

King Fahd University of Petroleum & Minerals
Department of Mathematics and Statistics
Linear & Abstract Algebra and Number Theory
Math 570; Semester 211
Prof. Jawad Abuhlail (abuhlail@kfupm.edu.sa)

Textbook: Alexey L. Gorodentsev, Algebra I, Springer (2016).

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| MATH 570 Linear & Abstract Algebra and Number Theory (3-0-3) |
| Description: Basis and Linear Independence, Linear Operators and Matrices, Eigenvectors and Eigenvalues, Inner Products, Divisibility, Euclidean Algorithm, Congruence, Definition of Groups, Subgroups, Lagrange Theorem, Euler Phi Function, Euler's Theorem, Cyclic Groups, Groups Isomorphism, Group Homomorphism, Permutation Groups, Finite fields, Quadratic Residues, Reciprocity, Discrete Probability Theory. |

Syllabus

| Topic(s) | Material | Week |
|---|----------------|----------|
| Fields, Rings, and Abelian Groups | 2.1 | 1 |
| The Ring of Integers (Divisibility; Euclidean Algorithm) | 2.2 | |
| Coprime Elements (Euler Phi Function; Euler's Theorem) | 2.3 | 2 |
| Rings of Residues | 2.4 | |
| Direct Products of Commutative Groups and Rings | 2.5 | 3 |
| Homomorphism | 2.6 | |
| Chinese Remainder Theorem | 2.7 | 4 |
| Finite fields (Quadratic Residues and Reciprocity) | 3.6 | |
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| Groups: Definition and First Examples (Revisited) | 12.1 | 5 |
| Cyclic Groups | 12.2 | |
| Groups of Figures (Permutation Groups) | 12.3 | 6 |
| Homomorphisms of Groups (Revisited) | 12.4 | |
| Factorization of Groups (Lagrange's Theorem) | 12.6 | 7 |
| Review and Catchup | | |
| Midterm Exam, Monday October 18th, 201. Material [2.1,12.6] | | 8 |
| Vector Spaces | 6.1 | 9 |
| Basis and Linear Independence | 6.2 | |
| Linear Operators | 6.3 | 10 |
| Vector Subspaces | 6.4 | |
| Matrices | 8.2 | 11 |
| Inner Products (Gram-Schmidt Orthonormalization Process) | 10.1 | 12 |
| Eigenvectors and Eigenvalues | 15.2 | 13 |
| Midterm Break, 28 November 2021 - 2 December 2021 | | |
| Discrete Probability Theory | Handout | 14, 15 |
| Final Exam: TBA | | |

Grading Policy:

| Midterm Exam | Final Exam | Quizzes | Homework | Projects |
|--------------|------------|---------|----------|----------|
| 25% | 35% | 20% | 10% | 10% |