BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
SECOND SEMESTER 2022-2023
COURSE HANDOUT

Date : 16/1/2023

Course No : **PHY F343,**
Course Title : **Nuclear and Particle Physics**
Instructor-in-Charge : Prof. Rahul Nigam (Chamber:A204)
Instructors: Asrarul Haque, Rahul Nigam

1. Scope and Objectives of the course

The course is designed to stress the general underlying ideas of theoretical as well as experimental Nuclear and Particle physics. Quantum Mechanics I & II are pre-requisites for this course. The course includes traditional nuclear physics at elementary level, but covers the new trends of elementary particle physics so that the students could pursue advanced courses/active research either in Nuclear or Particle Physics later on.

2. Text Book

Introduction to Nuclear & Particle Physics: A. Das and T.Ferbel, World Scientific.

Reference Book

Introduction to Elementary Particle Physics: David Griffiths , 2008 (John Wiley and Sons)

3. Course Plan

Lect. No.	Topics to be covered	Learning Objectives	Chapters of Text Book
1	Introduction	Rutherford's Scattering of Alpha particles, Cross-section, Nuclear model of atoms.	1
2-3	General Properties of Nuclei	Labeling of nuclei, Mass, size, spin, dipole moment, stability of nuclei, Nature of Nuclear force.	2
4-7	Nuclear Models	Liquid drop model(Bethe-Weizsacker mass formula), Fermi-Gas model, Shell model, Collective model, Superdeformed nuclei.	3
8-10	Nuclear Radiation	Alpha, Beta, Gamma decay	4
11-12	Application of Nuclear Physics	Fission, Fusion, Radioactive decay	5, class notes
13-15	Nuclear Force and two body problem	Deuteron	Class notes
16-21	Properties and Interactions of	Forces, Elementary particles, Quantum numbers, Resonanaces, Violation of Quantum	9,

	Elementary Particles	numbers, Interactions of Elementary particles	1.1-1.6(RB1) 1.7-1.8(RB1)
22-26	Symmetries and Conservation Laws	Spin & Orbital Angular momentum, Angular momentum addition	10, class notes
27-33	Discrete Transformation	Parity, Time reversal, Charge Conjugation, CPT theorem, CP violation, Wu's experiment	11,12
34-40	Basic idea of Standard Model of Particle Physics	Quarks & Leptons, Quark contents of mesons & baryons, color charge, Symmetry breaking, Gauge Bosons, QCD,QGP	13

4. Evaluation Scheme

Component	Duration	Weightage (%)	Marks	Date & Time	Remarks
Mid-sem	90 mins.	30 %	60	15/03 4.00 - 5.30PM	Open Book
Quizes (2)	50 mins	30 %	60	TBA	Open Book
Comprehensive	180 mins.	40 %	80	06/05 FN	Close Book
Total		100%	200		

5. Chamber Consultation Hours TBA, or by appointment through email

6. Notices **CMS.**

7. Make-up Policy Very strict, only for genuine reasons such as hospitalization with prior permission.

8. 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
PHY F343