



## Hankuk University of Foreign Studies

### 2023 Summer Session

### MATH 430 Introduction to Modern Algebra

### Course Outline

**Course Code:** MATH 430

**Instructor:** Vadim Olshevsky

**Home Institution:** University of Connecticut

**Office Hours:** TBA

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**Credit:** 4

**Class Hours:**

This course will have 52 class hours, including 32 lecture hours, professor 8 office hours, 8-hour TA discussion sessions, 4-hour review sessions.

**Prerequisites:** MATH 200 Linear Algebra and Differential Equations

**Course Description:**

**List of topics:** Modular arithmetic, generalities on rings and ring homomorphisms, Principal Ideal domains, and Euclidean domains focusing on the examples of  $\mathbb{Z}$ ,  $k[x]$ ,  $\mathbb{Z}[i]$ .

**Homework** will be assigned twice a week. Due online on Wednesday and Friday at 23:00. The homework problems will be lifted directly from the textbook. **NO LATE HOMEWORK WILL BE ACCEPTED.** One homework assignment can be dropped.

**Exams:** two exams, a midterm and a final.

**Required Course Materials:**

Thomas Hungerford Abstract Algebra, An Introduction, Third Edition. We will cover chapters 1-6, 10 and 13.



**Grading & Evaluation: (HW+Midterm+Final)/3**

**Grading System (1 ~ 100)**

The final score will be scaled and the scaled score will be used to assign a Course grade.

|               |             |
|---------------|-------------|
| A+ : 96 - 100 | A : 91 - 95 |
| B+ : 86 - 90  | B : 81 - 85 |
| C+ : 76 - 80  | C : 71 - 75 |
| D+ : 66 - 70  | D : 60 - 65 |
| F : 0 - 59    |             |
| Pa : Pass     | Fa : Fail   |

**Course Schedule**

**Week 1.**

- Monday:** The division algorithm. Divisibility
- Tuesday:** Primes and Unique factorization.
- Wednesday:** Congruence. Congruence classes. Modular arithmetic.
- Thursday:** The structure of  $\mathbb{Z}_p$  and  $\mathbb{Z}_n$ .

**Week 2.**

- Monday:** Rings. Definition, examples, basic properties.
- Tuesday:** Isomorphisms and homomorphisms.
- Wednesday:** Polynomial arithmetic and divisibility in  $\mathbb{F}[x]$ . Unique factorization.
- Thursday:** Polynomial functions. Irreducibility in  $\mathbb{Q}[x]$ ,  $\mathbb{R}[x]$ ,  $\mathbb{C}[x]$ .

**Week 3.**

- Monday:** Congruence in  $\mathbb{F}[x]$  and congruence classes.
- Tuesday:** The structure of  $\mathbb{F}[x]/(\mathfrak{p}[x])$  when  $\mathfrak{p}$  is irreducible.



**Wednesday:** Ideals and congruence. Quotients rings. Homomorphisms.

**Thursday:** The Structure of  $\mathbf{R/I}$  When  $\mathbf{I}$  is Prime or Maximal

**Week 4.**

**Monday:** Euclidean domains. Principal ideals domains and factorization.

Factorization of quadratic integers.

**Tuesday:** The Field of Quotients of an Integral Domain. Unique Factorization in Polynomial Domains.

**Wednesday:** Public Key Cryptography

**Thursday:** Chinese Remainder Theorem

