

NCSU Mathematics Department

MA 407-002 – Introduction to Modern Algebra for Math Majors

Spring 2019, TTh 1:30-2:45pm, SAS 2225

Instructor: Dr. Ronald Fulp, office SAS 4232, phone 515-3177,
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Office Hours: Tuesday-Wednesday 3:00-4:00 or by appointment, in SAS 4232.

Prerequisite: MA 225. **Note:** Credit is not allowed for both MA 403 and MA 407.

Contents: Elementary number theory, equivalence relations, groups, homomorphisms, cosets, Cayley's Theorem, symmetric groups, rings, polynomial rings, quotient fields, principal ideal domains, irreducible polynomials, splitting fields.

Text: *Contemporary Abstract Algebra* by Joseph Gallian, 9th edition, Brooks Cole, 2016, ISBN: 978-1305657960 (previous editions OK but the homework problem numbers differ).

Tutoring is available for free in the Math Multimedia Center in SAS 2105 on a first-come, first-served basis. See <https://www.math.ncsu.edu/mmc/index.php> for more information.

Grade will be determined from the homework, three in-class tests and the final exam. Homework will be given the same weight as a test and then the lowest of the four grades will be dropped. The remaining three grades will count 70% and the final exam will count 30%. In case of excessive absences, all three tests and the homework will be taken into account when determining the grade. Plus-Minus grades are given sparingly and usually only the highest one or two grades in a grade level are given a +. Similarly, only the one or two lowest grades in a level get a -.

Homework will be assigned regularly and will be collected and graded. Homework teams will be formed on the first day of classes, 3 per team. It must be turned in at the beginning of the lecture on the due date. Late homework will be accepted only in case of a documented excused absence. Selected problems will be discussed in class. Homework assignments will be posted on the course webpage.

Tests: There will be three tests and a cumulative final exam (on Tuesday, April 30, 1-4 p.m.). If you miss a test, you have to explain the reason in writing. Makeup tests can only be given for reasons such as illness, family emergency, participation in a University-sponsored event, required court attendance or military duty, or religious observances as certified by the Department of Student Development. If you know

you will be absent on a test date, you must clear the absence with the instructor in advance and schedule a makeup date. In the case of an unanticipated absence on a test date, you must provide documentation and schedule a makeup date as soon as possible. Keep the day and time of the final exam in mind when scheduling plane tickets or making other obligations as the university has strict policies on missing the final exam.

Attendance: Students are expected to arrive on time, to contribute to group work and class discussions, and to stay until the class ends. Attendance at all meetings of the class is expected and will be recorded. Occasional absences will be approved if they meet University policies (see <https://policies.ncsu.edu/regulation/reg-02-20-03>).

Adverse Weather: Announcements regarding scheduled delays or the closing of the University due to adverse weather conditions will be broadcast on local radio and television stations and posted on the University homepage.

Cell Phones: Cellular phones and other types of telecommunication equipment are prohibited from use during class. Make sure that any phones or other equipment are turned off during the class period. If you have a special need to have your phone on during class, please notify the instructor.

Academic Integrity Statement: *“Academic dishonesty is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student’s record or academic career.”* (NCSU Code of Student Conduct; see <https://policies.ncsu.edu/policy/pol-11-35-01>).

Statement for Students with Disabilities: Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disabilities Services Office (see <https://dso.dasa.ncsu.edu>).

Class Evaluations: Online class evaluations will be available for students to complete during the last two weeks of class. Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructors.

Tentative Schedule

Lecture	Chapter	Title	Contents
3	0	Preliminaries	integers, modular arithmetic, induction, equivalence relations
1	1	Introduction to Groups	symmetries of a square, dihedral groups, cyclic rotations
2	2	Groups	definitions, examples, elementary properties
2-3	3	Finite Groups	terminology, notation, subgroups, examples
2.5	4	Cyclic Groups	properties, subgroups, classification
2.5	5	Permutation Groups	definition, notations, cyclic notation, properties
Test 1			
2	7	7.1&7.2 Cosets and Lagrange's Theorem	definition, Lagrange's theorem, applications, rotations
2	9	9.1-9.3 Normal subgroups and Quotient Groups	definitions, applications, internal direct products
5	10-6	10.1-10.2, 6.1-6.4, 10.3	Isomorphisms and Homomorphisms
3	8	External Direct Products	definition, examples, properties, group of units mod m
1	Test 2		
1	11	Fundamental theorem of abelian groups	statement and examples
1	12	Introduction to Rings	motivation, definitions, examples, properties, subrings
2	13	Integral Domains	definition, examples, fields, characteristic

2	14	Ideals and Quotient Rings	ideals, quotient ring, prime ideals, maximal ideals
2	15	Ring Homomorphisms	definition, examples, properties, field of quotients
2	16	Polynomial Rings	notation, division algorithm, consequences
2	17	Factorization of Polynomials	reducibility, unique factorization domains

Test 3

Splitting fields if time permits

Review

**Final Exam April 30, 1-4
SAS 2106**