Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: OCT / NOV 2024
Faculty: Science and Technology

Program: B.Sc. (Gen 03) **Semester: V** **SET: A**
Program (Specific): General B.Sc. **Course Type: Core**
Class: T.Y.B. Sc. (Gen) **Max. Marks: 35**
Name of the Course: Classical Mechanics
Course Code: 24-PHY-353 **Time: 2Hr**
Paper: III

Instructions to the candidate:

1) *There are 4 sections in the question paper. Write each section on separate page.*
2) *All Sections are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw a neat labelled diagram wherever necessary.*

SECTION: A

Q1) Define or Explain the following. **(5 Marks)**

i) Define centre of mass of the system.

ii) What is meant by exoergic and endoergic process?

iii) State the different types of constraints.

iv) Determine reduced mass of system of two particles having equal masses.

v) What is phase space?

Q2) Answer the following. (Attempt any four) **(4 Marks)**

i) State nature of path described by charged particle moving in constant electric Field perpendicular to the direction of motion.

ii) State any two examples of central force.

iii) What do you mean by Laboratory frame or Lab frame?

iv) Give any one advantage of Lagrangian formulation over Newtonian approach.

v) Calculate force required to produce an acceleration of 22 m/s^2 on mass of 2 kg.

vi) Is the central force, a conservative force?

SECTION: B

Q3) Answer the following. (Attempt any four) (8 Marks)

i) A charged particle having charge 2×10^{-19}C enters into magnetic field of induction 6×10^{-4}T with velocity 3×10^{4} m/s with an angle 30º with field. Find the force acting on particle.

ii) What is eccentricity? What will be the nature of orbit if e = 1 and E = 0?

iii) Explain Rayleigh scattering.

iv) What is meant by geosynchronous orbit of a satellite?

v) What are degrees of freedom?

vi) How does the constraint affect the motion of a mechanical system?

SECTION: C

Q4) Answer the following. (Attempt any two) (8 Marks)

i) What is meant by central force? State its characteristics.

ii) Write a note on types of constraints.

iii) The distance between sun and earth is suddenly reduced to half of its present distance. What will be duration of year?

iv) Two bodies of masses 5 and 10 gm respectively, have position vectors $2\hat{\imath} + 3\hat{\jmath} - \hat{k}$ and $\hat{\imath} - \hat{\jmath} + 2\hat{k}$ respectively. Find the position vector and distance of center of mass from the origin.

SECTION: D

Q5) Attempt any two of the following. (10 Marks)

i) Obtain equation of motion for a charged particle moving parallel to constant electric field.

ii) Write a note on artificial satellite.

iii) Differentiate between elastic and inelastic scattering.

iv) A Hamiltonian of one degree of freedom has the form $H = \frac{p^2}{2m} + \frac{1}{2}kq^2$.

Find Lagrangian corresponding to this Hamiltonian.