A&M UNIVERSITY-Corpus Christi
Department of Mathematics and Statistics

MATH 3313.001 Foundations of Higher Mathematics

Fall 2013

I. COURSE INFORMATION

1. Meeting Time & Place: TR 11:00am.-12:15 pm. IH-158
2. Professor: Dr. Alexey L. Sadovski
3. Office Phone: (361) 825-2477
4. Office Address: CI-338
5. E-MAIL Address: Alexey.Sadovski@tamucc.edu
6. Office Hours: TR12:15 PM-2:00 PM, and 6:00-7:00 PM. Appointments also available. Office hours subject to meetings related to other duties on campus. They may change during the semester.

II. COURSE DESCRIPTION

This course assists students in the transition from lower-level courses such as calculus to higher-level courses such as advanced calculus and modern algebra. While lower-level mathematics courses emphasize skills and techniques needed for courses outside mathematics, higher-level mathematics courses require students to understand and write proofs and to think more abstractly. This course introduces students to fundamental ideas in logic and set theory needed for courses in higher mathematics and for secondary school and collegiate teaching. Techniques of proof, such as proof by contradiction and proof by induction, are used in various settings, such as analytic geometry and coordinate systems. The proper use of quantifiers, multiply quantified statements, properties of functions and relations on sets, modular arithmetic and equivalence relations, and partial orderings are emphasized. Examples used in this course will be taken from number theory, combinatorics, graph theory, modern algebra, and advanced calculus.

The following topics will be covered:

- Set Theory, Logic and Propositional Calculus
- Logic and Predicate Calculus (Quantifiers)
- Applications to Proofs in Set Theory and Calculus
- Methods of Proof (Mathematical Induction, Indirect Proofs, Epsilon-Delta Proofs)
- Relations (Equivalence Relations, Equivalence Classes, Partial Orderings)
- Functions and Mappings (Injective, Surjective, Bijective, Image, Inverse Image)
- Cardinality of Sets
- Axioms of Real and Complex Number Systems
- Geometry of Complex Arithmetic
- Introduction to Advanced Calculus
III. PREREQUISITES FOR THE COURSE

MATH 2414 Calculus II and MATH 2305, Discrete Math.

IV. TEXT AND OTHER SUPPLIES REQUIRED

A Transition to Advanced Mathematics, by Smith, Eggen and St. Andre, Brooks/Cole, 7th ed. is required.

V. COURSE OBJECTIVES

Students completing this course will learn to do the following:

- Understand the structure and properties of the real and complex number systems
- Read and understand arguments involving set theory and logic with minimal assistance from the instructor
- Generalize mathematical observations of special cases
- Write proofs of basic results in advanced calculus and set theory which include multiply quantified statements
- Present mathematically precise arguments to peers, beginning college students, and secondary school students
- Develop reasoning skills needed in higher mathematics course work and mathematics teaching

VI. INSTRUCTIONAL METHODS AND ACTIVITIES

Class meetings will usually consist of lectures over the material of the course and a combination of individual and small group work as well as whole-class discussion, with students presenting their work at the board.. The focus both in class and outside will be on working problems and discussing solutions designed to lead students from an operational to a structural understanding of the course material. (Anna Sfard defines "operational" understanding to mean understanding at the level of process or computation, while "structural understanding" is defined as when students incorporate the ideas to create a new abstract mathematical object, which can in turn be the foundation of further mathematical objects. She has developed evidence to show that both historically and in individual students, operational understanding must come before structural.)

VII. EVALUATION AND GRADE ASSIGNMENT

<table>
<thead>
<tr>
<th>Type of assignment</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Class participation/in-class work</td>
<td>5%</td>
</tr>
<tr>
<td>Paper-projects in the form of home assignments</td>
<td>15%</td>
</tr>
<tr>
<td>Quizzes (5-7 over the semester)</td>
<td>35%</td>
</tr>
<tr>
<td>2 Midterm exams</td>
<td>30%</td>
</tr>
<tr>
<td>Final</td>
<td>15%</td>
</tr>
</tbody>
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Letter grades will be assigned according to the table:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
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<tbody>
<tr>
<td>A</td>
<td>86 to 100</td>
</tr>
<tr>
<td>B</td>
<td>76 to 85</td>
</tr>
<tr>
<td>C</td>
<td>66 to 75</td>
</tr>
<tr>
<td>D</td>
<td>56 to 65</td>
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<tr>
<td>F</td>
<td>below 56</td>
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*Class participation/in-class work*: As noted above, class meetings will consist of small-group work and whole-class discussion. You will self-assess your participation three times over the course of the semester using a rubric I will hand out. I reserve the right to alter your self-assessment if I feel it is much too high or too low.

*Quizzes*: No open books and notes. Quizzes are on understanding of the basic material of the course.

*Midterm and Final*: I will discuss these in more detail as the times for them approach. The midterm will be given outside of class time so as to allow a longer period of time for you to take it. To compensate you for the time spent on the midterm, there will be no class meetings that week. Dates for the midterm and final are:

**VIII. TENTATIVE CLASS SCHEDULE**

Pending

**IX. OTHER CLASS POLICIES**

**IX.I Official Part**

*Attendance*: This is probably obvious, but since 5% of your grade is based on in-class work, unexcused absences will have a negative effect on your grade.

*Missed midterm/ final*: If you are unable to attend the midterm or the final and you wish to make it up, I need to hear from you no later than 24 hours after the missed test or final. You should be able to provide adequate documentation of why your absence was necessary. If you wait more than 24 hours to contact me, you will also need to provide adequate documentation of why you were unable to meet the 24-hour deadline. As an example, "I was called out of town unexpectedly on business" might be a valid reason to miss a test, but it is not an adequate reason to miss the 24-hour notification requirement.

*Notice to Students with Disabilities*: Texas A&M University-Corpus Christi complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. If you suspect that you may have a disability (physical impairment, learning disability, psychiatric disability, etc.), please contact the Services for Students with Disabilities Office, located in Driftwood 101, at 825-5816. If you need
disability accommodations in this class, please see me as soon as possible. **Grade Appeal Process.** As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

1. Attendance required, exceptions are sickness, job and family emergencies, but I will not use class roll at any time, because it is your responsibility to be in class and attend to the process of learning (see also II.2.).
2. Please, **print your name** on all assignments and tests: your professor is not a decoding device.
3. If you have questions you MUST ask, you have the right to interrupt lecture or discussion at any time (see also II.1).
4. I am always open for all questions and discussions during the class and office hours. You can always arrange meeting with me at any other time suitable for both sides.
5. No multi-choice tests, all tests will consist of problems you have to solve from the beginning to the end. Partial credit will be given for any parts of problems solved. The policy is **open books and notes, no talking, no cheating.**
6. **No open** books and notes during quizzes.
7. **Papers must be turned on time.**
8. There is **no social promotion** in my classes. **Grades** are given only for **knowledge acquired** (see also II.9.).

**II. Unofficial part.**

II.1. There are no "stupid" questions, there are only bad teachers.
II.2. All you do, you do it for yourself, not for the professor.
II.3. Do not be concern about grades, be concern of knowledge, because grades are the steepest increasing function of knowledge (here is an example of math language).
II.4. Do not be afraid of problems, let them be afraid of you.
II.5. Only doing nothing may be without mistakes. If you don’t make errors, you don’t learn anything.
II.6. Do not be nervous - it may be only worse.
II.7. Common sense is the base of all decisions, together with knowledge they can do almost everything (even pass this course!).
II.8. Keep your particles together.
II.9. **The only valid excuse for not knowing** the subject is a **sudden death.**