

Exam. Code : 103201

Subject Code : 1304

B.A./B.Sc. Semester-I

PHYSICS

Paper-A

(Mechanics)

Time Allowed—3 Hours]

[Maximum Marks—35

Note :— Section A is compulsory. Attempt **ONE** question from each of the Sections B, C, D and E.

SECTION-A

- I. (i) Prove that $\hat{r} \times \hat{\theta} = \hat{\phi}$.
- (ii) What is Conservative Force ? How is it related to potential energy ?
- (iii) Prove that angular momentum of a particle moving under central force is conserved.
- (iv) Is earth an inertial frame of reference ?
- (v) At what point on the surface of the earth, will the plane of vibration of the Foucault's pendulum rotate once a day ?
- (vi) What happens to the velocities and kinetic energies of the individual particles after an elastic collision in the centre of mass system ?

- (vii) How does a spherical top differs from a symmetric top ? 7×1=7

SECTION-B

- II. (i) Derive the expression for volume element in spherical polar coordinates. 5
- (ii) Define Solid Angle. Obtain an expression for solid angle subtended by the surface of a sphere at its centre. 2

OR

- III. (i) Starting from the expression for the velocity $\vec{v} = \dot{r}\hat{r} + r\dot{\theta}\hat{\theta} + r\dot{\phi}\sin\theta\hat{\phi}$ obtain an expression for the acceleration in spherical polar coordinates. 5
- (ii) Calculate the volume of a parallelopiped formed by the vectors $\vec{A} = 3\hat{i} - 4\hat{j} + 5\hat{k}$, $\vec{B} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{C} = \hat{i} + 4\hat{j} + 3\hat{k}$. 2

SECTION-C

- IV. Derive the equation of the orbit for an attractive inverse square law of force and also deduce its solution. 7

OR

- V. Determine the turning points of a particle moving under central force. Show how the total energy is related to the shape of trajectory. 7

SECTION-D

- VI. Discuss the effect of coriolis force on the free fall of a body from a height H above the surface of earth. 7

OR

- VII. Discuss the variation of g with Latitude. 7

SECTION-E

- VIII. What is differential and scattering cross section ? Obtain Rutherford's scattering formula. 7

OR

- IX. Derive the Euler's equations of rotation of a rigid body about a fixed point. 7