MTS 560	4	2	6	4	3	70	30	100
MTS 561	4	2	6	4	3	70	30	100
MTS 562	4	2	6	4	3	70	30	100
MTS 563	4	2	6	4	3	70	30	100
MTS 564	4	2	6	4	3	70	30	100

PSS: There shall be 2 hours of problem solving sessions (PSS) per week for each course having 4 credits and 1 hour problem solving session for an open elective. PSS are to be considered as teaching hours and in the PSS students are required to solve the problems in presence of the course instructor.

Scheme of Evaluation for Internal Assessment Marks:

1. Theory Course:
   Each Theory Course shall carry 30 marks for internal assessment based on two tests of 90 minutes duration each.
2. Project Work:
   Project Work shall carry 30 marks for internal assessment based on two presentations by the student before a panel of faculty members of the department.
3. Practical:
   Each Practical shall carry 15 marks for internal assessment based on two tests of 90 minutes duration each.

Pattern of Semester Examination:

1. Theory Paper:
   Each question paper for the theory course shall contain EIGHT questions out of which FIVE are to be answered. All questions carry equal marks.
2. Project Report:
   The evaluation of a project report is by two examiners as per the regulations.
3. Practical Exam:
   Each Practical exam question paper shall contain TWO questions on lab programmes which are to be executed.

C. Syllabi of Each Semester

I Semester

MTH 401	Algebra- I	4 Credits (48 hours)

Course Objectives

1. **Develop a strong foundation in group theory:** Understand the fundamental concepts of groups, subgroups, cyclic groups, homomorphisms, isomorphisms, etc. Explore their applications in various mathematical contexts.
2. **Analyze symmetries and isometries:** Study the symmetries of plane figures and the properties of isometries to understand their mathematical significance.
3. **Explore advanced group theory concepts:** Delve into the class equation, *p*-groups, conjugation in symmetric groups, and the Sylow theorems. Learn their applications in different areas of mathematics.

4. **Understand the fundamentals of ring theory:** Grasp the basic definitions and properties of rings, polynomial rings, integral domains, fields, homomorphisms, ideals.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Understand and apply the laws of composition, recognize various types of groups (such as cyclic groups), and classify subgroups of given groups.
2. Demonstrate proficiency in understanding and using homomorphisms and isomorphisms, including the Correspondence Theorem to solve problems involving cosets and quotient groups.
3. Understand the concepts of isometries, finite groups of orthogonal operators, and apply these ideas to various mathematical problems.
4. Use group operations, Cayley's theorem, the class equation, and the Sylow theorems to analyze finite subgroups and conjugation in symmetric groups, and solve advanced problems in group theory.
5. Comprehend the definitions and properties of rings, polynomial rings, integral domains, fields, and their homomorphisms and ideals. Apply these concepts to solve problems involving quotient rings, adjoining elements, product rings, and maximal ideals.

Contents

Unit I – Groups (12 Hours)

Laws of Composition, Groups and Subgroups, Subgroups of the Additive Group of Integers, Cyclic groups, Homomorphisms, Isomorphisms, Equivalance Relation and Partitions, Cosets and Lagrange's Theorem, Modular Arithmetic, The Correspondence Theorem, Product Groups, Quotient Groups.

Unit II - Isometries and Operations on Groups (12 Hours)

Symmetry: Symmetry of plane figures, Isometries, Isometries of the plane, Finite groups of orthogonal operators on the plane.
Abstract Symmetry: Group Operations, The operation on Cosets, The counting Formula, Operations on subsets, Permutation Representations.

Unit III - Advanced Group Theory (12 Hours)

Finite subgroups of the Rotation Group, Cayley's theorem, The class equation, p-Groups, Conjugation in the symmetric group, Normalizers, The Sylow theorems and its Applications.

Unit IV – Ring Theory (12 Hours)

Definitions of rings, Polynomial Rings, integral domains, Fields and their basic properties, Homomorphisms and Ideals, Quotient Rings, Adjoining elements, Product rings, Fractions, Maximal Ideals.

References

[1] Michael Artin, *Algebra*, 2nd Ed., Prentice Hall of India, 2013.

[2] J. B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Addison Wesley, 2003.