Roll No. .....

(011/17-I)

# 5157

## B. Sc. EXAMINATION

(First Semester)

PHYSICS : CLASSICAL MECHANICS AND THEORY OF RELATIVITY

Paper-I(PH-101)

*Time : Three Hours* *Maximum Marks :* 40

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. Q. No. 1 is compulsory. Log Tables way be asked for.

**(Compulsory Question)**

1. (a) What is the significance of coriolis force ? 1

(b) How will a rod moving with speed of light appears to a stationary observer ? 1½

(c) What are the advantages of generalised co-ordinates ? 1½

(d) What is centre of mass of a system of Partides ?
Show that the velocity of centre of mass of a system of particles remains constant if no external force acts on it. 2

(e) What conclusion drawn from Michelson-Morley experiment ? 2

## Unit I

2. (a) What are Constraints ? How do they affect motion of a mechanical system ? Also discuss various types of contraints with examples. 5

(b) State and prove conservation theorem for angular momentum of a particle. 3

3. State and prove law of conservation of energy and linear momentum of a system of particles. 8

## Unit II

4. (a) What is Hamilton's Principle ? Using this principle derive Lagrange's equation of motion. 5

   (b) What is generalised acceleration ? Obtain the expression for generalised acceleration. 3

5. (a) Explain degree of freedom and concept of generalised co-ordinates. Explain with examples the choice of generalised co-ordinates for a system of particles. 5

   (b) Obtain the Lagrange's equations for a system when its Lagrangian is given by

   $$L = q_k \dot{q}_k - \sqrt{1 - \dot{q}_k^2}\,.$$ 3

## Unit III

6. (a) What is Galilean Transformation ? Show that under Galilean Transformation, velocity is variant and acceleration is invariant ? 4

(b) Describe the Michelson Morley experiment and discuss the negative results. 4

7. (a) What is centrifugal force ? Show that the effect of the centrifugal force due to rotation of the earth on the acceleration due to gravity is maximum at the equator and minimum at the poles. 5

(b) Calculate the magnitude and direction of the coriolis force on a motor car of mass 800 kg travelling due north at 144 km/ hour at a laititude of 45°. 3

## Unit IV

8. (a) What do you mean by time dilation ? What is the proper time interval ? Derive an expression for it. Hence, explain the twin Paradox. 4

(b) If an electron having a rest mass energy of 0.51 MeV is moving so fast to have kinetic energy equal to 1000 MeV, then calculate the ratio of the mass of electron to its rest mass. 2

(c) What are the basic postulates of Einstein special theory of relativity ? 2

9. (a) Derive the formula for variation of mass of a body with its velocity. 3

(b) Obtain the law of addition of velocities on the basis of Lorenty transformations. 3

(c) Two photons are travelling in opposite directions. Determine their relative velocity. 2