62102

Reg. No. | | | | | | | | | |

I Semester M.Sc. Degree Examination, June/July - 2022

PHYSICS

Classical Mechanics

(CBCS-2019-20 & 2020-21 New Scheme)

Paper: P-102

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

Answer **All** questions.

(3×15=45)

1. a) State D Alembert's principle. Use it to obtain Lagrange's equation of motion for a conservative system. **(10)**

   b) Set up Lagrangian for an Atwood's Machine and Obtain its equation of motion. **(5)**

(OR)

2. a) Using the symmetry of homogeneity of time, prove the conservation of energy. **(5)**

   b) Discuss the motion of a particle under a central force that obeys the inverse square law. **(10)**

3. a) Calculate the fictitious force and total force acting on a freely falling body of mass 10kg with reference to a frame moving with an upward acceleration of 5 ms^{-1}. **(5)**

   b) What is Corioli's force? Discuss its effect on a freely falling body. **(10)**

(OR)

4. a) What are normal coordinates and normal modes? Explain. **(5)**

   b) Obtain the normal frequencies of two coupled harmonic oscillators and explain their normal modes of vibrations. **(10)**

|P.T.O.

5. a) Determine the degrees of freedom of rigid body. (5)

b) Explain the torque free motion of a symmetrical rigid body and apply it to explain the precession of earth's axis of rotation. (10)

(OR)

6. a) Set up Hamiltonian for a particle in a central force field and obtain Hamilton's equations of motion. (5)

b) Solve one dimensional linear harmonic oscillator problem using Hamilton Jacobi method. (10)

Answer any **FIVE** of the following. (5×5=25)

7. a) Obtain Lagrangian for a free particle in Cartesian and plane polar coordinates.

b) Explain the classification of orbits.

c) Write a note on Foucault pendulum.

d) Find the normal frequencies of linear triatomic molecule.

e) A system consists of three particles of masses 5 gm, 3gm, and 2gm, located at the points (1,0,-1), (-2,1,3) and (3,-1,1) respectively. Find the inertia tensor.

f) Find the Hamiltonian for the given Lagrangian, $L(x,\dot{x})$, $L=\frac{1}{2}\dot{x}^2-\frac{1}{2}\omega^2x^2-\alpha x^3+\beta x\dot{x}^2$.