MATH 103A, MODERN ALGEBRA I

UC San Diego

COURSE SYLLABUS, FALL 2020

This is the first course in a two-quarter introduction to abstract algebra with some applications. The prerequisite is Math 109 or Math 31CH. Note that Math 103A-B is focused on giving the students a basic knowledge of the definitions, main ideas and uses of abstract algebra, while Math 100A-C gives the students a rigorous grounding in algebra that is sufficient for graduate study in mathematics.

Instructor and Contact Information

Instructor: Kisun Lee
Office Hours: MWF, 10:00-11:00 am; and by appointment
E-mail: kil004@ucsd.edu

Course Websites

Course Information: http://canvas.ucsd.edu

On-line Discussions: www.piazza.com

Course Description and Learning Outcomes

Course Title: Modern Algebra I

Course Meeting Times: Pre-recorded lectures will be uploaded before class time. Regular lecture time will be used for office hours (MWF 10:00-11:00am)

Teaching Assistants, Office Hours, and Meeting Locations:

TA	*Email Address*	*Recitation Location*	*Office Hours*
Xindong Tang	xit039@ucsd.edu	Video is uploaded each Monday at 2pm	Tuesday 2-4pm via Zoom zoom link : 359 126 4227

Textbook: Audrey Terras, *Abstract Algebra with Applications*.

At the conclusion of Modern Algebra I, it is expected that:

- Review of arithmetic of the integers: division algorithm, gcd and lcm, addition and multiplication of integers modulo n.
- Basic definitions of groups, subgroups, homomorphisms, normal subgroups and factor groups, first isomorphism theorem.
- Emphasis throughout on the most common examples of groups, including the integers modulo n under addition, the unit group of integers modulo n under multiplication, groups of symmetries (especially dihedral groups), matrix groups and the symmetric and alternating groups.

Course Organization and Participation

This course will consist of lectures and recitations. You are required to attend all scheduled sessions at all times.

As your instructor, my role is to facilitate the lectures, coordinate with the teaching assistants to link lecture to recitation, provide you with ample assignments and assessments to gauge your understanding and knowledge of the subject matter, provide feedback on your performance, and be available for assistance when needed.

As students, you are expected to take your responsibility seriously, attend and participate in all of the class discussions, behave in a respectful manner to your instructor, TA, and fellow students at each class meeting, complete all assignments in a timely and professional manner, study the subject matter outside of class time, and ask for help when necessary.

Course Requirements and Grading

HOMEWORK: Homework will be assigned weekly with due-date on every Tuesday except the first week.

QUIZZES AND TESTS: We will have two quizzes and one final which will be given as open-book

- Quiz 1: Wednesday, October 21
- Quiz 2: Wednesday, November 18
- Final: Saturday, December 12

Your final average will be computed as follows:

Assignment	***Weighting***
Homework	40%
Quizzes (15% each)	30%
Final Exam	30%

Letter grades will be determined based on the following intervals. ***Do not expect any deviation from the following scale:***

A: 93-100

A-: 90-92

B+: 87-89

B: 83-86

B-: 80-82

C+: 77-79

C: 73-76

C-: 70-72

D+: 67-69

D: 63-66

D-: 60-62

F: Below 60

Important Dates Throughout the Term

1 October – First Day of Classes

21 October – Quiz 1

11 November – Veterans Day Holiday

18 November – Quiz 2

11 December – Final Instructional days

12 December – Final

Tentative Course Schedule

Please use this as an approximate class schedule; section coverage may change depending on the flow of the course.

1. Review of the integers (1.3)

2. Divisors, prime numbers, and prime factorization (1.5)

3. The division algorithm (1.5)

4. GCD, Euclid's algorithm, and Bezout's identity (1.5)

5. Congruences and congruence classes (1.6)

6. Modular arithmetic, the integers modulo n (1.6)

7. Composition laws and the group axioms. Examples. (2.1)

8. SO(2) and dihedral groups (2.1)

9. SO(3) and the Platonic solids (2.3)

10. Units modulo n and Euler's phi-function (2.3)

11. The cancellation law and multiplication tables (2.3)

12. Subgroups and powers of an element (2.4)

13. Cyclic subgroups and the order of an element (2.4)

14. Cyclic groups I (2.5)

15. Cyclic groups II (2.5)

16. Permutations and symmetric groups (3.1)

17. Cycle decomposition (3.1)

18. The sign of a permutation and alternating groups (3.1) 19. Isomorphisms. Cayley's theorem (3.2)

20. Cosets and Lagrange's index theorem (3.3)

21. Normal subgroups (3.3)

22. Quotient groups (3.4)

23. Homomorphisms, image and kernel (3.5)

24. The first isomorphism theorem (3.5)

25. Direct products. Chinese remainder theorem (3.6) 26. Group actions, orbits and stabilizers (3.7)

27. Conjugacy classes and other examples (3.7)

28. Burnside's lemma with applications (3.7)

29. Cauchy's theorem on elements of order p (3.7)

30. Extra