G-1/140/21 **Roll No……...**

M.Sc. I Semester Examination, April-2021

PHYSICS

Paper II

(Classical Mechanics)

Time : 3 Hours] [Maximum Marks : 80

Note : *All questions are compulsory. Question Paper comprises of 3 sections.* ***Section A*** *is objective type/Multiple Choice questions with no internal choice.* ***Section B*** *is short answer type with internal choice.* ***Section C*** *is long answer type with internal choice.*

SECTION 'A'

(Objective Type Questions)

Answer the following questions : **1 × 8 = 8**

1. What is holonomic constraints ? Give an example.

2. What are ignorable or cyclic coordinates ?

3. State Hamilton's variational principle.

4. What is dissipative system ?

5. Write the Hamilton's canonical equatins of motion.

6. What do you mean by Poisson brackets ?

7. What do you mean by Lagrange's brackets ?

8. Write the equations of motion in Poisson bracket form.

SECTION 'B' **6 × 4 = 24**

(Short Answer Type Questions)

Note : *Answer the following questions in 250 words.*

1. What do you mean by non-holonomic system ? Deduce Lagrange's equation fro non-holonomic system.

P.T.O.

Or

Write D'Alembert's principle and deduce Lagrange's equation from D'Alembert's principle.

2. Deduce Lagrange's equations of motion from Hamilton's principle for conservative system.

Or

Deduce Newton's second law of motion from Hamilton's principle.

3. Deduce Hamilton's canonical equation of motion from variational principle and hence write the physical significance of H.

Or

With the help of Hamilton's equation of motion write equation of motion for compound pendulum.

4. Find a solution of Harmonic oscillator problem of Hamilton Jacobi method.

Or

Prove that Poisson brackets are invariant under canonical transformations.

SECTION'C' **12 × 4 = 48**

(Long Answer Type Questions)

Note : *Answer the following questions in 500 words.*

1. Give the procedure outline to solve the problems of mechanics by Lagrangian method and hence solve the problem of Atwood's machine.

Or

What do you mean by generalised coordinates ? Write the generalised notations for :

(a) Generalised acceleration,

(b) Generalised force,

(c) Generalised potential ,

(d) Generalised momentum.

2. Find an expression for Lagrangian for a charged particle in an elecromagnetic field.

Or

Write the variational technique for calculus of variation and hence find the expression for Euler's Lagrange differential equations.

3. State and prove principle of least action.

Or

Deduce Hamilton's canonical equation of motion in different coordinate system :

(i) Cylindrical coordinates,

(ii) Spherical coordinates,

(iii) Rotating coordinates.

4. What do you mean by canonical transformations ? Write the necessary and sufficient condition for a transformation to be canonical.

Or

Write the properties of Lagrange's brackets and find the relation between Lagrange and Poisson brackets.

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