



GROUP THEORY METHODS IN PHYSICS

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PRE-REQUISITES : Linear Algebra, Quantum Mechanics, Special Theory of Relativity

INTENDED AUDIENCE : Students with background in Physics

INDUSTRIES APPLICABLE TO : This tool may be applicable at R&D department of industries

COURSE OUTLINE :

This group theory course is pitched at beginners at UG/PG level so that the students can appreciate the wide applications of the group theory tools in other areas of physics.

ABOUT INSTRUCTOR :

Prof. Ramadevi's research is in Mathematical Physics. She has been working on knot invariants from Chern-Simons theory and topological strings.

COURSE PLAN :

Week 1: Introduction to discrete groups, subgroups and generators, conjugacy classes

Week 2: Symmetric groups, permutation group, cycle notation

Week 3: Direct product groups, semi-direct product groups

Week 4: Symmetries of molecules, point groups and Stereographic projection

Week 5: Matrix representation of groups, Reducible and irreducible representation

Week 6: Great Orthogonality Theorem and Character tables, Mulliken notation

Week 7: Tensor product, projection operator, observables, selection rules, Molecular vibrations

Week 8: Continuous groups, generators, Lorentz transformations

Week 9: Orthogonal groups and Lie algebra

Week 10: Unitary groups, $SU(2)$, $SU(3)$, weight vector diagrams and root vector diagrams

Week 11: Wigner Eckart Theorem, Examples

Week 12: Quark model, $SU(3)$ baryons, mesons, Wigner-Eckart theorem, hydrogen atom, dynamical symmetry