1st Semester (Theory)

FPYC-101 CLASSICAL MECHANICS & SPECIAL THEORY OF RELATIVITY-I

UNIT -I

Constrained Motion: Constraints, Classification of constraints, Principle of virtual work, D'Alembert's principle and its application.

Lagrangian formulation : - limitations of Newtonian formulation, degrees of freedom , generalised coordinates and velocities, Derivation of Lagrange's equation, Calculus of variation, Euler – Lagrange equation, derivation of Lagrange's equation from Hamilton's principle , simple application of Lagrange's equation, Cyclic coordinates , Symmetry and conservation theorems. (12)

Unit-II

Phase Space and the motion of the system Hamiltonian Hamilton's Canonical Equation of motion, Physical significance of H, Advantage of Hamiltonian approach, Deduction of canonical equation from variational principle, Hamiltonian canonical equation of motion in different co ordinate system, Application of Hamilton's equation of motion in different co ordinate system, Application of hamiltonian's equation of motion Hamiltonian for charged particle in an electromagnetic field, Principle of least action.

Unit-III

Canonical or Contact transformations, Advantage of Canonical transformation, example of canonical transformation Solution of simple harmonic oscillator problem Condition for transformation to be canonical.

Infinitesimal contact transformation. Hamiltonian Jacobi Method, Solution of harmonic oscillator problem by Hamilton Jacobi Method. Particle Falling Freely, Hamilton Jacobi equation for Hamilton Characteristic function.

Unit-IV

Poisson Bracket-Definition Invariance of poission bracket with respect to canonical transformation Equation of motion in poisson bracket form Jacobi's identity ,Infinitesimal contact transformation interpretation in terms of poision's bracket The angular momentum and poisson bracket Poisson bracket in quantum mechanics Lagrange bracket ,Relation in Lagrange and poisson bracket, Liouvilies Theorem.

Galilean transformation(GT), Invariance of Newton's laws and laws of conservation of linear momentum and kinetic energy under GT. Michelson Morley experiment, postulates of special theory of relativity, Lorentz transformation, length contraction ,time dilation, Velocity transformation, relativistic mass and momentum, mass energy relation.

(8)

Books:

1. Classical Mechanics- H Goldstein (Narosa)
2. Classical Mechanics-Rana And Joag (TMH)
3. Introduction to Classical Mechanics- Takwale & Purnaik(TMH)
4. Mechanics- K R Simon (Addision Wesley)
5. Mechanics-D. S Mathur (S. Chand)
6. Properties of matter- Searle and Neaman (Arnold Publication)
7. Classical Mechanics- M. Das , P.K Jena (Sri krishna Publication)
8. Classical Mechanics- Kibble
9. Introduction to special theory of relativity by Resnick