

B.A./B.Sc. 1st Semester

PHYSICS (Mechanics)

Paper—A

Time Allowed—Three 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. 1. What does the term translational invariance imply ?
- 2. Prove that $\hat{r} \times \hat{\theta} = \hat{\phi}$.
- 3. What are turning points ? What are the number of turning points in an ellipse ?
- 4. What do you mean by Gallilean Invariance ?
- 5. No Cyclones are set up at equator. Explain.
- 6. Define impact parameter. Give its significance.
- 7. Define precession. 1×7=7

SECTION—B

- II. (i) Derive an expression for the velocity of a particle moving in spherical polar coordinates. 5
- (ii) The spherical polar coordinates of a point are (16, 60°, 30°). Find the Cartesian Coordinates. 2

OR

- III. Show that the rotational invariance of space leads to law of conservation of angular momentum. 7

SECTION—C

- IV. (i) Show that a two body central force problem can be reduced to an equivalent one body problem. 4
- (ii) Using differential equation of the orbit under central force. Find the force law if the orbit $r = e^{b\theta}$. 3

OR

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

SECTION—D

- VI. Derive an expression for the force acting on a particle in a rotating frame. 7

OR

- VII. Find the expression for deviation of a freely falling body from vertical due to coriolis force. 7

SECTION—E

- VIII. Find an expression for Rutherford scattering process. 7

OR

- IX. Show that the angular momentum \vec{L} of a rigid body is given by $\vec{L} = \vec{I}\vec{\omega}$ where $\vec{\omega}$ is angular velocity. Show that \vec{I} is a tensor of second rank. 7