

**B.SC. PHYSICS
FIRST SEMESTER
ELEMENTS OF MECHANICS
BSP – 102 IDMn
[USE OMR FOR OBJECTIVE PART]**

**SET
A**

Duration: 1.30 hrs.

Full Marks: 35

(PART-A: Objective)

Time: 15 min.

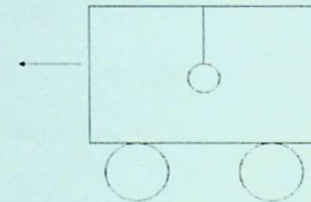
Marks: 10

Choose the correct answer from the following:

$1 \times 10 = 10$

- If a body is rotating about an axis, passing through its centre of mass then its angular momentum is directed along
 - Radius
 - tangent
 - axis of rotation
 - None
- A body in rotational motion possesses rotational kinetic energy given by _____
 - $KE = \frac{1}{2} I^2 \omega$
 - $KE = \frac{1}{2} I \omega^2$
 - $KE = 2I^2 \omega$
 - $KE = I\omega$
- Point, where the total volume of the body is assumed to be concentrated is _____
 - Centre of area
 - Centre of volume
 - Centre of mass
 - None
- The moment of inertia of a sphere of radius R and mass M about its centre of mass is given by
 - $\frac{1}{5} MR^2$
 - $\frac{2}{5} MR^2$
 - $\frac{3}{5} MR^2$
 - $\frac{4}{5} MR^2$
- Moment of Inertia depends on:
 - Mass
 - distribution of mass
 - angular velocity
 - position of rotation and mass distribution
- The product of moment of inertia and the angular acceleration is:
 - Force
 - Torque
 - Work
 - Angular momentum
- Which of the following proves there is a gravitational force between the earth and the sun?
 - Occurrence of day and night.
 - Earth revolving around the sun.
 - The sun is apparently revolving around the earth.
 - Falling bodies deviating towards the east

8. Average density of the earth
- a. Is directly proportional to g
 - b. Is inversely proportional to g
 - c. Does not depend on g
 - d. Is a complex function of g
9. What causes the motion of a body which is initially in the state of rest?
- a. Force
 - b. Displacement
 - c. Speed
 - d. Velocity
10. In the following figure, what will happen to the ball hanging from the roof of the car if the car suddenly moves towards left (direction shown by arrow)?



- a. Ball moves towards right
- b. Ball moves towards left
- c. Ball does not move
- d. Ball moves out of the paper

(Descriptive)

Time : 1 hr. 15min.

Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. State and prove the theorem of parallel axes for a plane laminar body. 5

2. a. Derive the expression of moment of inertia of a rectangular lamina about an axis passing through one of its corners and perpendicular to its plane. 5+5=10
b. Show that the gain in K.E. of a rotating particle in shortening its orbit is supplied by the work done against the centrifugal force acting on the particle.

3. a. Explain briefly the gravitational field, gravitational potential and gravitational potential energy 5+5=10
b. Show that the expression for escape velocity from the surface of the earth is given by $v_e = \sqrt{2gR}$ (g=acceleration due to gravity, R=radius of the earth).

4. Find the expression for the gravitational potential due to spherical shell for the following conditions 8+2=10
 - a. At a point outside the shell
 - b. At a point on the surface of the shell

5. a. State Newton's laws of motion. Show that Newton's first law of motion is simply a special case of the second law. 4+3+3=10
b. What is a Galilean transformation? Write down the transformation equations (transformation of position) for two inertial frame of references.
c. Show that the distance or length is invariant to Galilean transformation.

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