

Mathematical Methods of Physics II  
Graduate School – Second Semester  
**Course Outline**

## **Group Theory**

1. Basic Concepts of Group Theory
  - Finite groups
  - Representations and reducibility
2. Lie Groups
  - Manifold structure, integration
  - Lie algebras
  - Global properties; relationship between groups and algebras
  - Fundamental and adjoint representations
  - $SU(2)$  and its representations
3. Structure of Lie Algebras
  - Roots and weights
  - Dynkin diagrams
  - Classical groups:  $SO(n)$ ,  $SU(n)$ ,  $Sp(n)$ , Exceptional groups
4. Representations
  - Tensor methods
  - Clebsch-Gordan decomposition
  - Young tableaux
5. Noncompact Groups
  - Real and complex forms
  - Lorentz group: global structure, discrete subgroups, representations, fermions
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## **Path Integral Methods**

- Defining sums over paths
- Relation to standard formalism
- Phase space path integrals
- Evaluating gaussian integrals

## **BOOKS:-**

1. Georgi, Lie Algebras in Particle Physics
2. Cornwell, Group Theory in Physics: An Introduction
3. Gilmore, Lie Groups, Lie Algebras, and Some of Their Applications
4. Feynman and Hibbs: Quantum Mechanics and Path Integrals