BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

HYDERABAD CAMPUS

**SECOND SEMESTER 2021-2022**

**COURSE HANDOUT**

Date: 15-01-2022

Course No : **PHY F343,**

Course Title : **Nuclear and Particle Physics**

Instructor-in-Charge : Prof. Rahul Nigam (Chamber:A204)

Instructors: Sarmistha Banik, 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 prerequisites 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.

1. **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)

1. **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, Resonances, 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 |

1. **Evaluation Scheme**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Component | D | Weightage (%) | Marks | Date & Time | Nature of Component |
| Mid-sem | 90 mins. | 30 % | 60 | 11/03 9.00am to10.30am | Open Book |
| Quiz | NA | 30 % | 60 | TBA | Open Book |
| Comprehensive | 120 mins. | 40 % | 80 | 09/05 FN | Closed |
| Total |  | 100% | 200 |  |  |

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

**6. Notices CMS. Google classroom**

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

with prior permission.

**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