

**Department of Mathematics**

**Title of Course: Abstract Algebra**

**Course: MAT 320**

**Semester:**

**Credits: 3**

**Class hours: 3**

**Lab hours (if applicable):**

**Instructor:**

**Tel #:**

**Office:**

**Email:**

**Course Description:** The course covers the standard material comprising sets, mappings, relations, operations, groups, subgroups, factor groups, homomorphisms, Sylow theorems, rings, fields, ideals, factor rings and rings of polynomials. Students will be introduced to the nature of mathematical abstraction and formal proofs. The course is open to all students of the A.S. program in Mathematics who satisfy course prerequisites or by Departmental approval. The syllabus presents the standard content of similar courses and designed to be transferable to four-year institutions.

**Prerequisites/Co-requisites:** Linear Algebra (MAT315) or the equivalent with departmental approval.

**Student Learning Outcomes:**

- 1) Students will be able to identify groups, rings and fields
- 2) Students will be able to prove and apply Lagrange's theorem on the subgroups of a finite group
- 3) Students will be able to use the fundamental homomorphism theorem
- 4) Students will be able to operate in modular arithmetic and apply Little Fermat's theorem.
- 5) Students will be able to perform calculations involving polynomials and elements of different fields

**Required Text:** First Course in Abstract Algebra, Seventh edition; John B. Fraleigh; Addison-Wesley; 2003, ISBN: 0-201-76390-7.

**Other Resources (if applicable):**

**Evaluation & Requirements of Students:** At the beginning of the semester, the instructor will advise the student of the determination of the final grade, which will be based on class work, tests, and the final examination. Students are required to attend all scheduled classes.

<b>Outline of Topics: TOPICS</b>	<b>TEXT PAGES</b>
0. Sets and Relations	1 – 8
<b>Chapter 1: Groups and Subgroups</b>	
1. Introduction and Examples	11 - 18
2. Binary Operations	20 - 25
3. Isomorphic Binary Structures	28 - 33
4. Groups	36 - 45
5. Subgroups	49 - 55
6. Cyclic Groups	59 - 65
7. Generators and Cayley Digraphs	68 - 72
<b>Chapter 2: Permutations, Cosets, and Direct Products</b>	
8. Groups of Permutations	75 - 83
9. Orbits, Cycles, and the Alternating Groups	87 - 93
10. Cosets and the Theorem of Lagrange	96 - 101
11. Direct Products and Finitely Generated Abelian Groups	104 - 110
12. Plane Isometries (optional)	114 – 118
<b>Chapter 3: Homomorphisms and factor groups</b>	
13. Homomorphisms	125 - 133
14. Factor Groups	135 - 141
15. Factor-Group Computations and Simple Groups	144 - 151
16. Group Action on a Set	154 - 159
17. Applications of G-Sets to Counting (optional)	161 - 164
<b>Chapter 4: Rings and Fields</b>	
18. Rings and Fields	167 - 174
19. Integral Domains	177 - 182
20. Fermat's and Euler's Theorems	184 - 189
21. The Field of Quotients of an Integral Domain	190 - 196
22. Rings of Polynomials	198 - 207
23. Factorization of Polynomials over a Field	209 - 218
<b>Chapter 5: Ideals and Factor Rings</b>	
25. Ordered Rings and Fields	227 - 233
26. Homomorphisms and Factor Rings	237 - 243
27. Prime and Maximal Ideals	245 – 262
<b>Chapter 6: Extension Fields</b>	
29. Introduction to Extension Fields	265 - 272
30. Vector Spaces	274 - 280
31. Algebraic Extensions	283 - 291
32. Geometric Constructions (optional)	293 - 318
<b>Chapter 7: Advance group theory</b>	
36. Sylow Theorems	321 - 326

### **College Attendance Policy**

At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade.

### **Academic Adjustments for Students with Disabilities**

Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

### **BMCC Policy on Plagiarism and Academic Integrity Statement**

Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.

Students who are unsure how and when to provide documentation are advised to consult with their instructors. The library has guides designed to help students to appropriately identify a cited work. The full policy can be found on BMCC's web site, [www.bmcc.cuny.edu](http://www.bmcc.cuny.edu). For further information on integrity and behavior, please consult the college bulletin (also available online).