ROWAN UNIVERSITY
Department of Mathematics

Syllabus

Math 01.352 - Theory of Numbers

CATALOG DESCRIPTION:

Math 01.352 Theory of Numbers, 3 s.h.
Prerequisites: Math 01.210 (Linear Algebra) and either Math 03.150 (Discrete Mathematics) or Math 03.160 (Discrete Structures) with a grade of C- or better in all prerequisites

This course includes divisibility properties of the integers, theory of congruence, Diophantine Analysis, congruences of higher degree, quadratic residues and famous problems of number theory.

OBJECTIVES:
It is the objective of this course to provide an introduction to an area of pure mathematics that has had great appeal for the curious minds in the general public as well as for the mathematics community since the early days of civilization. Whenever it is feasible, important results will be presented in company with historic development and related influential work by some of the greatest mathematicians. Some applications will also be discussed.

CONTENT:

1. **Introduction**
   - 1.1 What is Number Theory?
   - 1.2 Brief History of Numerology

2. **Basic Concepts**
   - 2.1 Review of Properties of the Integers
   - 2.2 The Greatest Common Divisor and the Least Common Multiple
   - 2.3 The Division Algorithm
   - 2.4 The Euclidean Algorithm
   - 2.5 Prime Numbers and Prime Factorization
   - 2.6 The Fundamental Theorem of Arithmetic

3. **Linear Diophantine Equations**
   - 3.1 Linear Diophantine Equations in Two Variables
   - 3.2 Linear Diophantine Equations in Several Variables
   - 3.3 Applications

4. **Theory of Congruences**
   - 4.1 Definitions and Basic Properties
   - 4.2 Solving Linear Congruences
   - 4.3 Residue Classes
   - 4.4 System of Linear Congruences and the Chinese Remainder Theorem

4.5 Complete and Reduced Systems of Residues
4.6 The Theorems of Fermat and Euler
4.7 Applications:

- Tests for Divisibility Useful in Arithmetic
- Checks for the basic Operations in Arithmetic
- Public-Key Cryptography

5. Other Topics in Number Theory

5.1 Perfect Numbers
5.2 Pythagorean Triples
5.3 Fermat's Last Theorem
5.4 Pell's Equation
5.5 Continued Fractions

TEXTS:

1. Long, Calvin T., Elementary Introduction to Number Theory, 3rd Ed., Prentice-Hall, Inc., Englewood Cliffs, NJ, 1987.
2. Eynden, Charles V., Elementary Number Theory, Random House Inc., New York, 1987.
3. Ore, Oystien, Number Theory and Its History, Dover Publications Inc., New York, 1988.
4. Andrews, George E., Number Theory, Dover Publications Inc., New York, 1994.

REFERENCES:

1. Niven, Evan, Zuckerman, Herbert S., and Montgomery Hugh L., Introduction to the Theory of Numbers, 5th Ed., John Wiley and Sons Inc., New York, 1991.
2. Hadry, G. H. and Wright E.M., Introduction to the Theory of Numbers, 4th Ed., Oxford University Press, London, 1965.
3. Rosen, Kenneth, Elementary Number Theory, Addison Wesley Publishing Co.,5/E, 2005

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