Course Title : **Number Theory** Nature of the Course: Theoretical

Course No. : Math Ed. 425 Credit Hours: 3

Level : B Ed (Math Minor) Teaching Hours: 48

Semester : Second

# Course Description

This course deals with the study of the arithmetic properties of numbers. It comprises the basic techniques of arithmetic and high school mathematics in their solution. This course includes Diophantine equations, Golbach’s conjectures, Euler’s and Fermat’s theorem, Quadratic reciprocity, Pythagorean triples, Fibonacci’s numbers and Pell’s equations. Most of the chapters are independent of one another and even mathematical beginners can find it relatively easy to dip and choose at random.

# The General Objectives

The general objectives of this course are as follows:

* To familiarize students with the techniques of inductive methods and mathematical induction.
* To make students capable in proving and applying the divisibility theorem, Euclidean algorithm and Fundamental theorem of arithmetic.
* To make students competent in proving and applying the theory of congruence in establishing different theorems of Fermat, Wilson and little theorem.
* To enhance the skills of applying Euler’s generalization to find quadratic reciprocity.
* To make students competent in applying theorem of perfect number to establish Fermat theorem, Pythagorean triples and Fibonacci number in continued fraction.

# Specific Objectives and Contents

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| **Specific Objectives** | **Content** |
| * Prove the validity of mathematical statements by Induction. * Test Pascal’s rules * Sketch the development of number theory in earlier day. | **Unit 1: Review on preliminaries consideration of number theory (4)**   * 1. Mathematical induction   2. Binomial theorem   3. Early number theory |
| * Compute gcd by Euclidean algorithm. * Solve the Diophantine equation with integral solution. * Prove the fundamental theorem of arithmetic * Verify the Goldbach’s Conjecture. | **Unit II: Divisibility Theory (10)**   * 1. Euclidean algorithm   2. Diophantine equation ax+by=c   3. Fundamental theorem of arithmetic   4. Goldbach’s conjecture |
| * Prove the properties of congruence. * Validate and apply famous conjectures in number theory. * Prove different theorems based on the theory of congruence. | **Unit III: Theory of Congruence and its Application (12)**   * 1. Properties of congruence   2. Linear congruence   3. Fermat’s theorem   4. Littletheorem   5. Wilson’s theorem |
| * Identify the phi-function. * Find the primitive roots of primes. * Prove theorem in quadratic reciprocity. | **Unit IV: Euler’s Generalization and its Application (10)**   * 1. Euler’s phi-function and their properties   2. Primitives roots for primes   3. Quadraticreciprocity |
| * Prove little theorem. * State and prove Fermat’s last theorem. * Use continued fractions to develop arbitrary rational approximation to rational and irrational numbers. | **Unit V: Fermat’s Conjecture and Continued Fraction (10)**   * 1. Fermat numbers and little theorem   2. Pythagorean triples and last theorem   3. Fibonacci number and continued fractions |

# Instructional Techniques

# 4.1 General Instructional Techniques

Traditional way of teaching and learning of mathematics has degraded into area of rote memorization, the outcome of which leads to satisfactory formal ability but does not lead to real understanding or to greater intellectual independence. Most of mathematics can be understood and developed if it is connected to number theory. So, the goal of this course is to put the meaning back into mathematics. Discussion, lectures, project work will be general instructional technique of delivery of course.

# 4.2 Specific Instructional Technique

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| **Unit** | **Specific Activity and Instructional Techniques** |
| I | Experiences will be shared between groups |
| II | The Demonstration method will be used both giving task to students and  showing their task |
| III | Project assignment on some theorems |
| IV | Group discussion with sharing |
| V | Guided Discussion |

# Evaluation

# Internal Evaluation 40%

Internal evaluation will be conducted by the subject teacher based on the following aspects:

* Attendance 5 points
* Participation in learning activities 5 points
* First assignment 10 points
* Second assignment/assignment 10 points
* Third assignment/assignment 10 points

Total 40 points

# External Evaluation (Final Examination) 60%

Examination Division, Dean’s office will conduct final examination at the end of the semester.The types of questions and point allocated for each category of questions are given below:

* Objective Type Question (Multiple Choice ) 10 points
* Short Answer Question (6 Question 5 points ) 30 points
* Long AnswerQuestion (2 Question 10 points ) 20 points

Total 60 points

* 1. **Recommended Book and references**

**Recommended Book**

Courant, R.; & Robbins, H. (). *What is mathematics? An elementary approach to ideas and methods.* USA: Oxford University Press.

Burton, D. M. (2002). *Elementary number theory (2nd edition).* New Delhi: Universal Book Stall.

# Reference Books

Koshy, T. (2012). *Elementary number theory with application*. New Delhi: Academic Press.