

Lecture Plan		
Name of the College: Government College of Arts, Science and Commerce, Sanquelim-Goa		
Name of Faculty: Aaron Philip Alphonso	Subject: Mathematics	
Paper code: MAT-5002 Ring Theory	Program: M.Sc. Mathematics	Division: -
Academic year: 2026-27	Semester: I	Total Lectures: 60
Course Objectives: 1. To introduce the foundational concepts of Ring Theory, including the definitions and properties of rings, integral domains, homomorphisms, and ideals, to build a strong conceptual framework. 2. To develop the learner's ability to understand and articulate standard proofs and logical arguments concerning the structural properties of rings, polynomials, factor rings, and ideals. 3. To provide learners with the skills to select and apply appropriate algebraic techniques for solving computation-based problems involving ring operations, polynomial factorization, and ideal-related structures. 4. To foster analytical thinking and mathematical reasoning by engaging learners in solving unfamiliar problems in Ring Theory and formulating precise, logically sound justifications for their solutions.		
Expected Course Outcome: 1) Display familiarity and knowledge of basic definitions, structures, and theorems in Ring Theory, including rings, integral domains, homomorphisms, and ideals. 2) Demonstrate and explain standard proofs and logical arguments related to properties of rings, polynomials, factor rings, and ideals. 3) Choose appropriate methods and procedures to solve computation-based problems involving ring operations, polynomial factorization, and ideal structures. 4) Analyze and solve novel problems using the concepts of Ring Theory, and construct mathematically sound arguments to support their solutions. 5) Prove various results in Riemann integration. 6) Analyze and compare various number theoretic functions.		

7) Examine the convergence of improper integrals.							
Student Learning Outcome: Student will be able to 1) Have a skill of proving theorems specifically in Ring Theory, including results on integral domains, polynomial rings, ideals, and factorization. 2) Apply the theory of rings, ideals, and factorization to solve computation-based problems. 3) Apply the theory of Riemann integration in evaluating integrals.							
Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June	22/06/2026	27/06/2026	4	Discussion of prerequisites (groups and basic algebraic structures); Rings – definition, examples and basic properties		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	29/06/2026	04/07/2026	4	Ring Homomorphisms and Isomorphisms; Division Rings and Skew Fields		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	06/07/2026	11/07/2026	4	Integral Domains; standard theorems on Integral Domains		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
July	13/07/2026	18/07/2026	4	Characteristic of a Ring; Fermat's and Euler's Theorems		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	20/07/2026	25/07/2026	4	Application to solution of linear congruences; Field of Quotients of an Integral Domain; Uniqueness of the field of quotients		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.

Jul/Aug	27/07/2026	01/08/2026	4	Polynomials; the polynomial ring $R[x]$; the Evaluation Homomorphism; Zero of a Polynomial		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
August	03/08/2026	08/08/2026	4	Factorization of Polynomials over Fields; the Division Algorithm; Factor Theorem		Smart Board PDF	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	10/08/2026	15/08/2026	4	Irreducible Polynomials; Eisenstein's Criterion and consequences		Smart Board	Joseph A. Gallian, Contemporary Abstract Algebra, 8th Ed.
	17/08/2026	22/08/2026	4	Ring Homomorphisms revisited; Properties of Homomorphisms		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	24/08/2026	29/08/2026	4	Quotient Rings; Ideals		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
August/Sep t	31/08/2026	05/09/2026	4	Fundamental Homomorphism Theorem; Prime and Maximal Ideals; Prime Fields		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
Sep	07/09/2026	12/09/2026	4	Division in Rings; Unique Factorization Domains and Principal Ideal Domains		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	14/09/2026	19/09/2026	0	Ganesh Chaturthi Break (14–19 Sep)			
	21/09/2026	26/09/2026	4	Every PID is a UFD, and consequence to $F[x]$ and integers		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
Sep/Oct	28/09/2026	03/10/2026	3	If D is a UFD then $D[x]$ is a UFD; Euclidean Domains		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.

Oct	05/10/2026	10/10/2026	4	Every Euclidean Domain is a PID; Arithmetic in Euclidean Domains		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.
	12/10/2026	14/10/2026	1	Gaussian Integers; Fermat's $p = a^2 + b^2$ theorem		Smart Board	John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed.

*** Assessment Rubrics**

Component	Max Marks
ISA 1	15
Mid Point Exam	30
ISA 2	15
Practical	Nil
Project	Nil
Semester End Exam	40