

Roll No. ....

(12/24)

**15402**

**M.Sc. EXAMINATION**

(For Batch 2021 & Onwards)

(First Semester)

PHYSICS

M.Sc./PHY/1/CC2

Classical Mechanics

*Time : Three Hours*

*Maximum Marks : 70*

**Note :** Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory.

1. (a) Define the term generalised coordinates.
- (b) State De-Alembert principle.
- (c) Evaluate the Poisson brackets :  
 $[J_x, z]$  and  $[J_x, y]$

- (d) Define Cyclic coordinates.  
 (e) What do you mean by small oscillations ?

$$2 \times 5 = 10$$

### Unit I

2. (a) Deduce the Lagrange's equation of motion of one-dimensional simple harmonic oscillator. 7  
 (b) Derive Lagrange's equations of motion using Hamilton's principle. 8
3. (a) What are Coriolis forces ? Show that the total Coriolis force acting on a body of mass  $m$  in a rotating frame is  $-2m(\omega \times v)$ , where  $\omega$  is angular velocity of rotating frame and  $v$  is the linear velocity of the body in rotating frame. 12

- (b) What is Foucault's pendulum ? From this, how it can be proved that the earth rotates. 3

### Unit II

4. (a) State and prove the Kelper's laws of planetary motion. 8  
 (b) State and prove Virial theorem. 7
5. Discuss alpha particle scattering in Colombian field. 15

### Unit III

6. (a) State and prove principle of least action. 7  
 (b) State and prove Jacobi's identity. 8
7. What are generating functions ? Obtain the canonical transformation equations from generating functions. 15

#### Unit IV

8. Discuss the vibrations of linear triatomic molecule in detail. 15
9. When Hamilton-Jacobi theory is more useful ?  
Discuss the harmonic oscillator problem using Hamilton-Jacobi method. 15