

I Semester B.Sc. Examination, Nov./Dec. 2016  
(R) (CBCS/NS – 2011-12 and Onwards) (Prior to 2016-17)

## PHYSICS – 1

## Mechanics, Oscillations and Properties of Matter

Time : 3 Hours

Max. Marks : 70

**Instruction** : Answer **five** questions from **each** Part.

## PART – A

Answer **any five** questions. **Each** question carries **eight** marks. (5×8=40)

1. a) Define static friction and kinetic friction.  
b) What is angle of repose ? Derive the relation between coefficient of static friction and angle of repose. (2+6)
2. a) What are inertial frames of reference ? Give an example.  
b) Derive the mass-energy equivalence expression. (2+6)
3. a) State Kepler's laws of planetary motion.  
b) State and explain work-energy theorem. (3+5)
4. a) State and explain the law of conservation of mechanical energy with an example.  
b) Define surface tension of liquid. What are the factors affecting surface tension ? (3+5)
5. a) What are elastic and inelastic collisions ?  
b) Define centre of mass of system of particles.  
c) Explain conservation of linear momentum with an example. (2+2+4)
6. a) State and prove parallel axis theorem of moment of inertia.  
b) State and explain the principle of conservation of angular momentum. (5+3)
7. a) Define periodic motion with an example.  
b) Write the differential equation for a particle executing S.H.M. Arrive at the expression for the velocity of the same. (2+6)
8. What is Cantilever ? Obtain an expression for the depression at the free end of a thin light beam clamped horizontally at one end and loaded at the other. 8

P.T.O.



Solve **any five** of the following problems. **Each** problem carries **four** marks. **(5×4=20)**

9. A block of mass 10 Kg is placed on a horizontal plane. The mass just begins to slide when the angle of inclination of the plane gradually increased to  $25^\circ$  with the horizontal. Calculate the coefficient of static friction between the block and the surface and hence the force of static friction.  $g = 9.8 \text{ ms}^{-2}$ .
10. An electron of rest mass  $9.1 \times 10^{-31} \text{ Kg}$  moves with a velocity of  $0.99 C$  where  $C = 3 \times 10^8 \text{ ms}^{-1}$ . Calculate its total energy.
11. The earth is revolving round the sun in a circular orbit of radius  $1.5 \times 10^{11} \text{ m}$  with a time period of  $3.15 \times 10^7 \text{ s}$ . Calculate the mass of the sun.  
Given  $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ Kg}^{-2}$ .
12. A constant force of  $(2\hat{i}) \text{ N}$  is acting on a particle displacing it from a position  $(\hat{i} + \hat{j}) \text{ m}$  to  $(2\hat{i} + 2\hat{j}) \text{ m}$ .  
Calculate the workdone by the force.
13. A 5 Kg body and a 8 Kg body are moving along the x-axis. At a particular instant the 5 Kg body is 1 m from the origin and has a velocity of  $3 \text{ ms}^{-1}$  and 8 Kg body is 2 m from the origin and has a velocity of  $-1 \text{ ms}^{-1}$ . Find the position and velocity of the centre of mass.
14. A thin metal ring of radius 0.5 m and mass 0.5 Kg starts from rest and rolls down an inclined plane. Its linear velocity on reaching the foot of the plane is  $5 \text{ ms}^{-1}$ . Calculate : i) the moment of inertia of the ring and ii) the K.E. of rotation at that instant.
15. Two simple pendulums of length 1.5 m and 1 m starts swinging at the same time. Calculate the ratio of their time periods.
16. A cube of aluminium of side 10 cm is subjected to a shearing force of 100 N. The top surface of the cube is displaced by 0.01 cm with respect to the bottom. Calculate the shearing stress, shearing strain and shear modulus.



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PART - C

Answer **any five** of the following. **Each** question carries **two** marks.

(5×2=10)

17. a) While catching a Cricket ball, the player lowers his hands. Justify.
- b) Will a person inside a moving lift experience any change in his weight ?  
Explain.
- c) Write two examples of zero work.
- d) Write two examples of conservative forces.
- e) Soap solution is a better cleaning agent than ordinary water. Justify.
- f) Why are spokes fitted in the cycle wheel ?
- g) A pendulum clock is taken to moon, will it gain or lose time ? Explain.
- h) Why are the metal bridges declared unsafe after long use ?