BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
SECOND SEMESTER 2019-2020
COURSE HANDOUT

Date : 06/01/2020

Course No : **PHY F343,**
Course Title : **Nuclear and Particle Physics**
Instructor-in-Charge : Asrarul Haque (Chamber:A205)
Instructors: Asrarul Haque

1. Course Description:

The course is divided into two parts: Nuclear physics and particle physics. The basic physics of the nucleus including its structure and dynamics are explored in Nuclear physics. Moreover, the basic nature and properties of the sub-atomic/nuclear particles and their interactions are explored in Particle physics.
The course is designed to develop an operational understanding of the physics of nucleus, elementary and composite particles as well as fundamental forces.

2. Learning Outcomes:

- Knowledge of basic properties of nuclei and nuclear structure.
- Understanding of the elementary/composite particles and their interactions.
- How to evaluate the theoretical predictions using results of measurements.

3. Text Book

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

Reference Book

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

4. 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 Elementary Particles	Forces, Elementary particles, Quantum numbers, Resonanaces, Violation of Quantum numbers, Interactions of Elementary particles	9, 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
34-42	Basic idea of Standard Model of Particle Physics	Quarks & Leptons, Quark contents of mesons & baryons, color charge, Symmetry breaking, Gauge Bosons, QCD,QGP	13

5. Evaluation Scheme

Component	Duration	Weightage (%)	Marks	Date & Time	Nature of Component
Mid-sem	90 mins.	35 %	105	5/3 3.30 - 5.00 PM	Open Book
Quizzes	50 min.	20 %	60		Open Book
Comprehensive	180 mins.	45 %	135	11/05 FN	Closed
Total		100%	300		

5. Chamber Consultation Hour: To be announced in the class

6. Notices **CMS/ Department of Physics Notice Board**

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