Course Syllabus - Introduction to Lie Groups

Course Number:  Special topic.
Course Title:  Introduction to Lie Groups
Credit Hours:  3
Prerequisites: A good comprehension of linear algebra, calculus, and abstract algebra.
Objectives: To give an introductory course on the theory of Lie groups.

Course Content: (totally 38 hours)

(1) The exponential map
   ● vector fields, one-parameter groups [1 hour]
   ● Ad, ad, and d exp [2 hours]
   ● the Campbell-Baker-Hausdorff series [2 hours]

(2) Lie theory
   ● linear groups: definitions and examples [4 hours]
   ● the Lie algebra of a linear group [3 hours]
   ● coordinates on a linear group [1 hour]
   ● connectedness [1 hour]
   ● the Lie correspondence [2 hours]
   ● homomorphisms and coverings of linear groups [3 hours]
   ● closed subgroups [1 hour]

(3) The classical groups
   ● the classical groups: definitions, connectedness [4 hours]
   ● Cartan subgroups [3 hours]
   ● roots, weights, reflections [2 hours]
   ● fundamental groups of the classical groups [self-reading]

(4) Manifolds, homogeneous spaces, Lie groups
   ● manifolds [3 hours]
   ● homogeneous spaces [2 hours]
   ● Lie groups [4 hours]

(5) Integration on manifolds [optional]

(6) Representations: definitions and examples [optional]


References: (listed from introductory to advanced)


Evaluation Procedures: Homeworks, projects and tests are given at the instructor’s discretion. Students are expected to prove rigorous theorems and to compute concrete examples.

Grade Calculation: Homeworks 70%, Tests 30%. There may be variations in these procedures depending on the individual instructors.