

**T.Y.B.SC. SEM – V (CBCS - 2016 Course) : WINTER - 2018**

**SUBJECT : PHYSICS CLASSICAL MECHANICS**

Day : Saturday  
Date : 20/10/2018

**W-2018-0753**

Time : 03.00 P.M. To 06.00 P.M  
Max. Marks : 60

---

**N. B. :**

- 1) All questions are **COMPULSORY**.
  - 2) Figures to the right indicate **FULL** marks.
- 

**Q. 1** Attempt **ANY TWO** of the following: (12)

- a) Derive the differential equation of an orbit for a particle moving in central force field.
- b) Obtain the Hamiltonian equation from Lagrange's equation. Show that Hamiltonian of a system represents total energy of the system.
- c) Obtain the Lagrangian and hence obtain the equation of motion in case of cylinder rolling down the inclined plane. Assume that there is no slipping.

**Q. 2** Attempt **ANY TWO** of the following: (12)

- a) Prove that:  
$$\frac{d}{dt} \left[ \frac{\partial T}{\partial \dot{q}_j} - \frac{\partial T}{\partial q_j} \right] = Q_j$$
, by using D'Alembert's principle.
- b) Derive the Lagrangian equation for the linear harmonic oscillator.
- c) Derive the equation for the motion of a charged particle under the constant electric and magnetic field.

**Q. 3** Attempt **ANY TWO** of the following: (12)

- a) Derive the Kepler's Laws of Motion.
- b) Derive the relation between angular momentum and spin angular momentum.
- c) Derive the Lagrangian equation for compound pendulum.

**Q. 4** Attempt **ANY THREE** of the following: (12)

- a) Obtain an expression for D'Alembert's principle.
- b) Explain the effect of Coriolis force on freely falling body in rotating frame.
- c) Calculate the fictitious force and the total force acting on freely falling body of mass 10 kg with reference to a frame moving with downward acceleration of  $5\text{m/s}^2$ .
- d) Define constraints. Give the classification of constraints.

**Q. 5** Attempt **ANY FOUR** of the following: (12)

- a) Explain the concept of degrees of freedom in detail.
- b) Explain the concept of pseudo force. Give its examples
- c) Derive Lagrange's equation for projectile motion.
- d) Explain the term Generalized co-ordinates.
- e) Prove that the time taken by the earth to travel over one half of its orbit separated by minor axis remote from sun is 2 days more than  $1/2$  year.  
(Period of earth = 365 days and eccentricity of earth =  $1/60$ )
- f) Explain the concept centre of mass.

\* \* \* \* \*

---