



K22U 3428

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/  
Improvement) Examination, November 2022  
(2019 Admission Onwards)  
CORE COURSE IN PHYSICS  
1B01 PHY : Mechanics – I

Time : 3 Hours

Max. Marks : 40



PART – A

All questions are **compulsory**, each question carries **1** mark.

1. What is moment of inertia ? What is its unit ?
2. State parallel axis theorem.
3. What is impact parameter in scattering problems ?
4. Express velocity and acceleration in plane polar coordinates.
5. What do you mean by a central force ?
6. Give the relation between torque and angular momentum.

(6×1=6)

PART – B

Answer **any 6**, each question carries **2** marks.

7. Starting from Hooke's law, obtain the differential equation for simple harmonic motion for a block of mass  $M$  attached to one end of the horizontal spring with the other end of spring is fixed.
8. Define centre of mass. Give the expression for the centre of mass of a non-uniform mass distribution of density  $\rho$ .

P.T.O.

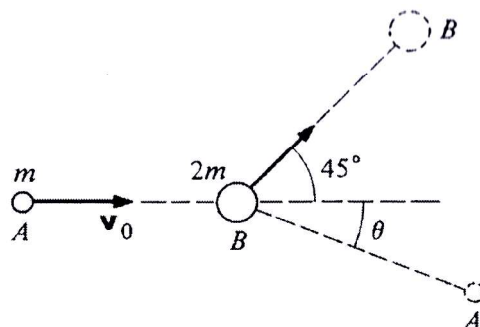


9. If weight is defined as the true gravitational force acting on a body, what happens to the weight of a turtle when it is inside an elevator which moves with a downward acceleration equals  $g$  ? What happens to the reaction by the elevator in this case ?
10. When do we call certain forces as conservative forces ? What is being conserved when work is done by a conservative force ?
11. Finite angular rotation is not a vector whereas angular velocity is a vector. Justify this statement.
12. What is meant by constraints ? What is the constraint in the Atwood's machine ?
13. What is the law of conservation of angular momentum ? A rolling cycle tyre remain vertical for some time whereas a cycle tyre placed vertically at rest falls immediately when released. Why ?
14. Describe stability using potential energy curve. (6×2=12)

### PART – C

Answer **any 4**, **each** question carries **3** marks.

15. The potential energy function of an interaction is given as  $U = x^3 - 3x^2$ . Find the points of equilibria. Find the point of stable equilibrium.
16. A mass  $m$  is attached to the end of a string of length  $R$  and whirled round in a vertical plane in the gravitational field of earth. Find the tension on the string and the tangential acceleration produced.
17. How do we apply Newtons laws of motion for a system of particles ? Derive the relation between the rate of change of the momentum of the system and the net external force acting on the system.
18. Particle A of mass  $m$  has initial velocity  $v_0$ . After colliding with particle B of mass  $2m$  initially at rest, the particle follows the path as shown in Figure. Find  $\theta$ .





19. Derive the accelerations of the masses  $M_a$  and  $M_b$  connected in an Atwood's machine with a massive pulley of mass  $M$ .
20. Describe how the Kater's pendulum allows to measure the value of  $g$  with great accuracy. (4×3=12)

PART – D

Answer **any 2, each** question carries **5** marks.

21. Determine the position vector of the centre of mass of a right triangular sheet of mass  $M$  and base 'a' and height 'b'.
22. State the work energy theorem. Show that the mechanical energy is conserved when a particle moves under a central force.
23. Derive an expression for the angular momentum of a body that is undergoing both translation and rotation in the x-y plane. (The rotation axis remains parallel to the z axis throughout the motion.)
24. What is centre of percussion ? Show that the place of a doorstop fixed on a wall to stop the door from banging the wall while opening should be at a distance  $\frac{2}{3}w$  from the hinges. (where 'w' is the width of the door). (2×5=10)

