REV-01
BSP/10/15

2023/01

SET A

B.Sc. PHYSICS
FIRST SEMESTER
ELEMENTS OF MECHANICS
BSP – 102

[USE OMR FOR OBJECTIVE PART]

Duration: 1.30 hrs. **Full Marks: 35**

(PART-A: Objective)

Time: 15 min. **Marks: 10**

Choose the correct answer from the following: ***1×10=10***

1. When the weight of a rocket is taken into account, then its velocity ---------- (where, v is the velocity of the jet).
   a. differs by - vt b. differs by gt
   c. differs by - gt d. differs by vt

2. The moment of inertia of a circular lamina about a diameter is ---------
   a. MR^2 b. $\frac{3}{2}MR^2$
   c. $2MR^2$ d. $\frac{1}{4}MR^2$

3. The thrust acting on a rocket of mass M is --------.
   a. $F = \frac{dM}{dt}v$ b. $F = \frac{dM}{dt}v^2$
   c. $F = \frac{dM}{dt}a$ d. $F = -\frac{dM}{dt}v$

4. The ratio of the moment of inertia of a solid sphere about its diameter to its tangent is ----.
   a. $\frac{2}{3}$ b. $\frac{2}{5}$
   c. $\frac{2}{7}$ d. $\frac{1}{6}$

5. The power of activity P is given by ----------.
   a. $P = \vec{F}.\vec{V}$ b. $P = \vec{F}.\frac{\vec{dr}}{dt}$
   c. $P = -\vec{F}.\vec{V}$ d. $P = -\vec{F}.\frac{\vec{dr}}{dt}$

6. The ratio of gravitational potential at the centre of the solid sphere to the gravitational potential on the surface of the sphere is --------.
   a. 1:2
   b. 2:1
   c. 2:3
   d. 3:2

7. Two identical spheres are placed in contact with each other. The force of gravitation between the spheres will beproportional to (R = radius of each sphere)
   a. R
   b. R^2
   c. R^4
   d. None of the mentioned

8. The law of conservation of energy is -------.
   a. independent of the Galilean transformation equation.
   b. not invariant to the Galilean transformation equation.
   c. invariant to the Galilean transformation equation.
   d. all of the above

9. On being slightly disturbed from its equilibrium position, if a body tends to acquire the original configuration, then the body is said to be in
   a. Stable equilibrium
   b. Unstable equilibrium
   c. Neutral equilibrium
   d. All of the above

10. What do take off in a jet airplane, riding a merry-go-round, and the circular motion of a tropical cyclone have in common? Each exhibit----------.
   a. Centrifugal force
   b. Coriolis force
   c. Real force
   d. None of the above

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Descriptive

Time : 1 hr. 15min. Marks : 25

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

1. a. Discuss the condition of stable and unstable equilibrium in a potential energy curve. **2.5+2.5 =5**

   b. Discuss the theorem of the parallel and perpendicular axis.

2. a. Show that acceleration is invariant under Galilean transformation. **3+4+3 =10**

   b. What is work-energy theorem?

   c. Discuss about inelastic collision with suitable examples.

3. a. Calculate the moment of inertia of a circular lamina or disc: **6+4=10**
   (i) about an axis through its center and perpendicular to its plane
   (ii) about a diameter.

4. Derive the expression of gravitational potential due to a spherical shell of mass M and radius R **6+2+2 =10**
   a. At a point outside the shell
   b. At a point on the surface of the shell
   c. At a point inside the shell

5. a. Discuss about Coriolis force and obtain an expression for Coriolis acceleration and Coriolis force. **5+5=10**

   b. Find the velocity of a rocket in terms of its mass. (neglecting the weight of the rocket)

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