

**PART A**

(10 x 2=20)

Answer any **TEN** questions.

1. State Newton's third law of motion.
2. What are generalized coordinates?
3. State the principle of virtual work
4. Explain the physical significance of Hamiltonian.
5. Define Poisson bracket.
6. What are called Euler's angles?
7. Define moment of inertia tensor.
8. Write the equation for potential energy about a point of stable equilibrium.
9. What are called normal co-ordinates?
10. What are inertial and non-inertial frames of reference?
11. What is proper time?
12. Write the principle of choke coil.

**PART B**

(2 x 5=10)

Answer any **TWO** questions

13. State and prove D'Alembert's principle.
14. Find the Lagrange's equation of motion of bob of a simple pendulum.
15. State and explain Hamilton-Jacobi equation.
16. Obtain Euler's equations of motion for a rigid body with one point fixed.
17. Derive the normal frequencies of longitudinal vibration of a CO<sub>2</sub> molecule.
18. Briefly explain stable and unstable equilibrium on the bases of potential function.
19. State and explain the laws of Special theory of relativity.
20. Show that  $x^2+y^2+z^2-c^2t^2$  is invariant under Lorentz transformation.

**PART C**

(2x10=20)

Answer any **TWO** questions

21. Using Newton's laws of motion, deduce the conservation laws for a system of particles. Discuss the assumptions involved and failure of Newton's third law.
22. If  $F(q,p,t)$  and  $G(q,p,t)$  are two integrals of motion, show that the Poisson bracket.  $[F,G]$  is also an integral of motion.
23. Explain the precessional motion with and without nutation in the case of a spinning heavy symmetric top with one point fixed.
24. Derive the expression for normal modes and normal co-ordinates of longitudinal vibrations of CO<sub>2</sub> molecule.
25. Derive the expression for Einstein's mass-energy relation.

-----