Kotebe University of Education
College of Natural and Computational Sciences

Course Title: Number Theory
Course Code: Math 3091
Credit Hours: 3
Tutorial: 1
Contact Hours: 4
Pre-requisite: Math 2312

Course Description:

This course covers algebraic structure of integers, basic notions of divisibility theory, Diophantine equations, theory of congruence and equations over finite rings, decimal representations of rational numbers, continued fractions, and quadratic extension of rational numbers.

Course objectives:

On completion of the course, successful students will be able to:

- explain basic properties of integers;
- use prime factorization of integers to find the LCM and GCF of two or more integers,
- compute the LCM and GCF of two or more integers with the help of EuclideanAl- gorithm,
- apply different techniques to solve Diophantine Equations,
- understand the basic notions of congruency,
- construct the rings of integers modulo n,
- apply Euler- Fermat Theorem,
- express a rational number as a decimal expansion,
- differentiate the different types of continued fractions.

Course Contents

1. Basic properties of integers
   - 1.1 Algebraic structure of integers
   - 1.2 Order Properties: The relation of the Well Ordering Axiom and Mathematical Induction
   - 1.3 Divisibility of integers
2. Diophantine equations
   - 2.1 Linear equations in one or more variables
   - 2.2 The method of Euler in linear equations
   - 2.3 Some general notions of Diophantine equations
3. Theory of congruence
   - 3.1 The notion of congruence and residue classes
   - 3.2 Operations on congruence classes and basic properties
   - 3.3 Basic facts from group theory in the notion of congruences
   - 3.4 Systems of linear congruences
4. The Euler - Fermat theorem

4.1 The notion of complete system of residues
4.2 Euler quotient function, $\phi(m)$
4.3 Euler-Fermat Theorem
4.4 An introduction to higher order congruence
4.5 Application of the Euler-Fermat Theorem to such congruences

5. Decimal expansion of rational numbers

5.1 The notion of decimal representation
5.2 Types of decimal representations
5.3 Characterizing the rationals using decimal representation

6. Other topics in number theory

6.1 Some examples of set of algebraic integers
6.2 Different completions of rational numbers
6.3 Continued fractions in real numbers

Teaching-Learning Strategy/Methods:

Active learning strategy

- Modified lecture, Inductive and deductive approach, Heuristic approach, and Assignment method.

Assessment Strategy/Methods:

- Assignments: 20%
- Tests: 30%
- Semester Examination: 50%

Course Policy:

A student has to

- Attend at least 85% of the classes
- Take all continuous assessments
- Take final examination
- Respect all rules and regulations of the University

References

[1] David M. Burton, Elementary Number theory, 5th ed., *McGraw-Hill*, 2002.

[2] W. Adams, W. Goldstein, Introduction to Number Theory, *Prentice-Hall*, 1976.

[3] Yismaw Alemu, Introduction to Elementary Theory of Numbers, *Department of Mathematics*, AAU.

[4] L. Hua, Introduction to Number Theory, *Springer-Verlag*, 1982.

[5] O. Ore, An Invitation to Number Theory, *Random House*, 1967.

[6] G. Hardy, H. Wright, and E.M, Introduction To the Theory of Numbers, *The Clarendon Press*, 4th Ed, Oxford, 1965.

[7] Jones & Jones, Elementary Number Theory, *Springer-Verlag*, 1998

[8] K. H. Rosen, Elementary Number Theory and its Applications, *Addison-Wesley*, 1984.

[9] Baker, A Concise Introduction to the Theory of Numbers, *Cambridge University Press*, 1984