GSE/D-20   **789**

CLASSICAL MECHANICS AND
THEORY OF RELATIVITY
Paper–I

Time : Three Hours]   [Maximum Marks : 40

Note : Attempt *five* questions. Questions No. 1 is compulsory. Attempt remaining *four* questions selecting *one* question from each unit. The symbols have their usual meanings.

Compulsory Question

1. (a) What are generalised coordinates ? What is their importance ?   2

   (b) What are constained forces ? Give an example of a constained force.   2

   (c) What is Newtonian Relativity Principle ?   2

   (d) Differentiate between relativistic and non-relativistic motion.   2

UNIT–I

2. (a) State and prove law of conservation of angular momentum of a particle.   6

   (b) Define centre of mass of a system of particles. What is its importance ?   2

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

UNIT–II

4. (a) What are transformation equations connecting two set of coordinates ? Using these equations, derive the expression for generalised velocity. 6

(b) What do you understand by configuration space ? Explain its significance. 2

5. What are Lagrangian and the Lagrange's equation of motion ? Set up the Lagrangian for a one dimensional harmonic oscillator and determine its time period of oscillation. Give at least *two* advantages of the Lagrangian approach. 8

UNIT–III

6. (a) What do you understand by intertial and non-intertial frames ? Derive Galilean transformation equations. 6

(b) What are the results of Michelson-Morley experiment ? Give their Justifications. 2

7. What are coriolis and centrifugal forces ? Explain the effect of centrifugal force on the value of acceleration due to gravity on earth. 8

UNIT–IV

8. (a) What is Einstein's massenergy relation ? Derive an expression for this relation-ship. 6

(b) A metre scale is moving with a very high speed V such that its mass appears double of its rest mass. Find out the value of V. 2

9. What are the postulates of special theory of relativity ? Derive the expressions of Lorentz Transformations. 8

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