

**Course Title:** Number Theory

**Course Code:** MATH-203

**Course Type:** Major Math

**Prerequisites:** N/A

**Credit Hours:** 3 (3 + 0)

**Course Objectives:** After completion of this course, the students will be able to:

- Learn the concepts of divisibility, congruences, the Chinese Remainder Theorem, arithmetic functions.
- Comprehend the hard concepts in number theory with the help of theorems and to write clear and precise proofs.
- Develop and enhance student's interest and knowledge towards algebraic and computational number theory.

**Course Contents:**

**Divisibility and Modular Arithmetic:** Divisibility, Divisibility and Division Algorithms, Well ordering Principle, Bezout's Identity. Modular Arithmetic, Properties, Euclid's algorithm for the greatest common divisor, Extended Euclid's Algorithm, Least Common multiple, Solving Linear Diophantine Equations, Modular Division.

**Primes and Congruences:** Prime Numbers, Prime-power factorization, Fermat and Mersenne primes, Primality testing and factorization, Congruences, Linear congruences, Simultaneous linear congruences, The Chinese Remainder Theorem, Fermat's little theorem, Wilson's theorem and Lagrange Theorem, Congruences with a Prime-Power Modulus, Pseudo primes and Carmichael numbers, Solving congruences modulo prime powers.

**Arithmetic Functions:** Sigma and Tau functions, Euler's Function-Euler's Totient function, Applications of Euler's Totient function, Mobius function and its properties, Mobius inversion formula, Bracket functions.

**Primitive Roots:** The order of an integer mod  $n$ , Primitive roots and their applications in solving higher order congruences.

**Recommended Books:**

1. Adler, A. and Cloury, J. E., *The Theory of Numbers*, Jones & Bartlett Pub, 1st edition, 1995.
2. Burton, D. M., *Elementary Number Theory*, McGraw Hill Company, 6th edition, 2007.
3. Hardy, G. H. and Wright, E. M., *An Introduction to the theory of numbers*, Oxford University Press, 6th edition, 2008.
4. Koblitz, N., *A Course in Number Theory and Cryptography*, Springer, 2nd edition, 1994.

5. Niven, I., Zuckerman, H.S. and Montgomery, H.L., *An Introduction to the theory of Numbers*, John Wiley and Sons, 5th edition, 1991.

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