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**LB—80—2023**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**M.Sc. (First Semester) EXAMINATION**

**APRIL/MAY, 2023**

**(New/CBCS Pattern)**

**PHYSICS**

**PHY-102**

**(Classical Mechanics)**

**(Saturday, 6-05-2022)**

**Time : 10.00 a.m. to 1.00 p.m.**

*Time— Three Hours*

*Maximum Marks—75*

*N.B. :— (i) All questions are compulsory and carry equal marks.*

*(ii) Figures to the right indicate full marks.*

1. Using Newton's laws of motion, deduce the conservation theorems for linear momentum, angular momentum and energy for the motion of a system of particles. 15

*Or*

- (a) State and explain D'Alembert's principle with suitable example. 8  
(b) What are constraints ? Give a brief note on its different types. 7
2. What is Rayleigh's dissipation function ? Explain. Give its physical significance. 15

*Or*

- (a) Show that Lagrange equations remain invariant under Galilean transformation. 8  
(b) State variational principle. Obtain Lagrangian equation from variational principle. 7

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3. Explain how a two body problem can be reduced to one body ? Deduce expression for such a reduced mass of two body problem. 15

Or

- (a) Derive Hamiltonian-Jacobi equation. 8
- (b) What are Poisson's brackets ? Evaluate the Poisson brackets  $[P_x, L_y]$  and  $[L_z, L_y]$ . 7
4. State and prove Euler's theorem for the motion of a rigid body with one point fixed. 15

Or

- (a) Discuss different modes of vibrations of a linear triatomic molecule. 8
- (b) Discuss small oscillations in a system with one degree of freedom. 7
5. Write short notes (any *three*) :  $3 \times 5 = 15$
- (i) Motion of a charged particle in electromagnetic field
- (ii) Gauge transformation for Lagrangian
- (iii) Rutherford scattering cross-section
- (iv) Angular momentum and inertia tensor.