PD-159-S.E.-CV-19

M.Sc. PHYSICS (1^{st} Semester)

Examination, Dec.-2020

Paper-II

CLASSICAL MECHANICS

Time : Three Hours] **[Maximum Marks : 80**

[Minimum Pass Marks : 29

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. Answer the following short answer type questions:- **2x10=20**

(a) **What are generalized co-ordinates? What is the advantage of using them?**

(b) **What are constraints? How do they affect motion of a mechanical system?**

(c) **Write Euler-Lagranges equation of motion of a system, using generalized co-ordinates.**

(d) **Use Lagrange's equation for obtaing the equation of simple harmonic motion with period $T = 2\pi\sqrt{\frac{l}{g}}$ of simple pendulum.**

(e) **State and discuss the principle of least action.**

(f) **Define phase space.**

(g) **What are the physical significance of H?**

(h) **Obtain the equations of motion of two dimensional is atrophic harmonic oscillator in Cartesian coordinates.**

(i) **State the definition and properties of Poisson Bracket.**

(j) **If $[\phi, \psi]$ be the Poisson Bracket, then prove that**

$$\frac{\partial}{\partial t}[\phi, \psi] = \left[\frac{\partial \phi}{\partial t}, \psi\right] + \left[\phi, \frac{\partial \psi}{\partial t}\right]$$

Section-B **15x4=60**

Answer the following long-answer type questions.

2. State and prove conservation of linear and angular momentum is Lagrangian formulation.

OR

Obtain Lagrange's equation from D' Alembert's principle for conservative system.

3. Deduce Hamilton's principle from D' Alembert principle.

OR

Write down Lagrange's equation for motion of a charged particle is an electromagnetic field.

4. Write application of Hamilton equation of motion for-

(a) Simple pendulum (b) Compound pendulum

OR

Write and explain Hamilton canonical equations of motion in cylindrical and spherical co-ordinates.

5. Show invariance of Poisson Brackets with respect to canonical transformations.

OR

(a) Show that the transformation defined by

$$q = \sqrt{2p}\, sin\theta$$

$$P = \sqrt{2p}\, cos\theta$$ **is canonical.**

(b) Jacobi Identity.