**D 114597**                    (Pages : 2)                    Name............................................

Reg. No...................................

# FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2024

(CBCSS)

Physics

PHY1C01—CLASSICAL MECHANICS

(2019 Admission onwards)

Time : Three Hours                                          Maximum : 30 Weightage

## Section A

*Answer* **all** *questions.*
*Each question carries 1 weightage.*
*8 short questions answerable within 7½ minutes*

1. What are the constraints of a rigid body ?

2. Explain Legendre transformation

3. What are coupled oscillators ?

4. How much is the number of degrees of freedom for a) Four particles moving freely in space ; b) A rigid body with two points fixed ?

5. Define phase space.

6. Differentiate between forced and free vibrations.

7. State Canonical or Contact transformation.

8. Define Jacobi identity.

(8 × 1 = 8 weightage)

## Section B

*Answer any* **two** *questions.*
*Each question carries 5 weightage.*
*4 essay questions answerable within 30 minutes*

9. Derive Lagrange's equation from Hamilton's principle

10. Obtain the equation of motion of two masses connected by a string and passes through a smooth pulley by using Lagrange equation.

11. Define Poisson bracket and discuss any four their properties with proof.

12. Explain normal modes of vibrations.

(2 × 5 = 10 weightage)

**Turn over**

## Section C

*Answer any* **four** *questions.*
*Each question carries 3 weightage.*
*7 problems within 15 minutes.*

13. Calculate the reduced mass of the following : a) Hydrogen atom b) positronium . Show that reduced mass of Hydrogen atom is almost half of positronium.

14. Solve Kepler's problem by using H-J method.

15. Show that Poisons brackets are a) commutative b) distributive.

16. Write the Lagrange's equation of motion of a particle moving under gravity of mass m near the surface of earth.

17. Show that the transformation is canonical.

  a)  $P = 1/2 \, (p^2 + q^2)^2$.

  b)  $Q = \tan^{-}(q/p)$.

18. Show that Poisson brackets are invariant under canonical transformations.

19. Prove that two or more successive canonical transformations also is canonical.

(4 × 3 = 12 weightage)