Syllabus
MA419 and MA519 Theory of Equations Spring Term, 2023

Course Instructor

Instructor: Ivan Mann, PhD
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Office: UH - 4125
Office hours: Monday 13:00 - 14:00, Thursday 15:00 - 16:00

Withdrawal The last day to drop this course without the payment of full tuition and fees is January 16, 2023. The last day to withdraw from this course with a grade of W is March 22, 2023.

Note The Course Instructor reserves the right to make changes to the course syllabus prior to or during the term. The Course Instructor will notify students, via email or Canvas Announcement, when changes are made in the requirements and/or grading of the course.

Theory of Equations

Theory of Equations: this course is concerned with the presentation of methods for solving equations of various types, practice of solving equations, and with certain related topics. Equations may involve functions of real numbers, functions of complex numbers, vectors, matrices, and other domains. There will be emphasis on visualizing problems, with some attention to real world problems.

Text

No text is required. There will be notes available on Canvas before each class, but you should bring a notebook to every class.

Proposed list of Topics

(subject to change based on course progress)

1. Linear Equations
    - Systems of linear equations.
2. Diophantine Equations
3. Quadratic Equations and Graphing
4. Cubic Equations

5. Complex Numbers
6. Polynomials Past Cubic Equations
7. Roots of Polynomials and of Numbers
8. Vector Equations
9. Matrix Equations
10. Polynomials in x, y, z.
11. Reciprocals of Polynomials
12. Other interesting topics

Regular Class Meetings

Students will work in two-person teams in the classroom. Each class meeting will consist of a discussion of a particular topic followed by classroom exercises. The exercises will be presented by one team member for grading. Points will be awarded for accuracy of the solution. After all exercises are presented there will be discussion in the class related to the problems, and the difficulties of the problems will be ranked.

Inclement Weather Policy

Spring in Alabama is noted for tornadoes and occasional extreme thunder storms. For some reason they prefer Thursday evenings. **In case of dangerous weather, do not put yourself in danger by driving during tornado events.** UAB may close classes due to dangerous weather so you should check the UAB status frequently on days with heavy weather. Changes in the class schedule may be required if classes are canceled.

Communication

Most communication to students will be Canvas announcements. These will generate an email to your uab email address,so you should be sure to check that email address periodically.

Class Meetings

The class meets Thursdays, 5:00 pm to 7:30 PM in UH4004. Students are expected to arrive promptly before 5:00 PM ready to learn for each class meeting.

Since class participation is a significant percentage of the grade, punctuality is very important. No make-ups are given for missed meetings and assignments/activities.

If you commute to campus, you should leave time for unexpected parking and traffic delays when planning your trip to campus.

Class Format

Each class will begin with a lecture of an hour or more on the subject of the class that day. Following the lecture individual problems will be handed out to be worked in class. During that time the professor will provide assistance as required. Then, each student will present the solution of the problem to the class, followed by discussion of that problem.

Solutions will be scored by the following rules:

Problem correct with only a minor flaw	4
Problem substantially correct with easy correction	3
Correct approach but problem not easily corrected	2
Problem not close to solution	1

After solutions are complete we will discuss the problems as a class. We may decide to give one problem an extra point for difficulty.

Masks and Covid

UAB policy does not require masks inside any building. Individuals may decide that they should wear masks, or should not. Individuals may decide to sit in the classroom with some degree of isolation. UAB policy, Common sense, and courtesy require the rest of us to respect those decisions.

List of Topics

The course is concerned with methods for solving polynomial and certain non-polynomial equations of various types; using methods to which students of high-school and middle-school mathematics have not previously been exposed. It serves the purpose of deepening student understanding of the pre-calculus algebra courses or calculus courses teachers are called upon to instruct in high-school or middle-school.

1. Simple polynomials
   (a) Quadratic
   (b) Roots of real numbers
2. Cubic Equations

   (a) Some History
   (b) Solutions
3. Review of complex numbers
   (a) Polar coordinates
   (b) Complex plane
   (c) Expressing complex numbers in a trigonometric format
4. Roots of complex numbers
   (a) Finding the square root of a complex number algebraically
   (b) Finding the n roots of any number
   (c) Complex sphere
5. Arithmetic operations on complex numbers in trigonometric form
6. Equations with irrational or complex roots
7. Solving equations with some roots known and some coefficients unknown
8. Equations with multiple roots
   (a) Using the derivative of a function to test for multiple roots
9. The relationship between roots and coefficients
10. Solving polynomial equations given some relationship between the roots
11. Given an equation, finding a second equation whose roots bear some stated relation to the roots of the first equation
12. Eliminating terms of a polynomial by shifting roots
13. Sturm's theorem for isolating roots - the number of distinct roots in a polynomial
14. Methods for numerical approximations of roots
   (a) Horner's method
   (b) The method of interpolation
   (c) Newton's method

Grade

Your final course grade will be determined as follows:

Percent of Presentation Points	Letter grade
90 -100	A
80 - 89	B
70 - 79	C
60 - 69	D
0 - 59	F

Grades for Graduate Students

The standards for graduate students in the course are higher than the standards for undergraduates. The course will include more advanced work for graduate students. In class work will be more advanced.

Important Dates

January 8	First Day of Classes
January 15	Martin Luther King Day
January 16	Last day to drop or add classes
March 10 - 16	Spring Break
March 22	Last day to withdraw with W
April 19	Last day of class
April 29	Grades due

DSS Accessibility Statement

UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff.

If you are registered with Disability Support Services, please contact DSS to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call 934-4205 or visit http://www.uab.edu/dss or Hill Student Center Suite 409.

Title IX Statement

The University of Alabama at Birmingham is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident. UAB provides several avenues for reporting.

For more information about Title IX, policy, reporting, protections, resources and supports, please visit http://www.uab.edu/titleix for UAB's Title IX Policy, UAB's Equal Opportunity, Anti-Harassment Policy and Duty to Report and Non-Retaliation Policy.