

**IMAYAM ARTS AND SCIENCE COLLEGE**  
**KANNANUR, THURAIYUR-621206**  
**SEMESTER-II**  
**MECHANICS**

**16SCCPH2**

**2 Marks**

**UNIT I- Projectile, Impulse and Impact**

**1. What is Projectile? Give some examples.**

A projectile is any object that is cast, fired, flung, heaved, hurled, pitched, tossed, or thrown. (or) A projectile is any object with an initial non-zero, horizontal velocity whose acceleration is due to gravity alone.

Some examples of projectiles are

- a baseball that has been pitched, batted, or thrown
- a bullet the instant it exits the barrel of a gun or rifle
- a bus driven off an uncompleted bridge
- a moving airplane in the air with its engines and wings disabled.
- the space shuttle or any other spacecraft after main engine cut off.

**2. What is Trajectory?**

The path of a projectile is called its trajectory.

**3. Define Angle of projection.**

When a particle is projected in any direction from a point on the earth, the angle which the direction of projection makes with the horizontal plane through the point of projection is called the angle of projection.

**4. What is called Range?**

The distance measured from the point of projection to the point where the particles reached the horizontal plane through the point of projection is called the Range on the horizontal plane.

**5. What is Time of flight?**

The interval of time from the instant of projection to the instant the particle reaches the horizontal plane through the point of projectile is Called the Time of flight.

**6. What is meant by impulse of a force? Give its Unit.**

Impulse is the change of momentum of an object when the object is acted upon by a force for an interval of time.

The SI unit of impulse is the newton second (N·s)

**7. What is impulse and impulsive force? Give example.**

Impulse of a force is the force multiplied by the duration of time for which it acts. Impulsive force is a big force acting for a short time. It is measured by the change of momentum in the body it acts on.

Example:

The stroke of a hammer (or) a one-time push given by a railway engine to a coach.

## UNIT II Motion on a plane curve

### 1. What is centripetal force and example?

The component of force acting on an object in curvilinear motion which is directed toward the axis of rotation or center of curvature.

**Example:** The force of gravity acting on a satellite in orbit is an example of a centripetal force; the friction of the tires of a car making a turn similarly provides centripetal force on the car.

### 2. What is Centrifugal Force?

The apparent force, which is equal in magnitude and opposite in direction to the centripetal force drawing a rotating object away from the center of rotation, caused by the inertia of the object. Centrifugal force unit is **Newton**.

### 3. Differences Between Centripetal and Centrifugal Force.

Centrifugal Force	Centripetal Force
If an object moving in a circle and experiences an outward force than this force is called the <b>centrifugal force</b>	If the object travels in a uniform speed in a circular path is called <b>centripetal force</b> .
The object has the direction along the centre of the circle from the centre approaching the object	The object has the direction along the centre of the circle from the object approaching the centre.
Mud flying of a tire is one example of the centrifugal force.	A satellite orbiting a planet is an example of the centripetal force.

### 4. Define Hodograph.

A hodograph is a diagram that gives a vectorial visual representation of the movement of a body or a fluid.

### 5. What is meant by acceleration due to gravity?

The acceleration which is gained by an object because of gravitational force is called its acceleration due to gravity.

Its SI unit is  $m/s^2$

## UNIT III Gravitation

### 1. What is Gravitation?

Gravitation is the fundamental force of attraction between objects having masses.

### 2. State Newton's law of Gravitation.

Every particle of matter in the universe attract every other particle with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

### 3. Define Gravitational constant (G).

The Gravitational constant is equal to the force of attraction between two unit masses of matter unit distance apart.

### 4. Dimensional formula for G.

$$G = \frac{Fr^2}{m_1 m_2}$$

$$G = \frac{MLT^{-2}L^2}{M^2}$$

$$= M^{-1}L^3T^{-2}$$

### 5. Define Inertial Mass.

The mass of a body may be determined by measuring the acceleration **a** produced on it by a known force **F**.

### 6. Define Gravitational Mass.

The mass of a body may also be determined by measuring the gravitational force exerted on it by earth.

### 7. State Kepler's Law of planetary motion.

i) Every planet moves in an elliptical orbit around the sun, the sun is being at one of the foci.

ii) The radius vector drawn from the sun to a planet sweeps out equal areas in equal interval of time

iii) The Square of the period of the revolution of the planet around the sun is proportional to the cube of the semi major axis of the ellipse.

### 8. Write the advantages of Boy's experiment.

1. The size of the apparatus is very much reduced.
2. By arranging the masses at different levels the effect of the attraction of the heavier mass on the remote smaller mass is very much reduced.
3. By the lamp and scale arrangement very small deflections can be measured accurately.
4. The use of a quartz fibre has made the apparatus very sensitive and accurate.

### 9. Define Gravitational Field.

The space around a body within which its gravitational force of attraction is perceptible is called its gravitational field.

### 10. Define Gravitational Potential.

The work done in moving a unit mass from infinity to a point in a gravitational field is called the gravitational potential at that point.

### 11. Define Escape Velocity.

The minimum velocity that a moving body (such as a rocket) must have to escape from the gravitational field of a celestial body (such as the earth) and move outward into space.

**12. Define Orbital Velocity.**

Orbital velocity is the velocity at which a body revolves around the other body.

**13. Define equipotential surface.**

An equipotential surface is the surface at all the points of which the gravitational potential is the same.

**UNIT IV Dynamics of rigid body and Friction**

**1. What is moment of Inertia?**

Moment of inertia is defined with respect to a specific rotation axis. The moment of inertia of a point mass with respect to an axis is defined as the product of the mass times the distance from the axis squared.

**2. What is angular momentum?**

The property of any rotating object given by moment of inertia times angular velocity.

**3. State Parallel axes theorem.**

The moment of inertia of a body about an axis parallel to the body passing through its center is equal to the sum of moment of inertia of body about the axis passing through the center and product of mass of the body times the square of distance between the two axes.

$$I = I_0 + Ma^2$$

**4. State Perpendicular axes theorem.**

For any plane body the moment of inertia about any of its axes which are perpendicular to the plane is equal to the sum of the moment of inertia about any two perpendicular axes in the plane of the body which intersect the first axis in the plane.

$$I_z = I_x + I_y$$

**5. What is compound Pendulum?**

A Compound pendulum consist of a rigid body capable of rotation about a fixed horizontal axis under gravity.

**6. Define Centre of Suspension.**

The point O where the axis of rotation meets the vertical plane through the centre of gravity G of the rigid body is called the centre of suspension.

**7. Define centre of persuption.**

When a body is capable of rotation about a fixed axis is given a blow at a suitable point such that there is no impulsive force exerted on the fixed axis, that point is Known as the centre of persuption.

**8. What is equivalent simple pendulum?**

A simple pendulum which has the same period as the given compound pendulum is called the equivalent simple pendulum.

### 9. What is centre of oscillation?

The centre of Oscillation is obviously a point at which the mass of the body may be considered to be concentrated without any change in the periodic time.

### 10 What is Friction?

The force that opposes the motion of an object is called **friction**.

### 11. What is cone of friction?

A **cone** in which the resultant force exerted by one flat horizontal surface on another must be located when both surfaces are at rest, as determined by the coefficient of static **friction**.

### 12. What do you mean by angle of friction?

**Angle of friction** is defined in the context of motion on inclined plane. The minimum **angle** of incline for which a body placed on it just starts sliding without any external force is called the **angle of friction**.

## UNIT V Centre of gravity, Centre of Pressure, Floating bodies, Atmospheric pressure

### 1. Define Centre of Gravity.

The centre of gravity of a body may therefore be defined as a point through which the line of action of the weight of the body always passes in whatsoever manner the body is placed.

### 2. Define centre of Pressure.

The centre of pressure of a plane surface in contact with a fluid is a point on the surface through which the line of action of the resultant of the thrusts on the various elements of the area passes.

### 3. Conditions of equilibrium of a floating body.

The body floating freely in a liquid is in equilibrium under the action of the following two forces.

- i) The weight of the body acting vertically downwards through the centre of gravity
- ii) The resultant upthrust on the body due to the liquid acting vertically upwards through the centre of buoyancy.

### 4. Laws of floatation.

1. The weight of the liquid displaced will be equal to the weight of the floating body.
2. The centre of gravity of the floating body and that of the displaced liquid will be in the same vertical line.

### 5. What is a barometer and what is it used for?

**Barometer**, device **used** to measure atmospheric pressure. Because atmospheric pressure changes with distance above or below sea level, a **barometer** can also be **used** to measure altitude. There are two main types of **barometers**: mercury and aneroid.

### 6. What is barometer and how it works?

The **barometer works** by balancing the weight of mercury in the glass tube against

the atmospheric pressure, much like a set of scales. ... If the weight of mercury is less than the atmospheric pressure, the mercury level in the glass tube rises (high pressure).

### **5 Mark Questions:**

#### **UNIT I Projectile, Impulse and Impact**

1. Explain particle projected in any direction.
2. Describe Range of a projectile on plane inclined to the horizontal.
3. Derive Impact of a smooth sphere on a smooth fixed horizontal plane.
4. Obtain an expression for Loss of KE due to direct impact.
5. Obtain an expression for Loss of KE due to Oblique impact.

#### **UNIT II Motion on a plane curve**

1. Write a note on Hodograph.
2. Derive an expression for Expression for normal acceleration.
3. Explain Motion of a cyclist along a curved path.
4. Explain upsetting of a carriage.

#### **UNIT III Gravitation**

1. Deduction of Newton's law of gravitation from Kepler's Law.
2. Explain gravitational potential due to a point mass.
3. Write a note on Equipotential surface.
4. Write a note on Escape velocity -Orbital velocity.

#### **UNIT IV Dynamics of rigid body and Friction**

1. Derive Kinetic energy of rotating body.
2. Explain Theorems of perpendicular and parallel axes.
3. Explain Acceleration of a body rolling down an inclined plane without slipping.
4. Explain Oscillations of a small sphere on a large concave smooth surface.
5. Explain Kater's pendulum.
6. Explain the Laws of friction.
7. Write a note on The friction clutch.

#### **UNIT V Centre of gravity, Centre of Pressure, Floating bodies, Atmospheric pressure**

1. Explain Centre of gravity of a body.
2. Derive Centre of gravity of a trapezoidal lamina.
3. Derive Centre of pressure - rectangular lamina
4. Derive CP of triangular lamina.
5. Explain Conditions of equilibrium of a floating body.
6. Stability of equilibrium of a floating body.
7. Write about Faulty barometer.
8. Explain about Variation of atmospheric pressure with altitude.

9. Write a note on barometer.

**10 MARKS**

**UNIT I Projectile, Impulse and Impact**

1. Derive Path of a projectile is a parabola.
2. Derive Direct impact between two smooth spheres.
3. Derive oblique impact between two smooth spheres.

**UNIT II Motion on a plane curve**

4. Motion of a railway carriage round a curved track.
5. Motion of a carriage on a banked up curve.
6. Explain Effect of earth's rotation on the value of the acceleration due to gravity.
7. Derive Variation of 'g' with altitude, latitude and depth.

**UNIT III Gravitation**

8. Determination of G-Boy's experiment.
9. Derive an expression for Gravitational potential and field due to a spherical shell.
10. Derive an expression for Gravitational potential and field due to a solid sphere.

**UNIT IV Dynamics of rigid body and Friction**

11. Explain the theory of Compound pendulum – Centre of suspension and centre of oscillation.
12. Explain Equilibrium of a body on a rough plane inclined to the horizontal.

**UNIT V Centre of gravity, Centre of Pressure, Floating bodies, Atmospheric pressure**

13. Derive C.G. of a solid hemisphere .
14. Derive C.G. of a solid tetrahedron.
15. Derive C.G. of a solid cone.
16. Derive Centre of pressure triangular lamina immersed in a liquid.
17. Experimental determination of a metacentric height of a ship.
18. Write a note on Fortin's barometer - Correction for a barometer.

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