Marshall University

College of Science

Mathematics Department

MTH 455: Number Theory

Course catalog description

A survey of some basic properties of the integers: divisibility (prime numbers, factorization, perfect numbers), congruences (modular arithmetic, linear and quadratic congruences, the Chinese Remainder Theorem), and Diophantine equations.

Credit hours

3 hours

Prerequisites

A grade of C or higher in MTH 300

List of topics

Divisibility

- Divisors
- Well-ordering property.
- G.C.D.s and L.C.Ms
- Euclidean Algorithm (standard and extended™)
- Prime numbers
- Prime Factorization
- Number-Theoretic Functions (Phi, number of divisors, sum of divisors)

Congruences

- Definitions and basic properties
- Linear congruences: existence and finding solutions
- Systems of congruences (Chinese Remainder Theorem)
- Wilson and Fermat's (little) Theorems

- Quadratic Congruences : Euler's criterion , Quadratic Reciprocity
- Order of elements (mod n): primitive roots and indices

Diophantine Equations

- Linear Diophantine equations: existence and production of
- Solutions
- Pythagorean Triples
- Fermat's Last Theorem (for n=4)
- The Two-square and Four-square Theorems
- Pell's Equation

Learner Outcomes

1. Students will learn a sound understanding of the fundamental concepts of number theory, a knowledge of its applications, and an appreciation of its history and links with other branches of mathematics.
2. Students will develop facility in using calculators and computers to solve mathematics problems.

Suggested textbooks

- Burton, David, Elementary Number Theory (7th ed.), McGraw Hill, 2010, ISBN-13: 978-0077349905
- Dudley, Underwood, Elementary Number Theory (2nd ed.), Dover Publications, 2008, ISBN-13 978-0486469317
- Jones, Gareth and Jones, Josephine, Elementary Number Theory, Springer, 1998, ISBN-13: 978-3540761976
- Niven, Ivan, Zuckerman, Herbert and Montgomery, Hugh, An Introduction to the Theory of Numbers (5th ed.), Wiley, 1991, ISBN-13: 978-0471625469
- Strayer, James, Elementary Number Theory, Waveland Press, 2001, ISBN-13: 978-1577662242
- Hardy, G.H. and Wright, Edward, An Introduction to the Theory of Numbers (6th ed) Oxford, 2008, ISBN-13: 978-0199219865

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