MTH 625: Theory of Associative Rings
Course Information Sheet and Syllabus[1]
Fall 2012

Instructor: Dr. Susan Cooper

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Office Hours: Mondays & Wednesdays 9:30 a.m. – 10:30 a.m.; Tuesdays 2:00 p.m. – 3:00 p.m.; or by appointment

Correspondence: The most reliable way to contact me is via email.

Class Times and Location: Mondays & Wednesdays 8:00 a.m. – 9:15 p.m., Pearce Hall – Rm 223.

Course Web Page: We will use *Blackboard* which can be found at `http://blackboard.cmich.edu/`.

Text: *Abstract Algebra* by David S. Dummit and Richard M. Foote (Third Edition).

Additional Course Materials: You can find a list of errata for the text on Richard Foote's home-page at `http://www.cems.uvm.edu/~foote/errata_3rd_edition.pdf`.

Course Prerequisite: MTH 623, The Theory of Groups.

Course Description and Objectives: MTH 625 is a one-semester graduate course that provides an in-depth study of Ring and Field Theory. The basic idea of Abstract Algebra is to study a set endowed with an algebraic structure. There are more axioms for rings and fields than there are for groups and two operations instead of only one. The extra axioms with the accompanying distributive law can make some properties of rings more familiar than for groups.

One of the great advantages of studying mathematics is that it helps one develop the ability to handle abstract ideas. Abstract Algebra allows us to cultivate this ability with concrete examples, mathematical rigour, and beautiful applications. Ring and Field Theory in particular are important branches of mathematics that are thriving and intriguing in their own right while hosting many applications to subjects such as Number Theory, Geometry, and Analysis. For example, central in Ring Theory is an ideal which was introduced by Kummer in his work on the famous Fermat's Last Theorem. A second example comes from 19th century work on solving polynomial equations – work that led to Galois Theory which will be a main focus in our study of Field Theory.

After successful completion of the course, students will be able to state, prove, and apply fundamental theorems from Ring and Field Theory. In doing so, students will gain an in-depth understanding of important topics such as:

- ideals;
- polynomial rings;
- Euclidean, Principal Ideal and Unique Factorization Domains;
- field extensions;
- The Fundamental Theorem of Galois Theory.

Students will also be able to construct and work with a variety of concrete examples.

We will be covering selected sections from Chapters 7, 8, 9, 13, and 14 of the textbook.

Homework: The best way to learn mathematics is by doing mathematics. *Problem Sets* will be assigned and collected regularly. A subset of these problems will be graded based on correctness, clarity, and style/creativity. The feedback is meant to *improve* your mathematical abilities and communication. Expectations on Problem Set submissions will be provided with the first assignment. *Daily Homework* consisting of readings and problems will also be assigned (but not collected).

Homework Presentations: It is crucial to be able to communicate mathematics with peers. Volunteers will be asked to present homework solutions to the class. Please take your turn in this activity.

[1] *The details stated in this course syllabus are subject to change at the discretion of the instructor. Announcements concerning all (if any) changes will be made in a timely fashion.*

Exams: There will be one midterm exam and one cumulative final exam. The midterm exam will be scheduled for a two-hour period outside of the regularly scheduled meetings. In turn, class will not meet on Monday, December 3. The final exam will be a "mini-qualifying exam" – questions will be similar to what has appeared on previous algebra qualifying examinations. The exam schedule is:

Examination	*Date*	*Time and Location*
Midterm	TBA - Week of October 15	TBA
Final Exam	Wednesday, December 12	8:00 a.m. – 9:50 a.m., Pearce Hall – Room 223

Missed/Late Work Policies: The following policies will be followed:

(1) Problem Sets must be turned in by the beginning of class on the day that they are due. Late work will receive no credit.
(2) A make-up exam for the midterm will be considered if arrangements are made with prior notification and you have a reasonable excuse for missing the scheduled exam. If you miss the midterm for an unforeseen, excusable absence, you must provide proper documentation in which case a make-up may be administered. No make-up exam will be granted for the final examination.

Course Grades: Final grades will be determined as follows:

Task	*Percentage of Grade*
Problem Sets	40%
Midterm	30%
Final Exam	30%

Grade	*Letter*	*Grade*	*Letter*	*Grade*	*Letter*
$\geq$ 90%	A	$\geq$ 85%	A−		
$\geq$ 80%	B+	$\geq$ 75%	B	$\geq$ 70%	B−
$\geq$ 65%	C+	$\geq$ 60%	C	$\geq$ 50%	C−

Classroom Atmosphere: A part of learning is making mistakes. We want to establish a classroom atmosphere where the inevitable false starts and mistakes become an opportunity to improve – not an opportunity for embarrassment. Please be constructive and polite in questioning your colleagues.

Expectations: I ask that you have a well-defined sense of professionalism, that you always put forth your best effort, and that you develop a sense of responsibility to your educational community. I ask that you exhibit a persistent desire to learn. In return I will provide you with significant support. Also:

- Be positive, open, and responsive to feedback.
- Be an active participant - mathematics is learned by doing; this includes being responsible for material when a class is missed, participating fully in classroom activities (please, turn your cell phones off during class), critically thinking about the mathematics during and outside of class. *In order for this class to be successful, it is imperative that you commit to coming to class, that you commit to coming to class prepared, and that you commit to participating in class!*
- Be committed, take pride in your work, and take your work seriously.
- Be/become a "risk taker".
- Challenge yourself to struggle through the material before asking too many questions. It can take time for new ideas to settle in.
- Be patient with yourself - it takes time to master newly learned things. Ask for assistance when it is needed. Constantly try to improve yourself as a mathematician.
- Be academically honest. This means, for example, providing a list of the people (if any) with whom you worked on a homework assignment and providing a list of sources other than the textbook (if any) that you used to complete an assignment. Although you are encouraged to work together, you should not submit anything that you do not understand or is not written in your own words. You are obligated to adhere to the CMU Policy on Academic Integrity.

Special Needs: CMU provides students with disabilities reasonable accommodation to participate in educational programs, activities, or services. Students with disabilities requiring accommodation to participate in class activities or meet course requirements should first register with the office of Student Disability Services (Park Library, Suite 120, telephone: 989-774-3018, TDD 989-774-2568), and then contact me as soon as possible.