



13DD 44 – I (08)

B.Sc. I Semester Degree Examination, November/December 2013
PHYSICS

1.1 : Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Section I is compulsory.
2) Answer **any four** questions from Section II and **any four** from Section III.

SECTION – I

1. Answer **any twelve** of the following : (12×1=12)

A) Choose the correct answer :

i) Newton's laws of motion are valid in

- a) Inertial frame of reference
- b) None inertial frame of reference
- c) Both inertial and non-inertial frame of reference
- d) None of these

ii) Kinetic energy of rotation is given by

- a) $\frac{1}{2}IW^2$
- b) $\frac{1}{2}WI^2$
- c) W^2I
- d) $\frac{1}{2}I^2W^2$

iii) If the external force acting on the system is zero, then total linear momentum of the system

- a) Increases
- b) Decreases
- c) Remains constant
- d) All the above

iv) The angle between viscous force and direction of flow of liquid is

- a) $\frac{\pi}{2}$
- b) $\frac{\pi}{4}$
- c) zero
- d) π

B) Fill in the blanks :

- i) Escape velocity of a satellite is _____ times orbital velocity.
- ii) Force is _____ under Galilean transformation.
- iii) Radius vector drawn from sun to planet sweeps out _____ areas in _____
- iv) Dimensional formula for co-efficient of viscosity is _____

P.T.O.



- C) State **true** or **false** :
- Centripetal and centrifugal forces are equal in magnitude but opposite in direction.
 - If external torque acting on a system of particles is zero, the total angular momentum of a system of particle is constant.
 - Strain is a dimensional constant.
- D) Answer the following in **one** or **two** sentences :
- What is frame of reference ?
 - Define radius of gyration.
 - Define bulk modulus.
 - Define surface tension.

SECTION – II

- Show that conservation of energy is invariant under Galilean transformation.
- State and prove perpendicular axes theorem.
- State and explain Newton's Law of gravitation.
- Derive the relation between angular velocity and torque.
- Derive an expression for bending moment.
- Derive an expression for surface energy.

SECTION – III

- What is compound pendulum ? Obtain an expression for time period of a compound pendulum.
 - Show that in case of compound pendulum there are four points about which the time period is same. **(2+7+4=13)**
- Obtain an expression for radial and transverse component of velocity and acceleration of a particle executing uniform circular motion.
 - An air craft of mass 18×10^3 kg flies in a horizontal circle of radius 0.5 km with a speed of 83.33 m/s. Find the horizontal thrust of the air upon the air craft.



10. a) Define elastic and inelastic collision.
b) Show that the magnitude of velocities of the particles remain unaltered in case of elastic collision in the centre mass frame of reference.
c) Show that if external force acting on a system of particles is zero, then total linear momentum is conserved. (2+7+4=13)
11. a) What is central force ?
b) State and prove Kepler's second and third law of planetary motion.
c) Show that conservation of energy in case of S.H.M. of a light spiral spring. (1+8+4=13)
12. a) What is cantilever ? Obtain an expression for depression produced at its free end (weightage of the beam is not taken into account).
b) Find the energy stored in a wire 5 m long and 10^{-3} m in diameter when it is stretched through 3×10^{-2} m by a load Young's modulus of the material is 2×10^{11} N/m².
13. a) Define co-efficient of viscosity. Derive Poiseuille's equation for the flow of liquid through capillary tube.
b) Water is flowing through a horizontal capillary tube, 10 cm long and 4 mm diameter at a distance 0.5 m below the free surface of water in the vessel. Calculate the rate of flow of water. Given co-efficient of viscosity water is 0.0014.