

Syllabus

Math 01.352 Theory of Numbers

CATALOG DESCRIPTION:

Math 01.352 Theory of Numbers 3 s.h.

(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 present the students an introduction to an area of pure mathematics which has intrigued nonprofessionals as well as the greatest minds of human kind since the dawn of history. A brief history of the development of numbers and some of the influential number theorist will be presented. Some application will also be considered.

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

- 4.7.1 Tests for Divisibility Useful in Arithmetic
- 4.7.2 Checks for the basic Operations in Arithmetic
- 4.7.3 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, The 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