

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

P. Pages : 2

Time : Three Hours



**GUG/W/24/11222**

Max. Marks : 80

**Either:**

1. a) Obtain Lagrange's equation of motion from Hamilton's Variational principle. 6
- b) Prove the law of conservation of linear momentum and energy for a system of interacting particles. 4
- c) An inextensible string of negligible mass hanging over a smooth pulley B. Connects one mass  $m_1$  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  $\sin\theta = \frac{m_2}{m_1}$  6

**OR**

- e) Discuss Variational principle. 8
- f) What are constraints? Give detailed classification with suitable examples. 8

**Either:**

2. a) How through Routhian procedure, we can eliminate the ignorable co-ordinate from Lagrange's equation of Motion? 8
- b) Define Poisson bracket and state the different proportion of Poisson bracket. Further show that,  $[x, y + z] = [x, y] + [x, z]$ . 8

**OR**

- e) Explain Hamilton-Jacobi theory. 8
- f) Show that if a co-ordinate corresponding to a rotation is cyclic, 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

**Either:**

3. a) A particle describing a closed orbit under the influence of a central force. Derive the quantities which remain invariant during the motion. 8
- b) Obtain a relation between scattering angles in laboratory system and C.M system. 8

**OR**

- e) How will you reduce the two body problem into one body problem? 8
- f) A particle describe a circular orbit under the influence of an attractive central force directed towards a point on the circle. Show that the force varies as the inverse fifth power of the distance. 8

**Either:**

4. a) State and prove Euler's Theorem. 8
- b) Explain the term 'Principal axes transformation'. 4
- c) Calculate the inertia tensor for the system of four point masses 1gm, 2gm, 2gm, 2gm located at the point (1, 0, 0), (1, 1, 0), (1, 1, 1) and (1, 1, -1) cm. 4

**OR**

- e) Explain non-inertial and pseudo forces. 8
- f) What is principle moment of inertia? Classify rigid bodies as per principal moments of inertia. 8

5. Answer all the followings.

- a) What is D'Alembert's principle? 4
- b) Prove that the transformation,  $p = \frac{1}{2}(p^2 + q^2)$ ;  $q = \tan^{-1}(q/p)$  is Canonical. 4
- c) Define scattering cross section, scattering angle  $\Phi$  and Impact parameter. 4
- d) What are Euler's angle? 4

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