BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
SECOND SEMESTER 2017-2018
Course Handout (Part II)

Date: 02.08.2018

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

CourseNo. :PHYF211

CourseTitle :ClassicalMechanics

Instructor-in-Charge :RAKESH CHOUBISA

CourseDescription: This course aims at an elementary introduction to the advanced formulations of classical mechanics such as the Lagrangian and Hamiltonian formalisms.

Scope&Objectives: The course begins with the D'Alembert's principle and derives Lagrange's equations from it. The Hamiltonian formalism is introduced. Canonical transformations, Poisson brakets and symmetry Groups are discussed. The course ends with the kinematics of rigid body motion and physical effects of rotating frame, like Coriolis effects.

TextBook: (1) H.Goldstein,C.Poole&J.Safko,ClassicalMechanics,ThirdEdition, PearsonEducation,Inc.,2002 (2) N.C.RanaandP.S.Joag,ClassicalMechanics, McGrawHill,2006

CoursePlan:

Lect. No.	Learning Objectives	Topics to be covered	Reference to Text book	Learning Outcome
1-2	Basic Mechanics	Mechanics of a P1rticle and a System of particles	1.1,1.2	A review of basic mechanics which will be a base of the starting of course.
3-7	Lagrangian Formulation	Constraints, D'Alembert's principle, Velocity dependent potential and Lagrange's equation	1.3-1.6	Learning of alternate approach but more powerful as compared to the Newtonian approach.
8-9	Variational Principles and Lagrange's Equations	Hamilton's Principle, Calculus of variations, Lagrange equations from Hamilton's principles	2.1-2.3	Learning of alternate approach to the Lagrangian approach and more useful in Quantum

				Mechanics.
10-12	Variational Principles and Lagrange's Equations	Nonholonomic Systems, Symmetry principle and conservation laws	2.4-2.6	Learning of symmetric aspects of Nature.
13-14	Central Force Problem	One Body Problem, First Integrals, Classification of orbits, Virial Theorem	3.1-3.4	Students will be exposed to the intrecacies and difficulty of such types of problems, useful in many realistic problems like solar system.
15-16	Central Force Problem	Power-Law Potentials, Bertrand's theorem, Kepler Problem	3.5-3.8	Will expose students to handle Planetary motion problems.
17-18	Hamilton's equations	Legendre transformations and Hamilton's equation	8.1-8.2	Learning of equivalence of two approaches (Lagrangian and Hamiltonian approach)
19-20	Hamilton's equations	Hamilton's equations from variational principle	8.5	Dynamical equations in Hamiltonian Formalism.
21-23	Canonical transformations	Equations of canonical transformations	9.1-9.2	Students lean the concepts useful in Statistical Mechanics. Useful tool for complicated dynamical problems
24-25	Canonical transformations	harmonic oscillator	9.3	Students learn the applications to the realistic problem.
26-28	Poisson brackets	Poisson brackets and other canonical invariants	9.5	Compact approach to the Lagrangian and Hamiltonian approach. It resembles commutation algebra in Quantum Mechanics. A

				good learning aspect for more advanced Physics problems.
26-28	Infinitesimal canonical transformations (ICT)	ICT and angular momentum	9.6	Learning of beauty of symmetry and Conservation laws of all the independent constants of motion.
29	Symmetry groups	Angular momentum, symmetry groups of mechanical system	9.8	Explaining a compact approach to solve complicated problems. More Intuitive based approach.
30	Liouville's theorem	Liouville's theorem	9.9	Explaining a compact approach to solve complicated problems.
31-33	Kinematics of Rigid Body Motion	Independent Coordinates, Orthogonal Transformations	4.1-4.2	This applies for the extended system and unlike the cases we discussed before this.
34-36	Kinematics of Rigid Body Motion	Transformation Matrix, Euler Angles	4.3-4.4,4.6	Transition from coordinates fixed in space to coordinates fixed in the rigid body by means of Transformation Matrix. Expression of Transformation Matrix in terms of Euler angles.
37-38	Kinematics of Rigid Body Motion	Finite and Infinitesimal Rotations	4.7, 4.8	Representation of the coordinate transformations in terms of parameters of the rotation.

				Orthogonal Transformation of coordinate axes.
39-40	Kinematics of Rigid Body Motion	Rate of Change of a Vector, Coriolis Effects	4.9-4.10	Related to the realistic physical aspects of earth's rotation, namely Coriolis effects.

Evaluation Scheme:

EC No.	Evaluation Component.	Duration.	Weightage	Date & Time	Nature of Component.
1	Midsem Test		30%	13/10 9:00 - 10:30 AM	Closed Book
3	Tutorial/Assignment		30%		Closed Book
4	Comprehensive Examination	3 Hours.	40%	12/12 FN	Open and Closed Book

Chamber Consultation Hour: To be announced in the class.
Notices: Notices concerning the course will be put up on the **NALANDA** SITE only.
Make-up Policy: No Make will be granted for tutorial tests. Make-up for the test/s will be granted only for genuine cases of health problems or urgency for going out of town with prior permission. In case of medical grounds for make-ups, the students must arrange to send the application, which must mention the location of student, with their trusted friends or by email on my bits server not later than the end of that test.

Instructor-in-charge
Rakesh Choubisa