

2071  
B.A./B.Sc. (General) Second Semester  
Physics  
Paper – A: Mechanics – II

Time allowed: 3 Hours

Max. Marks: 44

**NOTE:** Attempt five questions in all, including Question No. VII (Unit- III) which is compulsory and selecting two questions each from Unit I - II. Use of non-programmable scientific calculator is allowed.

x-x-x

UNIT – I

- I. a) Derive an expression for the angular momentum of a rigid body and hence define the inertia tensor.  
b) Calculate the rate of rotation of the plane of oscillation of a Foucault pendulum at latitude  $30^\circ$  and hence obtain the time it will take to turn through  $90^\circ$ . (6,3)
- II. What is Coriolis force? Discuss its effect on a particle mass  $m$  moving with linear velocity  $\vec{v}$  on the surface of the earth at latitude  $\lambda$ . How it effects the motion of rivers in northern and southern hemisphere of earth. (9)
- III. Describe Michelson Morley Experiment. What are finding of Michelson -Morley Experiment? (9)

UNIT - II

- IV. a) Starting from Lorentz transformations equations for space and time coordinates derive equations for relativistic addition of velocities. Hence prove that not material particle can move with a velocity greater than that of light.  
b) A rocket moving with speed  $10^8$  m/s ejects a projectile in its direction of motion with speed relative to rocket  $2 \times 10^8$  m/s . Find the speed as measured by an observer on earth. (6,3)
- V. a) What do you understand by length contraction? What is proper length interval? Derive expression for it.  
b) A rod 1m long is moving along its length with a velocity of  $0.6 c$ . Calculate its length as it appears to an observer on the earth. (6,3)

P.T.O.

(2)

- VI. Discuss relativistic Doppler effect and derive relations for longitudinal and transverse Doppler effect. What is meant by the terms red shift and blue shift. (9)

UNIT - III

- VII. Attempt any eight of the following:-

- (a) Find the latitude at which the plane of vibration of Foucault's pendulum does not rotate at all.
- (b) Define Principal axes of inertia.
- (c) How the rotation of earth affects the value of  $g$ ?
- (d) What is precession?
- (e) What are non- inertial frames of reference?
- (f) Two photons are moving towards each other. What is their relative velocity?
- (g) What do you mean by four vector space?
- (h) What is muon paradox?
- (i) What is relationship between relativistic Momentum and Energy?
- (j) An electron having rest mass  $9 \times 10^{-31}$  kg moves with velocity equal to 80% of that of light. Find its mass. (8x1)

x-x-x