SYLLABUS

MTH 331/431 – Abstract Algebra I – Fall 2017

Instructor: Dr. Sofya Chepushtanova (http://chepusht.mathcs.wilkes.edu/)

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- Class webpage: http://chepusht.mathcs.wilkes.edu/abstract-algebra-fall2017

Class Meetings: MWRF 10:00-10:50am, SLC 405.

Office Hours: MWF 11:00-11:50am and T 9:00-10:50am or by appointment, SLC 410.

What is Abstract Algebra? Algebra is defined to be the study of algebraic structures. Mathematicians study algebraic structures from a general point of view, compare different structures, and find relationships between them. In this course we will study elementary number theory, groups, rings, and fields.

Prerequisites: MTH 202 or an equivalent course in set theory and logic (or consent of the instructor). Students are expected to understand and apply various methods of proofs (*e.g.*, direct proof, proofs by contrapositive and contradiction, induction, etc.) and be comfortable working with concepts and results related to elementary set theory (*e.g.*, union, intersection, complement, etc.)

Textbook: Tom W. Judson's *Abstract Algebra: Theory and Applications*, freely available online: http://abstract.ups.edu/index.html.

Other Useful References:

1. Joseph Gallian, *Contemporary Abstract Algebra*, 8th Ed., CENGAGE Learning
2. Charles Pinter, *A Book of Abstract Algebra*, 2nd Ed., Dover
3. William Gilbert and W. Keith Nicholson, *Modern Algebra with Applications*, 2nd Ed., A John Wiley & Sons

Course Objectives: Upon completion of this course,

1. Students will demonstrate factual knowledge including the mathematical notation and terminology used in this course. Students will read, interpret, and use the vocabulary, symbolism, and basic definitions used in abstract algebra, including binary operations, relations, groups, subgroups, homomorphisms, rings, and ideals.
2. Students will describe the fundamental principles including the laws and theorems arising from the concepts covered in this course. Students will develop and apply the fundamental properties of abstract algebraic structures, their substructures, their quotient structure, and their mappings. Students will also prove basic theorems such as Lagrange's theorem, Cayley's theorem, and the fundamental theorems for groups and rings.

3. Students will apply course material along with techniques and procedures covered in this course to solve problems. Students will use the facts, formulas, and techniques learned in this course to prove theorems about the structure, size, and nature of groups, subgroups, quotient groups, rings, subrings, ideals, quotient rings, and the associated mappings. Students will also solve problems about the size and composition of subgroups and quotient groups; the orders of elements; isomorphic groups and rings; and the composition of ideals.
4. Students will develop specific skills, competencies and thought processes sufficient to support further study or work in this or related fields. Students will acquire a level of proficiency in the fundamental concepts and applications necessary for further study, including graduate work, in academic areas requiring abstract algebra as a prerequisite, or for work in occupational fields requiring a background in abstract algebra or other highly abstract mathematics. These fields might include the physical sciences and engineering as well as mathematics.

Attendance: You are expected to attend classes regularly. *Remember that poor attendance is a major contributor to poor performance!* If you miss a class, it is your responsibility to obtain notes from a classmate, find out any announcements made during the class, and make sure your homework turned in on time. After five or more unexcused absences from a class, students may be readmitted to the class only by action of the Office of Student Affairs and the department chairperson concerned; this may also result in failure of the course, unless there are extenuating circumstances.

Homework: Homework problems will be assigned regularly. Start working on assigned problems as soon as the corresponding section(s) are covered. *It is a fact that doing problems is the way to learn mathematics.* You are encouraged to work on the homework together, but I insist that everybody writes up their own solutuions demonstrating understanding. Problem sets will be due at the beginning of class. Homework submitted within 24 hours after class will be subject to 25% deduction from the total score of this problem set. Problem sets which are more than 24 hours late *will not be accepted for grading.*

Write your homework solutions neatly and legibly on 8.5" x 11" paper. You are also encouraged to type your solutions using TEXor LATEX, the standard in mathematical typesetting. There are versions available for you ti use in the department labs. See our course webpage for tutorial and example links.

Graduate Student Presentations: Each MTH 431 student will receive a project/lecture topic for a 20 to 25 minute presentation to be delivered to the class by the end of the semester.

Exams and Grade Distribution: There will be three in-class one-hour examinations and a comprehensive final examination. Make-up examinations will not be allowed except for extreme circumstances. It is the students responsibility to contact the instructor if an emergency situation occurs. Notice of the emergency should be made in a timely fashion and proper documentation will be required.

MTH 331 student's final score in this course will be calculated as follows:
Homework 15% + Best Exam (22%) + Median Exam (18%) + Worst Exam (15%) + Final Exam (30%) = 100%.

MTH 431 student's final score in this course will be calculated as follows:
Homework 10% + Presentation 5% + Best Exam (22%) + Median Exam (18%) + Worst Exam (15%) + Final Exam (30%) = 100%.

The final grade will be computed from the total percentage earned as follows:

Percentage	*Grade*
$90-100\%$	4.0
$85-89\%$	3.5
$80-84\%$	3.0
$75-79\%$	2.5
$70-74\%$	2.0
$65-69\%$	1.5
$60-64\%$	1.0
$<60\%$	0.0

Drop Policy: If you wish to drop from the course, I will give my permission during the first ten weeks of the semester. Thereafter you will need the permission of the Dean. Be aware that poor performance in the course will not be a sufficient reason for the Dean's permission to be granted.

Academic Honesty: By handing in homework, quizzes, and exams you certify that this is your own work. You are encouraged to discuss homework solution strategies with fellow students but the final write-up must be your own. A violation will result in a grade of zero on that particular assignment; serious or repeated infractions of the Academic Honesty policy will result in failure of the course.

Tentative **Class Schedule Fall 2017**

1. Week of 8/28: Introduction and history. Preliminaries: summary on proofs, set theory overview (Ch. 1). The integers: principle of well-ordering, division algorithm, Euclidean algorithm, prime numbers, Fundamental theorem of arithmetic (Ch. 2).

2. Week of 9/4: *No class on Monday - Labor Day.* Integer equivalence classes and symmetries. The integers mod n; definitions, properties, and examples of groups and subgroups (e.g., abelian and permutation groups) (Ch. 3).

3. Week of 9/11: Continuing on groups (Ch. 3). Cyclic groups (Ch. 4).

4. Week of 9/18: Permutation groups (Ch. 5). Review and **Exam I** on chapters 1-4.

5. Week of 9/25: Continuing on permutation groups (Ch. 5). Cosets and Lagrange's Theorem (Ch. 6).

6. Week of 10/2: Continuing on Cosets and Lagrange's Theorem (Ch. 6). Isomorphisms (Ch. 9).

7. Week of 10/9 Normal subgroups and factor (or quotient) groups (Ch. 10) *No classes Thursday and Friday - Fall Recess.*

8. Week of 10/16: Continuing on normal sybgroups and factor groups (Ch. 10). Review and **Exam II** on chapters 5, 6, 9, 10.

9. Week of 10/23: Homomorphisms (Ch. 11).

10. Week of 10/30: On the structure of groups (part of Ch. 13). Rings (Ch. 16).

11. Week of 11/6: Continuing on rings (Ch. 16).

12. Week of 11/13: Polynomials (Ch. 17). Review and **Exam III** on chapters 11, 13, 16, 17.

13. Week of 11/20: On integral domains (part of Ch. 18). *No classes Wednesday through Friday - Thanksgiving Recess. Tuesday follows Thursday schedule.*

14. Week of 11/27: Vector spaces (Ch 20). Fields (Ch. 21).

15. Week of 12/4: Continuing on fields (Ch. 21). **Graduate student presentations.**

16. Week of 12/11: Review and **Final Exam: TBA. Graduate student presentations.** *Monday (last day of class) follows Friday schedule. Final exams end on Wednesday, December 20th.*