

M.Sc. F.Y. (Physics) (CBCS Pattern) Sem-II  
**PSCPHYT07 - Paper-VII (Core-VII) : Classical Mechanics**

P. Pages : 2

Time : Three Hours



**GUG/W/22/11222**

Max. Marks : 80

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- Either
1. a) What is D'Alembert's principle? 3
- b) An inextensible strings of negligible mass hanging over a smooth pulley B. Concepts one mass  $m$ ; on a friction less inclined plane of angle  $\theta$  to another mass  $m_2$  using D'Alembert's principle prove that the masses will be in equilibrium, if  $\sin \theta = \frac{m_2}{m_1}$  5
- c) Derive Lagrange's equation from D'Alembert's principle for conservative system. 8

**OR**

- e) Deduce Hamilton's equations and Lagrange's equation from variational principle for non-conservative system. 10
- f) Find the equation of motion and force of constraint in case of simple pendulum by using Lagrange's method of undetermined multiplier's. 6

Either

2. a) Show that if a co-ordinate corresponding to a rotation is cycle, Rotation of the system about the given axis has no effect on the description of the system motion i.e. angular momentum is conserved. 8
- b) By using Hamilton dynamics write down the equation of motion of a particle in a central force field. 8

**OR**

- e) Define 'Hamiltonian principle'. Obtain Hamilton's canonical equation of motion. 8
- f) Show that the Poisson bracket of two variables is invariant under a canonical transformation. 8

Either

3. a) What is meant by 'Laboratory system' and the 'Centre of mass system' in a two body scattering problem? How will you transform the differential cross-section, energy and scattering angle from the Centre of mass system to the Laboratory system? 8
- b) A particle describing a closed orbit under the influence of a central force. Derive the quantities which remain invariant during the motion. Show that total energy and angular momentum of a particle under a central force is conservative. Also show that rate at which the area is swept out by the radius vector is constant. 8

**OR**

- e) Show that total energy and angular momentum of a particle under a central force is conservative. Also show that rate at which the area is swept out by the radius vector is constant. **8**
- f) Obtain an expression for the reduced mass of the system. **8**

Either

4. a) State and prove Euler's theorem. **8**
- b) What do you understand by Normal co-ordinates and normal modes of Vibrations? **8**

**OR**

- e) Explain Periodic motion in small oscillations. **8**
- f) Defining principle axes and principal moment of inertia. Find the principal axes and their associated moments of inertia for a cube of mass 'M' & side 'a'. **8**

5. Answer all the following.

- a) What are constraints? Classify the constraints with some example. **4**
- b) Define scattering cross section, scattering angle  $\phi$  and Impact Parameter. **4**
- c) What is stability of orbit? Also write the conditions for the closure. **4**
- d) Explain the term "Principal axes transformation". **4**

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