# 17HS050 NUMBER THEORY

**Course Description and Objectives:**

This course gives emphasis to enhance students' knowledge about the concepts of the niceties and nuances in the world of numbers. And to prepare the students for coding through congruences. Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization. Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues. Formulate and prove conjectures about numeric patterns. Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems. Evaluate trigonometric and inverse trigonometric functions. Solve trigonometric equations and applications and apply and prove trigonometric identities.

**Course Outcomes:**

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes |
|---|---|
| **1** | Demonstrate knowledge and understanding of topics including, but not limited to divisibility, prime numbers, congruences, quadratic reciprocity, Diophantine equations. |
| **2** | Learn methods and techniques used in number theory. |
| **3** | Write programs/functions to compute number theoretic functions. |
| **4** | Use mathematical induction and other types of proof writing techniques and evaluate trigonometric and inverse trigonometric functions. |
| **5** | Solve trigonometric equations and applications and apply and prove trigonometric identities. |

**UNIT-I (12 hours)**

Divisibility – Greatest Common Divisor – Euclidean Algorithm – The Fundamental Theorem of Arithmetic

**UNIT-II (12 hours)**

Congruences – Special Divisibility Tests - Chinese Remainder Theorem- Fermat's Little Theorem – Wilson's Theorem – Residue Classes and Reduced Residue Classes – Solutions of Congruences

**UNIT-III (12 hours)**

Number Theory from an Algebraic Viewpoint – Multiplicative Groups, Rings and Fields

**UNIT-IV (12 hours)**

Quadratic Residues - Quadratic Reciprocity – The Jacobi Symbol

**UNIT-V (12 hours)**

Greatest Integer Function – Arithmetic Functions – The Moebius Inversion Formula

**Reference Books:**


1. Introduction to the Theory of Number by Niven, Zuckerman & Montgomery, John Wiley & Sons
2. Elementary Number Theory, by David, M. Burton 2nd Edition (UBS Publishers).
3. Introduction to Theory of Numbers, by Davenport H., Higher Arithmetic 5th Edition (John Wiley & Sons) Niven, Zuckerman & Montgomery.(Camb, Univ, Press)
4. Number Theory by Hardy & Wright , Oxford Univ, Press.
5. Elements of the Theory of Numbers by Dence, J. B & Dence T.P, Academic Press.