

# King Fahd University of Petroleum & Minerals

## Department of Mathematics and Statistics

### Math 345 – Modern Algebra

#### Jawad Abuhlail

**Description:** Review of basic group theory including Lagrange's Theorem. Normal subgroups, factor groups, homomorphisms, isomorphisms theorems, Fundamental Theorem of finite Abelian Groups. Examples and basic properties, integral domains and fields, ideal and factor rings, homomorphisms. Polynomials, factorization of polynomials over a field, factor rings of polynomials over a field. Irreducible elements and unique factorization, Principal Ideal Domains.

**Textbook:** Contemporary Abstract Algebra by J. A. Gallian, eighth edition (2013)

**Learning Outcomes:** Upon completion of this course, students should be able to *explain, provide examples and prove the basic theorems and results related to:*

- normal subgroups, factor groups, homomorphisms, isomorphisms
- cyclic groups, order of an element
- permutation groups
- internal products of subgroups, external direct products of groups
- Finite Abelian groups
- integral domains and fields
- factor rings and ring homomorphisms
- prime ideals, maximal ideal
- factorization of polynomials over a field, factor rings of polynomials over a field
- irreducible elements and unique factorization
- principal ideal domains

#### Grading Policy:

Exam 1	Exam 2	Assignments	Final Exam
25%	25%	10%	40%

**Attendance:** KFUPM attendance policy will be enforced. A DN grade will be awarded to every student who accumulates 9 unexcused absences.

**Academic Integrity:** All KFUPM policies regarding ethics apply to this course

## Syllabus

Chapter(s)	Title	Week(s)
2	Groups	1
3	Finite Groups; Subgroups	
4	Cyclic Groups	2
5	Permutation Groups	3
6	Isomorphisms	4
7	Cosets and Lagrange's Theorem	5
<b>First Major Exam: Wednesday 21.2.2018, 6:00 – 8:00 PM</b>		
8	External Direct Products	6
9	Normal Subgroups and Factor Groups	7
10	Group Homomorphisms	8
11	Fundamental Theorem of Finite Abelian Groups	9
11	Introduction to Rings	10
12	Integral Domains	11
<b>First Major Exam: Monday 9.4.2018, 6:00 – 8:00 PM</b>		
14	Ideals and Factor Rings	12
15	Ring Homomorphism	
16	Polynomial Rings	13
17	Factorization of Polynomials	14
18	Divisibility in Integral Domains	15
<b>Final Exam (Comprehensive): Tuesday 8.5.2018, 8:00 – 11:00 AM</b>		