| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DE | **NMCD524** | Representation Theory of Finite Groups | 3 | 0 | 0 | 3 |

**Prerequisite**

● Group Theory and Linear Algebra

**Course Objective**

- To represent abstract algebraic objects like groups as subobjects of matrix groups and study linear representations of finite groups.
- To classify all the irreducible representations of a finite group, up to isomorphism.

**Learning Outcomes**

- Representation theory is used in many parts of mathematics, as well as in quantum physics. After the course the students will be able to understand that.
- The students will be able to use tools from linear algebra to solve abstract algebraic problems.

| Unit No. | Topics to be Covered | Contact Hours | Learning Outcome |
|---|---|---|---|
| 1 | Revision of basic group theory, Representations, Subrepresentations, Sum and tensor product of representations, Symmetric and Alternating Squares representations, Irreducible representations | 9 | This unit will help students to represent abstract algebraic objects like groups as subobjects of matrix groups and learn their properties. |
| 2 | Characters, Schur's lemma, Maschke's theorem, Orthogonality relations, Decomposition of regular representation, Number of irreducible representations, canonical decomposition and explicit decompositions. | 10 | Students will learn the basic idea of characters and irreducible representations |
| 3 | Representation of subgroups and Product groups, Induced representations. Examples of Representations for Cyclic groups, dihedral group, alternating and symmetric groups | 11 | This unit will help students to understand the representation of subgroups and product groups and to classify all representations of cyclic and symmetric groups. |
| 4 | Integrality properties of characters, Burnside's $p^a q^b$ theorem. The character of induced representation, Frobenius Reciprocity Theorem, Restriction to subgroups, Meckey's irreducibility criterion, Examples of induced representations, Representations of supersolvable groups. | 12 | Students will be able undertand irreducibility criterion and different applications of representation theory. |
| | **Total** | 42 | |

**Text Books:**

1. J. P. Serre, Linear Representation of Finite Groups, Springer-Verlag, 1977.

**Reference Books:**

1. M. Burrow, Representation Theory of Finite Groups, Dover Publications, 2011.
2. N. Jacobson, Basic Algebra 2nd Edition, Dover Publications, 2009.
3. S. Lang, Algebra, 3rd Edition, Springer, 2005.