Title: Math 455- 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: Divisibility, Primes, Congruences, Fermat's and Wilson's Theorems, Pseudoprimes and Carmichael numbers, Solution of polynomial congruences, Primitive roots, Quadratic residues and quadratic reciprocity, Arithmetic functions, Perfect numbers, Pythagorean triangles, Diophantine equations, Cryptography.

Prerequisite: Math 232 or senior standing.

Learning Outcomes:

Upon the completion of this course, a student 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. demonstrate familiarity with at least one application of Number Theory, such as cryptography.

Grading Policy:

- Exam 1: 20% (6th week)
- Exam 2: 20% (12th week)
- Homework: 20%
- Project: 10%
- Final Exam: 30%

Office Hours:

- Office location: 5-326
- Office Phone Number: 1268
- Time: UTR: 9:00-9:50 & 11:00-11:45 am (or by appointment)
- E-mail: irasasi@kfupm.edu.sa
- Resources: Check Blackboard.

Wishing you all the best,

Ibrahim Al-Rasasi
The Course Instructor

Math 455 Syllabus
2014-2015 (142)

Week	Date	Sec.	Topics
1	Jan. 25-29, 2015	1.1 1.2	Introduction Divisibility (GCD, LCM)
2	Feb. 1- 5	1.3 1.4	Primes (FTA) The Binomial Theorem; Fermat's Factorization Method
3	Feb. 8- 12	5.1 2.1	The equation $ax+by=c$ Congruences (Fermat's and Wilson's Theorems, pseudoprimes and Carmichael #)
4	Feb. 15-19	2.1 2.2	Continued Solutions of Congruences
5	Feb. 22-26	2.3	The Chinese Remainder Theorem; Euler phi function.
6	March 1-5		Cryptography (Handout)
7	March 8-12	 2.6	Cryptography Prime Power Moduli
8	March 15-19	2.7	Prime Modulus
Midterm Break: March 22- 26, 2015			
9	March 29-April 2	2.8	Primitive Roots and Power Residues
10	April 5-9	3.1	Quadratic Residues
11	April 12-16	3.2 3.3	Quadratic Reciprocity The Jacobi Symbol
12	April 19-23	4.1 4.2	Greatest Integer Function Arithmetic Functions and Perfect numbers
13	April 26-30	4.2 4.3	Continued The Mobius Inversion Formula
14	May 3-7	5.3	Pythagorean Triangles Diophantine Equations (Handout)
15	May 10-14		Diophantine Equations
Final Exam: Monday, May 25, 2015 at 8:00 a.m.			

Homework Problems

Section	Questions numbers
1.2	2, 6(a), 11, 15, 23, 26, 32, 50, 53
1.3	3, 10(b), 11, 19, 26(a), 31, 32, 42, 44, 48
1.4	Appended
5.1	Appended
2.1	A: 2, 6, 7, 8, 14, 32, 33
	B: 13, 18, 19, 20, 28, 30, 45, 47
2.2	3, 5(a, d), 8, 9
2.3	A: 3, 7, 8, 14, 18
	B: 12, 25, 31, 32, 35, 36
2.6	3, 6, 10
2.7	1(b), 2, 3, 4, 10, 11
2.8	A: 2, 4(a), 5, 8(b), 9, 12, 13
	B: 17, 18, 21, 22, 23, 24
3.1	7(a, c, e, g), 9, 13, 19, 23
3.2	2, 6, 7, 10, 16(a), 17
3.3	2(a), (a), 6, 7, 16
4.1	2, 3(a), 7, 9, 16, 30
4.2	3, 5, 9, 12, 13, 17, 21
4.3	2, 3, 5, 6, 8, 18
5.3	2, 3, 5, 8, 11

Note: Homework problems on Cryptography and Diophantine equations will be provided with the handouts.