

2005.2006

SSP-S-115 P102: Classical Mechanics

1. Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation 5 Hrs.

Chapter : 1. Section : 1, 2, 3, 4, 5 & 6.

2. Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy. 6 Hrs.

Chapter : 2. Section : 1, 2, 3, 5, 6 & 7.

3. Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field.

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8 & 10 7 Hrs

4. Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action. 6 Hrs.

Chapter : 8. Section: 1, 2, 5 & 6.

5. Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations. 5Hrs

Chapter : 9. Section : 1, 2, 3, 5, 6 & 7.

6. Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom. 8 Hrs.

Chapter : 10. Section : 1, 2, 3, & 6.

7. Independent coordinates of rigid body., The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 & 10.

8. The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body 6 Hrs.

Chapter 5. Section: 3, 4, 5 & 6.

9. The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 6. Section: 2, 3 & 4.

7 Hrs.

Textbooks : " Classical Mechanics " by H. Goldstein (Addison-Wiley, 1st & 2nd ed)

Reference : "Classical Dynamics of Particles and Systems" by J.B. Marion.