Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021-2022
Course Handout Part II

Date: 20-08-21

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.   : *PHY F422*
Course Title   : Group Theory and Applications
Instructor-in-Charge : Rahul Nigam

Scope and Objective of the Course: Group theory is an important tool which allows a better understanding of concepts across many areas of Physics including particle physics, string theory, atomic, molecular and nuclear physics. The objective of the course is to introduce students to the two essential branches of group theory – Discrete groups and Lie groups and their applications.

Textbooks:
1. Elements of Group Theory for Physicists by A W Joshi (AWJ)
2. Lie Groups, Physics and Geometry by Robert Gilmore (RG)

Reference books
1. A course on Group Theory by John S. Rose

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-6	Introduction to Symmetries and Abstract Group Theory	Definition of Groups, Connection between Symmetries and groups, Subgroups, Cosets, Isomorphism and Homomorphism, Classes	AWJ 1
7-12	Hilbert spaces and operators	Vector spaces and Hilbert spaces, operators, Group action on vector spaces	AWJ 2
13-19	Discrete groups	Permutation groups, Multiplication table, Schur's lemma, Reducible and Irreducible Representations	AWJ 3
20-29	Continuous groups and their representations	Topological and Lie groups, SO(2), SO(3), Lorentz group, Lie algebra and representation, Unitary representation	AWJ 4
30-34	To understand Root spaces and Dynkin diagrams	Properties of roots, Root space diagrams, Dynkin diagrams	RG 10
35 – 43	Learning the applications of Group	Application in Molecular and crystal structure, Quantum Mechanics, Symmetry of	AWJ 5,6

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| | Theory in Physics | Hamiltonian, Selection rules, Isospin symmetry, SU(3) quark model | |

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
MidSem	90 mins	30	19/10/2021 1.30 - 3.00PM	Open book
Assignments (2)		15 each		
Comprehensive Exam	120 mins	40	15/12 AN	Open book

Chamber Consultation Hour: To be announced in the class.

Notices: Notices concerning the course will be put up on the CMS

Make-up Policy: Make-up for the tests will be granted only for genuine cases of health.
Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the

students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE