Modern Algebra MATH 4306  
Department of Mathematics and Statistics  
Spring 2016

A. COURSE INFORMATION

Course number/section: MATH-4306.001  
Class meeting time: MW 5:30-6:45pm  
Class location: IH 267  
Course Website: bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Jordan Alexander  
Office location: CI 213a  
Office hours: MTWR 2:00-4:00pm  
Telephone: (361) 825-3613  
e-mail: jordan.alexander@tamucc.edu  
Appointments: email me to make an appointment to meet outside office hours

C. COURSE DESCRIPTION

Catalog Course Description
3 sem. hrs. (3:0) Fundamentals of set operations, maps and relations, groups, rings and field theory. Topics include permutation groups, cosets, homomorphisms and isomorphisms, direct product of groups and rings, integral domains, field of quotients, fundamental properties of integers, the ring of integers modulo n, and rings of polynomials. Applications.

Extended Course Description
This course develops a deeper understanding of the common operations of mathematics through a detailed investigation of the abstract properties of those operations applied to generalizations of the common types of numbers. Almost all professional mathematicians have studied modern algebra at some level in order to help them better understand the structure of their favorite objects of study.

D. PREREQUISITES FOR THE COURSE

Prerequisites  
MATH 3311 and MATH 3313

Corequisites  
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES
Required Textbook(s)
Anthony W. Knapp’s *Basic Algebra*.
Michael Tinkham’s *Group Theory and Quantum Mechanics*. (published by Dover)

Optional Textbook(s) or Other References
Victor J. Katz and Karen Hunger Parshall’s *Taming the Unknown*. This text provides a fairly detailed historical sketch of the development of algebra from ancient Egypt and Mesopotamia to the early twentieth century.

Supplies
None

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the courses student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Describe why mathematicians have studied the main ideas of Modern Algebra in the past and why students study them today.
2. Give the definitions of groups, rings, and fields.
3. List examples of groups, rings, and fields.
4. Prove theorems about the structure of groups, rings, and fields.
5. Participate in verbal discussions about the structure and applications of groups, rings, and fields.
6. Describe connections between Modern Algebra and other branches of science, including other areas of mathematics.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

Class time will mostly consist of group discussion and lecture. Students may also give short, informal presentations on the blackboard.

H. MAJOR COURSE REQUIREMENTS AND GRADING

Student learning outcomes will be measured in the 4 following areas:
1. After a lesson is discussed in class, students will work through a corresponding homework assignment. New assignments will be given each class period and will be due the following class period. You should come to my office to ask questions about the exercises you are struggling with each week. To provide you with some motivation to actually do this, for each day that you come to my office and ask a question about a homework problem you have worked on, I’ll give you one point toward the next exam. Ultimately, you need to build a solid understanding of the relevant mathematical concepts, solutions to problems, and proofs of theorems and be able to communicate that understanding through an in-class written examination.

2. Two in-class written exams will be given during the semester (with a third comprehensive final exam at the end of the semester). Students will not be allowed to use calculators, phones, notes, or any other type of help during the exams.

3. A comprehensive final exam will be given at the end of the semester and will be similar in style to the two semester exams. Studying for the final exam helps solidify students’ understanding of key concepts developed in the class. Studying for the exam serves as the finishing step in preparing the student for future work with the powerful mathematical tools developed throughout the semester. Students who consistently study well throughout the semester should find studying for the final to be a pleasant experience.

4. Students will form groups of 3-4 and complete a project together. (These groups could also serve as great study groups for our exams.) The project will be worth 30% of your final grade. One third of the project grade (10% of your final grade) will be based on your group’s submissions during the preparatory stages: outline, first draft, second draft. Another third of the project grade will depend on the group’s in-class presentation (to be given in late April). The presentation needs to be Beamer or Powerpoint. Beamer provides much better graphics for mathematical equations, as well as a lot of flexibility in style, but it takes a significant amount of time to get over the learning curve. The last third of the project grade will come from your final paper, which will be turned in by the last day of class. Finally, individual grades within each group may be adjusted based on how members of the group rate each other on a provided rubric.

Each group must choose one of the following topics to report on: overview of applications of modern algebra to a specific field of science (physics, chemistry, biology, computer science, mathematics, etc.); specific application of modern algebra (this will need to be a detailed report); historical account on the development of modern algebra. Your final paper must be 5-10 pages, and your in-class presentation needs to be 10-15 minutes. You need to utilize at least 3 academic sources (books or professional papers), and your final paper should include a bibliography. See the class schedule for due dates, including those for having an outline and rough drafts.

The following letter grades will be assigned to the associated range of final grades: 85.0 – 100 A; 70.0 – 84.99 B; 55.0 – 69.99 C; 40.0 – 54.99 D; below 40 F.
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<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Exam 1</td>
<td>10%</td>
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<td>Exam 2</td>
<td>10%</td>
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<tr>
<td>Final Exam</td>
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<td>Group Project</td>
<td>30%</td>
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I. COURSE CONTENT/SCHEDULE

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<tr>
<th>DATES</th>
<th>WEEK</th>
<th>TOPIC</th>
<th>TEXT</th>
<th>DUE WED.</th>
<th>DUE MON.</th>
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</thead>
<tbody>
<tr>
<td>1/20 – 1/25</td>
<td>1</td>
<td>Preliminaries</td>
<td>K-1</td>
<td>K-1 1-20</td>
<td>K-1 1-20</td>
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<td>1/27 – 2/1</td>
<td>2</td>
<td>Vector Spaces</td>
<td>K-2</td>
<td>K-1 21-29</td>
<td>K-2 1-30</td>
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<tr>
<td>2/3 – 2/8</td>
<td>3</td>
<td>Inner-Product Spaces</td>
<td>K-3</td>
<td>K-2 31-44</td>
<td>K-3 1-25</td>
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<td>2/10 – 2/15</td>
<td>4</td>
<td>Groups</td>
<td>K-4</td>
<td>Exam 1</td>
<td>K-3 26-34</td>
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<td>T-2 3,4</td>
<td>T-2 5,6</td>
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<td>Outline</td>
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<td>T-3 4,5</td>
<td>T-3 6,7</td>
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<td>Draft 1</td>
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<tr>
<td>3/30 – 4/4</td>
<td>10</td>
<td>Multilinear, App.’s</td>
<td>K-6, T-4</td>
<td>K-6 29-40</td>
<td>T-4 4,5</td>
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<td>Exam 2</td>
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<td>4/6 – 4/11</td>
<td>11</td>
<td>Advanced Groups</td>
<td>K-7</td>
<td>K-6 41-56</td>
<td>K-7 1-19</td>
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<td>T-4 6-8</td>
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<td>Present</td>
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<td>Final Draft</td>
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<td>15</td>
<td>Final Exam</td>
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<td>Wed. 5/11</td>
<td>5:30-7:00 pm</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Punctual class attendance is highly recommended.

Late Work and Make-up Exams
In general, late work will not be accepted. Four homework grades will be dropped. These drops are meant to cover all possible good excuses for late work, such as illness, technical problems, and family emergencies. Long term illness and official university business are probably the only exceptions to this rule.

Make-up exams will not be given. If a student misses an exam, the student’s score on the final exam will serve as the score for the missed exam. For students who take both semester exams, the final exam score will replace the student’s lowest semester exam score (unless the final score is lower than both semester exam scores).

Extra Credit
You should come to my office to ask questions about the exercises you are struggling with each week. To provide you with some motivation to actually do this, for each day that you come to my office and ask a question about a homework problem you have worked on, I’ll give you one point toward the next exam.

Cell Phone Use
Please turn off cell phones before class starts. I will ask any student with their phone out to turn it off and put it up. If this happens multiple times with the same student, I will ask the student to leave class.

Laptop Use
Please do not open laptops during class. This can distract others from learning, and part of my job is to provide a class atmosphere that aids student learning.

Food in Class
Please do not eat during class. This can distract others from learning, and part of my job is to provide a class atmosphere that aids student learning.

Missed Exam
See “Late Work and Make-up Exams” above.

Participation
Strong, consistent class participation is expected from all students.

K. COLLEGE AND UNIVERSITY POLICIES
• **Academic Integrity (University)**

   University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

• **Classroom/Professional Behavior**

   Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructors ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

• **Statement of Civility**

   Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

• **Deadline for Dropping a Course with a Grade of W (University)**

   The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar at http://www.tamucc.edu/academics/calendar/ for the last day to drop a course.

• **Grade Appeals (College of Science and Engineering)**

   As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at

http://www.tamucc.edu/provost/university_rules/index.html

and the College of Science and Engineering Grade Appeals webpage at

http://sci.tamucc.edu/students/GradeAppeal.html

For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the
department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The Colleges Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.