1 Assignment I

Problem 1.1. Define: Generalized coordinates, Degrees of freedom, Constraints (Holonomic and non-holonomic constraints), Generalized velocity, Generalized acceleration, Generalized force, Generalized momentum.

Problem 1.2. Derive De'Alembert's principle and hence deduce Lagrange's equation from De'Alembert principle.

Problem 1.3. Define and derive Hamilton principle.

Problem 1.4. Discuss integral principle.

Problem 1.5. Which postulate is suitable for working with monogenic system? Discuss with proper logic.

Problem 1.6. Distinguish between the concept of configuration space and the physical three-dimensional space.

Problem 1.7. Derive Lagrange's equation from Hamilton's principle.

Problem 1.8. Use mathematical concept of calculus of variations elaborately to discuss the following properties:

(i) Shortest distance between two points in a plane

(ii) Minimum surface of revolution

(iii) The Branchistochrone problem.

Problem 1.9. Discuss the advantage of a variation of principle formulation.

Problem 1.10. Find Newton's 2nd law of motion from Hamilton principle.

Problem 1.11. Define cyclic coordinates.

Problem 1.12. Guptas's Book: P144 (Q. 2,3), P147 (Q. 1,2,3), P150 (Q1)

Problem 1.13. Explain the principle of least action with the required diagram features.

Problem 1.14. Show the proof of principle of least action.

Problem 1.15. Discuss the application of Hamilton equation of motion

(i) simple pendulum

(ii) compound pendulum

(iii) polar coordinates

Problem 1.16. Properties (I-IV) P157 (Gupta)

Problem 1.17. Derive Hamilton equation of motion.

Problem 1.18. Poisson bracket using by first form of generating function.

Problem 1.19. How can we get 4 generating function from $4n + 1$?

Problem 1.20. Why is Lagrangian form convergent to obtain equation of motion?

Problem 1.21. Show that the kinetic energy of a system can be written as the sum of three homogeneous function of the generalized velocities.

Problem 1.22. Analyze the following with the help of Lagrangian form

(i) Single particle in space

(ii) Cartesian coordinates

(iii) plane polar coordinates.