

## Abstract Algebra II

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

<b>Course Category:</b> Core	<b>Schedule of Offering:</b> Odd
<b>Course Credit Structure:</b> 4	<b>Course Code:</b> MTH2112
<b>Total Number of Hours:</b> 5	<b>Contact Hours Per Week:</b> 5
<b>Lecture:</b> 3, 3	<b>Tutorial:</b> 1, 2
<b>Practical:</b> 0, 0	<b>Medium of Instruction:</b> English
<b>Date of Revision:</b>	<b>Skill Focus:</b> Other
<b>Short Name of the Course:</b> Abstract Algebra II	<b>Course Stream</b>
<b>Grading Method:</b> Regular	<b>Repeatable:</b> Credit
<b>Course Level:</b> Intermediate	

#### Course Description

This course is a core course for B.Sc. B.Ed. Mathematics students. This course discusses the theory of rings and fields.

#### Course Introduction

This course is an introductory course in ring theory – study of algebraic structure called rings. The course discusses fundamentals of rings, its types, their homomorphisms and their applications. The course exposes the students to the tools of modern abstract algebra, and provides essential foundation for other advanced algebra related courses.

#### Course Objective

The objectives of the course are:

1. To discuss the fundamental concepts of ring theory
2. To study integral domains and their properties
3. To discuss ring homomorphisms, their properties and applications
4. To study polynomial rings, irreducibility of polynomials and their applications

#### Course Outcome

At the end of the course students will be able to

1. List various examples of rings and their properties
2. Apply the properties of ideals in solving problems
3. Prove and apply the properties of ring homomorphisms
4. Apply various criteria of irreducibility to determine irreducibility of polynomials
5. Analyse ring theory as generalisation of elementary number theory
6. Appreciate the theory and applications of rings

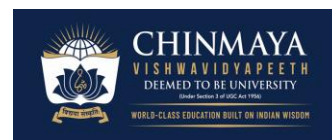
#### PO-CO Mapping

**PO-CO Mapping Matrix**

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓							
CO2		✓						
CO3		✓						
CO4		✓	✓					

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Approval Date:



CO5		✓						
CO6								

### 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. Herstein (2006). Topics in Algebra. Wiley.
2. Artin (1994). Algebra. Prentice Hall of India. New Delhi.
3. Fraleigh (2013). First course in Algebra, Seventh Edition. Pearson Education India
4. Gallian (2008). Contemporary abstract algebra. Narosa.
5. Bhattacharya, Jain and Nagpaul (1994). Basic Abstract Algebra. Cambridge University Press.
6. Santhanam (2017). Algebra. Alpha Science International Ltd.
7. Dummit and Foote (2011). Abstract Algebra. Wiley.

### Evaluation Pattern

#### Evaluation Matrix

	Component Type	Weightage Percentage	Total Marks	Tentative Dates	Course Outcome Mapping
<b>Continuous Internal Assessment (CIA) Components*</b>	Mid-semester exam	50% of CIA	15	Around 9 <sup>th</sup> week	1, 2
	Assignment	25% of CIA	7.5	End of each module	1, 2, 3, 4, 5, 6
	Quizzes/Problem Solving	17% of CIA	5	Every two weeks	1, 2, 3, 4, 5
	Presentations	8% of CIA	2.5	End of two modules	1, 2, 3, 4, 5, 6
	CIA Marks	100% of CIA (to be converted into 30)	30		
	<b>ESE</b>		70%	70	End of the semester

### Module Sessions

#### Module 1: Introduction to Rings

(20 Hours)

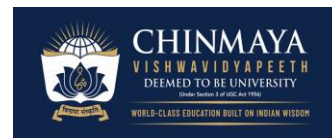
Rings, Integral Domains, Division Rings, Fields, Skew-fields - Examples. Subrings. Characteristic of a ring; Ideals, Maximal Ideals, Prime Ideals, Principal Ideals and Quotient Rings.

#### Reading:

1. Gallian
2. Herstein
3. Fraleigh

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Approval Date:



**Activities:**

- a. Quiz
- b. Assignment

**Module 2: Divisibility in Integral Domains (18 Hours)**

Principal Ideal Domain, Divisibility in an Integral domain, Prime elements and irreducible elements; Units and Associates. Euclidean Domain and Unique Factorization Domain.

**Reading:**

1. Gallian
2. Fraleigh

**Activities:**

- a. Quiz
- b. Assignment
- c. Presentation

**Module 3: Ring Homomorphisms (17 Hours)**

Homomorphism of a ring, Kernel of a ring homomorphism, Fundamental theorem of homomorphism and consequences. Correspondence theorem and consequences. Field of quotients, embedding of an integral domain.

**Reading:**

1. Gallian
2. Herstein
3. Artin

**Activities:**

- a. Quiz
- b. Assignment

**Module 4: Polynomial Rings (20 Hours)**

Polynomial rings, Divisibility, Irreducible polynomials, Division Algorithm, Greatest Common Divisor, Euclidean Algorithm.  $\mathbb{Z}[x]$  as a UFD, Polynomial rings over UFD (Statement only), Criteria for irreducibility, and Eisenstein criterion.

**Reading:**

1. Gallian
2. Fraleigh
3. Herstein

**Activities:**

- a. Quiz
- b. Assignment
- c. Presentation