Unit IV

8. (a) Using special theory of relativity derive $E = mc^2$. Hence give its physical significance. **5**

(b) Calculate the momentum of a proton whose KE is 10^3 MeV and rest mass energy of proton is 938.3 MeV. **3**

9. (a) What do you understand by Lorentz Transformation ? Derive the equations for x, y, z and t coordinates. **5**

(b) Using special theory of relativity and Lorentz transformation find the relative velocity of two Photons approaching towards each other in vacuum. **3**

Subject Code—52477

B. Sc. EXAMINATION

(Batch 2017 Re-appear)

(First Semester)

PHYSICS

PH-101

Classical Mechanics and Theory of Relativity

Time : 3 *Hours* *Maximum Marks :* 40

Note : Q. No. **1** is compulsory. Attempt *Four* more questions selecting *one* question from each Unit. All questions carry equal marks or the marks are written against the question.

Compulsory Question

1. (a) Distinguish between Scleronomous and Rheonomous constraints. Give *one* example of each.

(b) What are the advantages of Lagrangian approach over Newtonian approach ?

(c) What conclusions were drawn from Michelson-Moreley experiment ?

(d) What are the postulates of special theory of relativity ? These postulates leads to which transformation.

Unit I

2. (a) State and prove conservation theorem for energy of single particle. **5**

(b) Prove that the angular momentum is conserved in motion under central forces. **3**

3. State and prove conservation theorem for total angular momentum of system of n particles. **8**

Unit II

4. (a) What are generalised co-ordinates ? What are advantages of generalised co-ordinates ? Obtain expression for generalised acceleration. **4**

(b) Set up Lagrangian equation for a simple pendulum. Hence derive a relation for its time period of oscillation. **4**

5. (a) State Hamilton's variational principle and derive Lagrangian equation of motion from it. **6**

(b) What is Configurational Space ? How many generalized co-ordinates are needed for a system of 100 particles in space with 20 constraints (independent). **2**

Unit III

6. (a) What are Galilean Transformations ? Show that law of conservation of energy is invariant under these transformations. **4**

(b) Discuss the effect of Coriolis force on a freely falling particle. **4**

7. Define Inertial and non-inertial frame of reference. Hence explain need of centrifugal and coriolis forces. Also derive a relation showing effect of these forces on acceleration due to gravity on earth. **8**