

**PROGRAMME NAME: B.Sc.(H) Mathematics**

**COURSE NAME: Ring Theory & Linear Algebra-I**

**SEMESTER DURATION: January to May**

<b>Week</b>	<b>Topic(s)</b>	<b>Teaching Methodology Adopted/ Continuous Internal Evaluation</b>
1.	Definition and examples of rings, Properties of rings, Subrings.	Presentations
2.	Integral domains and fields, Characteristic of a ring.	Lectures/Discussions
3.	Ideals, Ideal generated by a subset of a ring, Factor rings.	Lectures
4.	Operations on ideals, Prime and maximal ideals.	Presentations/lectures
5.	Ring homomorphisms, Properties of ring homomorphisms.	Case Study/Practicals
6.	First, Second and Third Isomorphism theorems for rings, The Field of quotients.	Practicals
7.	Vector spaces, subspaces, Algebra of subspaces.	Lectures
8.	Linear combination of vectors, Linear span, Linear independence.	Demonstration/Lectures

9.	Bases and dimension.	Lectures
10.	Dimension of subspaces.	Practicals
11.	Linear transformations, Null space, Range, Rank and nullity of a linear transformation.	Practicals
12.	Matrix representation of a linear transformation	Case study/Lectures
13.	Algebra of linear transformations.	Assignments
14.	Isomorphisms, Isomorphism theorems, Invertibility and the change of coordinate matrix.	Assignments

**Course Objectives:** The objective of this course is to introduce the fundamental theory of two objects, namely - rings and vector spaces, and their corresponding homomorphisms.

**Course Learning Outcomes:** The course will enable the students to learn about:

- i) The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding morphisms.
- ii) The concept of linear independence of vectors over a field, the idea of a finite dimensional vector space, basis of a vector space and the dimension of a vector space.

- iii) Basic concepts of linear transformations, the Rank-Nullity Theorem, matrix of a linear transformation, algebra of transformations and the change of basis