ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (Hons.) Physics						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
VI	32227625	Advanced Mathematical Physics-II	5	1	0	6
Teacher/Instructor(s)		Dr. Abid Hussain				
Session		2021-22				

Course Objective:

The course is intended to develop new mathematical tools in terms of Calculus of Variation, Group Theory and Theory of Probability in the repertoire of the students to apply in Theoretical and Experimental Physics.

Course Learning Outcomes:

- To understand variational principle and its applications: Geodesics in two and three dimensions, Euler Lagrange Equation and simple problems in one and two dimensions.
- Acquire basic concept of Hamiltonian, Hamilton's principle and Hamiltonian equation of motion, Poisson and Lagrange brackets.
- Learn elementary group theory: definition and properties of groups, subgroups, Homomorphism, isomorphism, normal and conjugate groups, representation of groups, Reducible and Irreducible groups.
- Learn the theory of probability: Random variables and probability distributions, Expectation values and variance.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Variable Calculus	25	Variational Principle, Euler's Equation and its Application to Simple Problems. Geodesics. Calculus of Variations. Concept of Lagrangian: Generalized co-ordinates. Definition of canonical moment, Euler-Lagrange's Equations of Motion and its Applications to Simple Problems (e.g., Simple Pendulum and One dimensional harmonic oscillator). Definition of Canonical Momenta. Canonical Pair of Variables. Definition of Generalized Force: Definition of Hamiltonian (Legendre Transformation). Hamilton's Principle. Poisson Brackets and their properties. Lagrange Brackets and their properties.
2.	Group Theory	25	Review of sets, Mapping and Binary Operations, Relation, Types of Relations. Groups: Elementary properties of groups, uniqueness of solution, Subgroup, Centre of a group, Co-sets of a subgroup, cyclic group, Permutation/Transformation. Homomorphism and Isomorphism of group. Normal and conjugate subgroups, Completeness and Kernel. Some special groups : SO(2), SO(3), SU(2), SU(3).
3.	Advanced Probability Theory	25	Fundamental Probability Theorems. Conditional Probability, Bayes' Theorem, Repeated Trials, Binomial and Multinomial expansions. Random Variables and probability distributions, Expectation and Variance, Special Probability distributions: The binomial distribution, The poisson distribution, Continuous distribution: The Gaussian (or normal) distribution, The principle of least squares.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Class Test		
	• Assignment		
	• Attendance		
2.	End Semester Examination	3 h	75

Details of the Course		
Unit	**Contents**	**Contact Hours**
1	Variable Calculus	25
2.	Group Theory	25
3.	Advanced Probability Theory	25
	Total	**75**
Suggested Books:		
Sl. No.	**Name of Authors/Books/Publishers**	
1	Mathematical Methods for Physicists: Weber and Arfken, 2005, Academic Press.	
2	Elements of Group Theory for Physicists by A. W. Joshi, 1997, John Wiley.	
3	Introduction to Mathematical Probability, J. V. Uspensky, 1937, Mc Graw-Hill.	
Mode of Evaluation:	Internal Assessment / End Semester Exam	