Modern Algebra II - MA 542
Spring 2025
MWF 1:25 PM - 2:15 PM

Instructor: Timothy Kohl
Office: CDS-511
E-mail: tkohl@bu.edu (I read my e-mail throughout the day!)

Lecture: CAS 320
Office Hours: Wed, Fri: 4-5

Text: *A First Couse In Abstract Algebra (7th Ed.)* – John B. Frahleigh (Addison Wesley) 2000.

Remarks: The main prerequisite for this course is group theory, which was the primary content of MA 541. (However, I will try to make the material as self contained as possible.) In this course, we will study **rings**, which are similar to groups, except that there are now two binary operations on a given set instead of one. This is not unfamiliar, in that, for example, the integers naturally have two operations defined on them, addition and multiplication. We know, moreover, how these two operations interact to yield the usual laws of arithmetic. In a similar fashion, one adds and multiplies two polynomials f(x) and g(x) according to a similar set of rules. Indeed, the concept of a ring formalizes the notion of '*arithmetic*' and expands on it. Progressing further into this topic, we will discuss fields (which are a type of ring) and explore the seemingly elementary question of whether polynomial equations have solutions. (*Think 'quadratic formula.'*) This will lead us to the final topic, Galois Theory, which establishes a correspondence between solutions of a given equation, if they exist, and properties of a group associated to that equation.

[This last topic is one of the most beautiful ideas in mathematics, in that it deals with questions about **arithmetic** (described by rings and fields) using **symmetry**, which is embodied in the group concept.]

Outline of topics to be covered:
(Note: Not all sections in a given chapter are covered.)

Part IV	Rings & Fields	-	Chapters 18 - 24
Part V	Ideals & Factor Rings	-	Chapters 26 - 27
Part IX	Factorization	-	Chapters 45 - 46
Part VI	Extension Fields	-	Chapters 29 - 31
Part X	Automorphisms & Galois Theory	-	Chapters 48 - 54

Exams: During the semester, there will be a take-home mid-term worth 100 points, as well as a final exam (also take-home) worth 100 points. The schedule for these exams is given on the next page.

Homework: During the semester, I will generally assign homework on a daily basis. This homework is your primary means of learning the material, even more so than the lectures. Indeed, it is only by actually working out the solutions to problems that one really learns this material. Not doing homework is a *bad* idea and will result in a poor performance in the course.

Additionally, there will be, throughout the course of the semester, 10 turn-in homework assignments, each worth 10 points, for a total possible maximum of 100 points *if you complete each perfectly.* Each turn-in assignment will be due by the next class meeting after it was assigned.

[Note: On the homework, you may discuss the material with each other, but plagiarism is **not** acceptable. Your written answers must be your own. I do not wish to see identically worded answers on the exams or homework.]

Grading: Your grade in the course will be based on the combined sum of the two exams, the 10 turn-ins, and the final exam, out of a possible total of 300 points.

Cheating: I consider cheating to be a very serious offense and any cases of it will merit action by the University Academic Standards Committee.

Important Dates:

Holidays: **Monday February 17**
(Substitute Monday on Tuesday February 18)
Spring Break – March 8 - 16
Monday April 21
(Substitute Monday on Wednesday April 23)

Mid Term Exam – Assigned Friday February 28 (due Monday March 3)

Final – Assigned April 30 (due May 7)

The **last lecture** will be **Wednesday April 30**.

Web Page: I will not be using Blackboard, instead, there is a web page for the course where you can find the homework assignment listings, as well as the syllabus and other materials that will be made available during the course.
The URL is http://math.bu.edu/people/tkohl/teaching/current/542.html