METU - MATHEMATICS DEPARTMENT
2017 − 2018 Spring semester
Math 116 − Basic Algebraic Structures

Objectives: This course aims to introduce students to two basic algebraic concepts, namely groups and rings. These concepts constitute an essential part of mathematical culture.

Sections and Instructors:

1. **Gülin Ercan** (Monday 10:40-11:30 in **M103**, Wednesday 13:40-15:30 in **M103**)

2. **Ömer Küçüksakallı** (Monday 10:40-11:30 in **M104**, Wednesday 13:40-15:30 in **M104**)

3. **Mahmut Kuzucuoğlu** (Monday 12:40-13:30 in **M13**, Wednesday 10:40-12:30 in **M103**)

4. **Ahmet Beyaz** (Monday 12:40-13:30 in **M104**, Wednesday 10:40-12:30 in **M104**)

5. **Ferruh Özbudak** (Monday 12:40-13:30 in **M102**, Wednesday 10:40-12:30 in **M102**)

Textbook: *Elements of Modern Algebra*, J. Gilbert, L. Gilbert. Seventh edition. There are several copies available in the reserve section of library.

Course web page: `http://ma116.math.metu.edu.tr`

Grading: There will be two midterms on March 22 and April 26 with weights 30%. The final exam is of weight 40%. The date of the final exam will be announced later. The exam content and locations will be announced from the course web page.

Coordinator: Ömer Küçüksakallı (komer@metu.edu.tr)

NA policy: If you attend less than the %70 percent of the classes and if your two midterm scores add up to less than the %50 percent of the total midterm score then you will not be able to take the final exam and receive

the NA grade. Medical reports less than 5 days will not be collected; the %70 percent attendance is to allow you for all possible minor excuses including illnesses for short terms. If you have a special situation which prevents you from coming to the lectures for a long time, you shall inform the coordinator as soon as possible. If you are not a first year student and if you have a conflicting class, then you may attend the classes in a suitable section. You must inform the coordinator about your conflicting course so that he can change your section.

Make-up policy: Only one make-up examination will be offered. The excuse for not attending an examination must be proved with documents. The make-up examination will take place shortly after the final exam. If you have missed both midterms, your letter grade would be NA. If you've missed one midterm and attended less than %70 of lectures and received a score less than 50 out of 100 from the midterm you've taken then your letter grade would be NA. If you receive NA, then you can not take the final exam and the makeup.

Advice for success in the course: If you are looking for ways to improve your grade then consider the following tips. You shall keep in mind that mathematics courses are cumulative. In each course, you will keep using the concepts that you have previously learned. That's why, it is a very good idea to have a good understanding of the concepts in this course.

- **You must be involved in the learning process.** It is not possible to learn mathematics by just going to class and watching the instructor solving problems. You have to work on exercise problems yourself, even if you are not assigned any. You have to study on a regular schedule, not just the night before exams.

- **You must be involved in the thinking process.** Memorization might be enough to pass a history or a geography course. However, you cannot pass a mathematics course by just memorizing a set of solutions or formulas. You need to understand how to use the ideas yourself.

- **You must be involved in the writing process.** In a multiple choice exam, it may enough to find the correct answer, even though you don't have a valid explanation. In a written exam, you shall express the ideas in your mind on a paper by using mathematical symbols together with meaningful sentences.

Tentative course outline: The last lecture of our course will be on Monday, May 21. In total there will $14 \times 3 = 42$ lectures. In each week, we will attempt to cover the following topics.

Week 1. (Feb 12, Feb 14) Binary operations, matrices (Sec. 1.4, 1.6)

Week 2. (Feb 19, Feb 21) Divisibility, prime factors and GCD (Sec. 2.3, 2.4)

Week 3. (Feb 26, Feb 28) Congruence of integers, classes (Sec. 2.5, 2.6)

Week 4. (Mar 05, Mar 07) Groups (Sec. 3.1, 3.2)

Week 5. (Mar 12, Mar 14) Subgroups, cyclic groups (Sec. 3.3, 3.4)

Week 6. (Mar 19, Mar 21) Isomorphisms, homomorphisms (Sec. 3.5, 3.6)

Midterm 1 – March 22, Thursday

Week 7. (Mar 26, Mar 28) Permutation groups, cosets (Sec. 4.1, 4.4)

Week 8. (Apr 02, Apr 04) Normal subgroups, quotient groups (Sec. 4.5, 4.6)

Week 9. (Apr 09, Apr 11) Rings, subrings, integral domains (Sec. 5.1, 5.2)

Week 10. (Apr 16, Apr 18) Fields, ideals (Sec. 5.2, 6.1)

Week 11. (~~Apr 23~~, Apr 25) Quotient rings, homomorphisms (Sec. 6.1, 6.2)

Midterm 2 – April 26, Thursday

Week 12. (Apr 30, May 02) Real and complex numbers (Sec. 7.1, 7.2)

Week 13. (May 07, May 09) Quaternions, polynomials (Sec. 7.2, 8.1)

Week 14. (May 14, May 16) Divisibility, factorization in $F[x]$ (Sec. 8.2, 8.3)

Week 15. (May 21) Zeros of a polynomial (Sec. 8.4)