BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI, HYDERABAD CAMPUS

FIRST SEMESTER 2021-2022

Course Handout (Part II)

20-08-2021

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

Course No. : Phy F211

Course Title : Classical Mechanics

Instructor-in-Charge : SOURI BANERJEE

*Course Description* : The course begins with Lagrangian dynamics which is followed by Hamiltonian Mechanics and covers Hamilton’s equations of motion. It initiates Poisson’s Bracket which is a gateway to Quantum Mechanics. It ends with a rigorous coverage of rotational dynamics and heavy symmetrical top

*Scope & Objectives* : This is an advanced course on classical mechanics which deals with some advanced techniques for solving problems of mechanics. It also deals with formulations of classical mechanics that find their use in quantum mechanics as well as classical statistical mechanics.

*Text Book*: H. Goldstein, C. Poole & J. Safko, Classical Mechanics, Third Edition, Pearson Education, Inc., 2002

*Reference Books***:** 1) N. C. Rana and P S Joag, Classical Mechanics, Mc Graw Hill, 2006

## *Course Plan:*

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| --- | --- | --- | --- |
| Lecture  No. | Learning Objectives | Topics to be covered | Chapter in the Text Book |
| 1-3 | Drawbacks of Newtonian Mechanics | d'Alembert's principle of virtual work | 1.1 to 1.3 |
| 4-6 | Generalized Coordinate | Lagrange’s equation | 1.4 |
| 7-14 | Illustration of the applications of Lagrange’s equations. | Various applications of Lagrangian formulation, Foucault’s Pendulum | 1.5 – 1.6 |
| 15-19 | To prove certain conservation theorem and introducing Hamiltonian | Cyclic coordinates and conservation theorems. | Class Notes and 2.6-2.7 |
| 18-20 | Hamiltonian | The Hamilton’s equations of motion and its application | Class Notes |
| 21-23 | Learn techniques of calculus of variation in order to obtain equations of motion by minimizing action. | Some techniques of calculus of variation and derivation of Lagrange’s equations from Hamilton's principle | 2.2 – 2.3 |
| 24-26 | Canonical Transformation | The Poisson Brackets, the gateway to Quantum Mechanics | Class notes or 9.1-9.7 |
| 27-30 | Hamilton-Jacobi formalism | Application to standard problems, Linking Quantum Mechanics | 10.1-10.4 and Class notes |
| 31-34 | To study rotation of coordinate systems and orthogonal transformations in order to understand kinematics of rigid bodies. | Orthogonal transformations and their properties | 4.1-4.3 |
| 35-42 | To obtain the kinetic energy and angular momentum of a rotating rigid body and introduce moment of inertia tensor. To introduce principal axes of inertia. Euler Angles | Angular momentum and kinetic energy of motion about a point and inertia tensor. The principal axis transformation. The Euler equation of motion and torque-free motion of a rigid body. Top Motion | 5.1 – 5.7 |

*Evaluation Scheme:*

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| --- | --- | --- | --- | --- | --- |
| EC No. | Evaluation  Component. | Duration. | Weightage | Date, Time & Venue. | Nature of Component. |
| 1 | Midsem | 90 mins | 35% | 18/10/2021 9.00 - 10.30AM | Open book |
| 2 | Quiz | 30 mins | 25% | TBA | Open book (best 3 out of 4 to be taken) |
| 4 | Comprehensive Examination | TBA | 40% | 11/12 FN | Open book |

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

*Notices:*Notices concerning the course will be put up on the **PHYSICS** notice board.

*Make-up Policy:*Make-up for the tests will be granted only for genuine cases of health problems or urgency for going out of town.

**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 F211