Version No:
Approval Date:

Number Theory and Matrices

Programme(s) in which it is offered: B.Sc.B.Ed. Mathematics

Course Category: Core	**Schedule of Offering**: Odd
Course Credit Structure: 4	**Course Code:** EG413
Total Number of Hours: 5	**Contact Hours Per Week:** 5
Lecture: 3, 3	**Tutorial:** 1, 2
Practical: 0, 0	**Medium of Instruction:** English
Date of Revision:	**Skill Focus:** Others
Short Name of the Course: Number Theory & Matrices	**Course Stream**
Grading Method: Regular	**Repeatable:** Credit
Course Level: Beginner	

Course Description

This course is a core course for B.Sc.B.Ed. Mathematics students. This course is an elementary course in number theory, a branch of mathematics that studies integers and their properties. The course also discusses fundamentals of matrix algebra that lay foundation to courses in abstract and linear algebra to be studied in the later semesters in the programme.

Course Introduction

'Integer' is the most fundamental concept in mathematics. The study of integers and their properties form the core of a branch of mathematics called 'Number Theory'. This course is an introduction to elementary number theory. The course also introduces the learners to tools and techniques of matrix algebra that prepare them to a course of linear algebra taken in higher semesters.

Course Objective

The objectives of the course are:

1. To familiarize the students with the concepts and techniques of Elementary number theory
2. To inculcate the skills of problem-solving among the students through a few classic problems in number theory.

3. To familiarize the students with the concepts and techniques of matrix algebra
4. To equip the students with the skills of applying the algebra of matrices in solving problems.

Course Outcome

At the end of the course students will be able to

1. State and prove basic theorems on integers
2. Apply appropriate results in solving problems in elementary number theory
3. Describe various operations on matrices and their properties
4. Apply properties of determinants in evaluating them
5. Apply the algebra of matrices in solving system of linear equations

PO-CO Mapping

<This should explain how the Course Outcomes (CO) are mapped with the Programme Outcomes (PO). All programmes to have two generic POs which can map to all minors/proficiency courses and foundation/self-immersion courses. Please tick the respective cells only; leave the other cells blank.>

PO-CO Mapping Matrix

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

Prerequisites and other constraints

This course is offered to all students of B.Sc.B.Ed. Mathematics. There is no prerequisite course.

Pedagogy

The teaching-learning of the course is organized through lectures, problem-solving sessions and student presentations.

Suggested Reading:

1. Burton, D. M. (2017). Elementary Number Theory. McGraw Hill Education.

2. Niven, Zuckerman and Montgomery (2008). An introduction to the theory of numbers. Wiley.
3. Apostol, T. M. (1998). Introduction to Analytic Number Theory. Narosa.
4. Barnard and Child (2016). Higher Algebra. Arihant Publications.
5. Pillay, Natarajan and Ganapathy (2009). Algebra Volume 1. Viswanathan, S., Printers & Publishers Pvt Ltd.
6. Ayres (2003). Matrices. Schaum's Outlines series.

Evaluation Pattern

Evaluation Matrix

	Component Type	Weightage Percentage	Total Marks	Tentative Dates	Course Outcome Mapping
Continuous Internal Assessment (CIA) Components*	Mid-semester exam	50% of CIA	30	Around 9th week	1, 2
	Assignment	25% of CIA	15	End of each module	1, 2, 3, 4, 5
	Quizzes	17% of CIA	10	Every two weeks	1, 2, 3, 4, 5
	Presentations	8% of CIA	5	End of two modules	1, 2, 3, 4, 5
	CIA Marks	**100% of CIA**	**60**		
ESE		40%	**80**	End of the semester	1, 2, 3, 4, 5

Module Sessions

Module I: Theory of Numbers I **(20 Hours)**

Division Algorithm; Divisibility; Prime and Composite Numbers; fundamental theorem of Arithmetic; proving the existence and uniqueness of GCD and the Euclidean Algorithm; the least common multiple; congruences; linear congruences; Simultaneous congruences; Wilson's theorem; Fermat's little theorem and Euler's theorem.

Reading:

a) Burton. 2017.

b) Apostol. 1998.

Activities:

a) Quiz
b) Assignment

Module II: Theory of Numbers II (20 Hours)

Primitive roots, quadratic residues and the law of quadratic reciprocity; Arithmetical functions; the Mobius function, the Euler's function and sigma function; the Dirichlet product of arithmetical functions, multiplicative functions; perfect numbers; The series of Fibonacci and Lucas.

Reading:

a) Burton. 2017.
b) Apostol. 1998.
c) Niven. 2008.

Activities:

a) Quiz
b) Assignment
c) Individual Presentation

Module III: Matrices I (15 Hours)

Matrices of order m x n; Algebra of matrices; Symmetric and Skew symmetric, Hermitian and Skew Hermitian matrices and their standard properties; Determinants; Adjoint of a square matrix, Singular and non-singular matrices, Rank of a matrix, Elementary row / column operations. In-variance of rank under elementary operations, Inverse of a non-singular matrix by elementary operations.

Reading:

a) Ayres. 2003.
b) Bernard. 2016.
c) Pillay. 2009.

Activities:

a) Quiz
b) Assignment

Module IV: Matrices II (20 Hours)

System of m-linear equations in n-unknowns, Matrices associated with linear equations, Trivial and non-trivial solutions, Criterion for existence of non-trivial solution of homogeneous and non-homogeneous systems and their uniqueness. Characteristic equation of a square matrix, Eigen values and Eigen vectors, finding them for a real symmetric matrix, Diagonalization of a real symmetric matrix, Cayley – Hamilton theorem and its applications.

Reading:

a) Ayres. 2003.
b) Bernard. 2016.
c) Pillay. 2009.

Activity:

a) Quiz
b) Assignment
c) Individual Presentation