King Fahd University of Petroleum and Minerals

Department of Mathematics and Statistics

Math 427, Number Theory, Term 181

Instructor: Ibrahim Al-Rasasi

Title: Math 427, Number Theory

Credit: 3-0-3

Textbook: An Introduction to the Theory of Numbers, by Niven, Zuckerman, and Montgomery, 5th edition, Wiley & Sons, 1991.

References: You may use any book on elementary/introductory number theory that is available in KFUPM library.

Description: This is a first course in number theory. It will cover the fundamental concepts of number theory and some applications. Main topics covered: Divisibility, Primes, Congruences, Fermat's, Euler's and Wilson's theorem, Pseudoprimes and Carmichael numbers, solution of polynomial congruences, Primitive roots, Quadratic residues and quadratic reciprocity law, Arithmetic functions, Perfect numbers, Pythagorean triangles, Diophantine equations, and Cryptography.

Prerequisite: Math 210 or senior standing.

Learning Outcomes: Upon completion of this course, students should be able to

1. Prove some basic results in number theory
2. Solve questions about divisibility and primes both theoretically and computationally
3. Apply the theorems of Fermat, Euler, and Wilson in computing and/or proving some statements in number theory
4. Solve different types of congruences
5. Use the Chinese Remainder Theorem to solve systems of linear congruences in one variable
6. Find primitive roots modulo primes and prime powers
7. Use Quadratic Reciprocity Law in computing and proving some statements in number theory

8. Work with arithmetic functions both theoretically and computationally
9. Solve and prove questions about Pythagorean triples
10. Solve some types of Diophantine equations
11. Solve some problems on selected applications of number theory.

Grading Policy:

- Exam I: 20% (6^{th} week: Tuesday, 6:00-8:00 pm.)
- Exam II: 20% (12^{th} week: Tuesday, 6:00-8:00 pm.)
- Homework: 15%
- Project: 10%
- Final Exam: 35%

Office Hours:

- Office location: 5-326
- Office phone number: 1268
- Days & Time: UMTWR: 9:00-9:50 am (and by appointment)
- E-mail: irasasi@kfupm.edu.sa
- Resources: Check Blackboard.

Math 427 Syllabus (Term 181)

Week	Date	Sec.	Topics
1	Sep. 2-6, 2018	1.1 1.2	Introduction Divisibility (GCD, LCM)
2	Sep. 9-13	1.3 1.4	Primes (FTA) The Binomial Theorem; Fermat's Factorization Method
3	Sep. 16-20	5.1 2.1	The equation $ax + by = c$ Congruences (properties, complete and reduced residue systems, Fermat's, Euler's and Wilson's Theorems, Pseudoprimes and Carmichael numbers)
Sunday, September 23, 2018: National Day Holiday			
4	Sep. 23-27	2.1 2.2	Continued Solutions of congruences
Saturday, September 29, 2018: a Normal Sunday Class			
5	Sep. 30-Oct. 4	2.3	The Chinese Remainder Theorem
Exam I: Tuesday, Oct. 9, 2018; 6:00- 8:00 pm.			
6	Oct. 7-11		Cryptography (Handout)
7	Oct. 14-18	 2.6	Cryptography Prime Power Moduli
8	Oct. 21-25	2.7	Prime Modulus
9	Oct. 28-Nov. 1	2.8	Primitive Roots and Power Residues
10	Nov. 4-8	3.1	Quadratic Residues
11	Nov. 11-15	3.2 3.3	Quadratic Reciprocity Jacobi Symbol (Optional)
Exam II: Tuesday, Nov. 20, 2018; 6:00- 8:00 pm.			
12	Nov. 18-22	4.1 4.2	Greatest Integer Function Arithmetic Functions and Perfect Numbers
13	Nov. 25-29	4.2 4.3	Continued The Mobius Inversion Formula
14	Dec. 2-6	5.3	Pythagorean Triangles Diophantine Equations (Handout)
15	Dec. 9-13		Diophantine Equations
Final Exam: Saturday, Dec. 15, 2018; 7:00- 10:00 pm.			