MATH 113 – INTRODUCTION TO ABSTRACT ALGEBRA (4 UNITS)

COURSE OVERVIEW

SUMMARY

Math 113 is an upper division introduction to abstract algebra course, operated like a typical upper division math course (multiple lecture sections for 30-40 students, each taught by a different professor). As such, your experience in this course can be highly dependent on the section you're in. The course broadly goes over group theory, rings, and fields, and their mathematical properties. There is very little computation in this course, making it relatively concept and proof-heavy. For chemists, this course can be helpful if you want to know more about group theory (inorganic chemistry) from a completely theoretical (and generalized) standpoint.

PREREQUISITES

Math 54 (math54.html) or equivalent;

Taking a more rigorous math course (MATH 55 or MATH 110) before taken this class can help develop mathematical maturity for this class

TOPICS COVERED

- Equivalence relations
- Groups, subgroups, order

    - Cyclic groups, Dihedral groups, product groups, quotient groups, abelian groups, normal groups, (all the groups) etc.
- Properties of Z, R, N, etc.
- Homomorphism and Isomorphisms, Automorphisms
    - First Isomorphism Theorem
- Cosets, Lagrange's theorem
- Group actions, orbits, stabilizers, conjugacy, centralizers, normalizers
- Sylow's Theorems
- Rings
    Subrings, Quotient Rings
- Kernels and Ideals
- Fields

WORKLOAD

COURSEWORK

- Weekly homeworks
- 1-2 midterms (depending on the professor)
- Final

TIME COMMITMENT

3 hours of lecture a week, no discussion. Expect to spend a lot of time on the homeworks (maybe up to 10 hours+ per homework, including GSI and professor office hours), and possibly even more time reviewing/revising the material.

CHOOSING THE COURSE

WHEN TO TAKE

Ideally, you should take this class when you have a lot of mathematical maturity (some experience with proofs, but not necessarily rigorous proofs), which means you should probably be at least a junior or second semester sophomore. Some students (even math majors) struggle in this course due to its abstract nature.

WHAT NEXT?

- MATH 114 – Second Course in Abstract Algebra (math114.html)
- MATH 125A – Mathematical Logic (math125a.html)

ADDITIONAL COMMENTS AND TIPS

Personal note: this class was one of the more difficult classes I've taken at UC Berkeley (on the lines of Chem 120A, 220A, 220B, etc.), and it was partly because I was underprepared in terms of my math background (and the other part is that it is a difficult class). As chemists, it can be hard to transition from a computation-based math mindset to a more theory or proof-based mindset needed to do well in this course. Most of the students taking the course are math majors in their junior year. That being said, the class can be interesting for chemists, and it is possible to do well.

As with many upper division math courses, the homeworks are generally extremely difficult, but graded leniently. Much of the overall grade in the course is dependent on exams, which are generally less difficult (although sometimes more tricky) than the homeworks. Furthermore, this course is aimed for independent learners, so there isn't a lot of structured support from professors/GSI (there's only one GSI for all the math sections), even though most of the instructors are very generous with their time if you ask for it. Expect to spend a lot of time studying for this class on your own, and do not try to rush through the homeworks.

Two Math GSIs created good resources for the course, linked here: [Link 1] (https://math.berkeley.edu/~mcivor/math113su16/notes/113notes2016.pdf) [Link 2] (https://math.berkeley.edu/~mcivor/math113su16/113ringnotes2016.pdf)

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lang=en) students/peer-
advising