

**LR-2153**

**M. A. / M. Sc. (Fourth Semester) Examination,  
May-June 2023**

**(Optional Group-I)**

**MATHEMATICS**

*Paper : Second*

**(Mechanics-II)**

*Time Allowed : Three hours*

*Maximum Marks : 40*

*Note : Attempt questions of all sections as directed.  
Symbols have their usual meanings.*

**Section-A**

**(Short Answer Type Questions)      5×3=15**

*Note : Attempt all questions. Each question carries  
3 marks.*

1. Define generalized coordinates.

**Or**

Explain Holonomic and non holonomic systems.

2. Properties of the Hamilton function.

**Or**

Show that the area of the surface of revolution of a curve  $y = y(x)$  is

$$2 \pi \int_x^{x_2} y \sqrt{(1+y^2)} dx$$

Hence show that for this to be a minimum the curve must be catenary.

3. Explain Whittaker's equations.

**Or**

Write the statement of Lee Chung's theorem.

4. Explain Poisson brackets under Canonical transformation.

**Or**

Explain Lagrange-Brackets with equation.

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5. Explain method of separation of variables.

**Or**

Explain method to find solution of Hamilton Jacobi equation.

**Section-B**

**(Long Answer Type Questions)      5×5=25**

*Note : Attempt all five questions in detail. Each question carries 5 marks.*

6. Obtain Lagrange's equation of first kind.

**Or**

State and prove total energy theorem.

7. State and prove Fundamental lemma of calculus of variation.

**Or**

Explain Euler Lagrange's equation for higher order derivative of one dependent variable.

8. State and prove Hamilton's principle.

**Or**

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Explain Poincaré-Cartan Integral Invariant.

9. State and prove Jacobi-Poisson theorem.

**Or**

Show that :

$$[u, [v, w]] + [v, [w, u]] + [w, [u, v]] = 0$$

10. Write the equation of spherical shells and sphere and prove it.

**Or**

State and prove Jacobi theorem.