

GE8292 Engineering Mechanics

Two Marks Question Bank

UNIT-I Basics and statics of particles

1. Define Engineering Mechanics

Engineering Mechanics is defined as the branch of physical science which deals with the behaviour of a body at rest or motion under the action of forces.

2. What are the branches of Engineering Mechanics?

1. Rigid body Mechanics
2. Deformable body mechanics (also called strength of materials)
3. Fluid Mechanics

3. What are the branches of Rigid body Mechanics?

1. Statics
2. Dynamics

4. Define statics

Statics is defined as the branch of rigid body mechanics, which deals with the behaviour of a body when it is at rest.

5. Define Dynamics

Dynamics is defined as the branch of rigid body mechanics which deals with the behaviour of a body when it is in motion.

6. Distinguish between particle and Rigid body

A body of negligible dimension is called a particle. A large number of particles which occupy fixed positions with respect to each other both before and after applying a load is called Rigid body

7. The Quantity which has only magnitude is called (Ans: Scalar)

8. Vector Quantity has both (Ans: Magnitude and direction)

9. Define Force.

Force is defined as an agent which changes or tends to change the state of rest or of uniform motion of a body. It represents the push or pull exerted by one body on another. It is a vector quantity.

10. What are the characteristics of a force?

1. Magnitude
2. Line of action
3. Direction & angle of inclination

11. State Newton's laws of motion

Newton's first law: Everybody preserves in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed there on.

Newton's second law : The acceleration of a particle will be proportional to the force and will be in the direction of the force (ie. $F = ma$)

Newton's third law: To every action there is an equal and opposite reaction.

12. State the Principle of transmissibility.

It state that “any force at a point on a rigid body can be transmitted to act at any other point along its line of action without changing its effect on the rigid body”

13. What is collinear force system?

Force acts on a common line of action.

14. What is like parallel forces?

The parallel force which acts in the same direction are called like parallel forces.

15. What is unlike parallel forces?

The parallel force which acts in the opposite direction are called unlike parallel forces.

16. Two vectors are equal if

Ans: Their magnitudes, direction and the sense are the same and lie anywhere in space)

17. If $\vec{A} = 4\mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$ and $\vec{B} = 3\mathbf{i} - 2\mathbf{j} + 4\mathbf{k}$ find $\vec{A} \cdot \vec{B}$ and $\vec{A} \times \vec{B}$

Ans: $\vec{A} \cdot \vec{B} = (4 \times 3) - 14 + (3 \times -2) + (-5 \times 4) = -14$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 4 & 3 & -5 \\ 3 & -2 & 4 \end{vmatrix}$$

$$= \mathbf{i}(12 - 10) - \mathbf{j}(16 + 15) + \mathbf{k}(-8 - 9) = 2\mathbf{i} - 31\mathbf{j} - 17\mathbf{k}$$

18. the direction angles of a line are, $Ox = 65^\circ$, $Oy = 110^\circ$. Find Oz

$$\begin{aligned} \cos^2 65^\circ + \cos^2 110^\circ + \cos^2 O_z &= 1 \\ \cos 65^\circ + \cos 110^\circ + \cos O_z &= 1 \\ 0.1786 + 0.1168 + \cos^2 O_z &= 1 \\ 0.2954 + \cos^2 O_z &= 1 \\ \cos^2 O_z &= 0.7046 \\ O_z &= 32.94^\circ \text{ or } 147.1^\circ \end{aligned}$$

19. What is coplanar force system?

In coplanar force system, lines of action of all forces lie on a single plane.

20. What is Non-coplanar (or spatial) force system?

In Non-coplanar (or spatial) force system, lines of action of all forces lie on different planes

21. What is collinear force system?

In collinear force system, all the forces lie on a single line.

22. What is concurrent force system?

In concurrent force system, lines of action of all forces intersect at a point.

23. What is parallel force system?

In parallel force system, lines of action of all forces are parallel to each other.

24. State Newton's law of Gravitation?

It states that two particles of mass m_1 and m_2 are mutually attracted with equal and opposite forces.

25. State the difference between internal and external forces.

External forces: The forces which represent the action of other bodies on the rigid body considered and which are responsible for the external behaviour of the rigid body are called as 'External forces'.

Internal forces:

The forces which hold together the forming the rigid body or holding the component parts together are called as internal forces.

26. Define resultant force?

Resultant force is a single equivalent force which can replace the given force system for an equivalence of effect

27. State parallelogram law of forces?

It states that "If two forces acting simultaneously on a particle be represented in magnitude and direction by the two adjacent sides of a parallelogram their resultant may be represented magnitude and direction by the diagonal of the parallelogram which passes through their point of intersection."

28. State triangle law of forces?

It states that "If two forces acting simultaneously on a particle represented in magnitude and direction by the two sides triangle, taken in order, their resultant may be represented magnitude and direction by the third side of the triangle, taken opposite order".

29. State polygon law of forces?

It states that "If a number of forces acting simultaneously on a particle be represented in magnitude and direction, by the sides of a polygon taken in order, then the resultant of all these forces may be represented in magnitude and direction, by the closing side of the polygon, taken in opposite order".

30. State the principle of resolution?

The algebraic sum of the resolved parts of a number of forces in a given direction is equal to the resolved part of their resultant in the same direction of their resultant and in the same direction.

31. What is the significance of parallelogram law in statics of particles?

Parallelogram law is used to find the resultant of two concurrent coplanar forces It can be applied by both analytically and graphically.

32. Define equilibrium?

A body is said to be in a state of equilibrium, if the body is either at rest or is moving at a constant velocity.

33. State Lami's theorem?

It states that, "If three coplanar forces acting at a point be in equilibrium, then each force is proportional to the sine of the angle between the other two".

$$P/\sin\alpha = Q/\sin\beta = R/\sin\gamma$$

34. What is two force equilibrium principles?

If a body is in equilibrium acted upon by two forces they must be of collinear forces of equal magnitude and opposite sense.

35. What is three force equilibrium principles?

If a body is in equilibrium acted upon by three forces, then the resultant of any two forces must be equal, opposite and collinear with the third force.

36. What is four force equilibrium principles?

If a body is in equilibrium, acted upon by four forces, then the resultant of any two forces must be equal, opposite and collinear with the resultant of the other two.

37. What are the three equations of equilibrium?

The algebraic sum of the horizontal forces must be zero.
ie., sum of the left hand side forces must be equal to sum of the right hand side forces.

$$2. \Sigma V = 0 (\uparrow \quad \downarrow)$$

The algebraic sum of the vertical forces must be zero.
ie. Sum of the upward forces must be equal to sum of the downward forces

$$3. \Sigma M = 0$$

The algebraic sum of the moments about a point must be zero
ie., sum of the clockwise moments about a point must be equal to sum of the anticlockwise moments about the same Point.

38. What is stable equilibrium?

A body is said to be in stable equilibrium, if it returns back to its original position after it is slightly displaced from its position of rest.

39. What is unstable equilibrium?

A body is said to be in unstable equilibrium, if it does not return back to its original position and heels farther away after slightly displaced from its position of rest.

40. What is neutral equilibrium?

A body is said to be in neutral equilibrium, if it occupies a new position (also remains at rest) after slightly displaced from its position of rest..

41. What is Free body diagram?

Its a sketch of the particle which represents it as being isolated from its surroundings. It represents all the forces acting on it

UNIT - IIEquilibrium of Rigid bodies

1. The position vector and force are $2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$ and $120\mathbf{i} - 260\mathbf{j} + 320\mathbf{k}$ respectively. Find the moment of the Force about the origin. And also find the scalar quantity of the moment.

$$\begin{aligned}\overrightarrow{Mo} &= \overrightarrow{r} \times \overrightarrow{F} \\ &= 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k} \times 120\mathbf{i} - 260\mathbf{j} + 320\mathbf{k} \\ &= \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & -3 & 4 \\ 120 & -260 & 320 \end{vmatrix} \\ &= 80\mathbf{i} - 160\mathbf{j} - 160\mathbf{k}\end{aligned}$$

$$\begin{aligned}\text{Scalar quantity} &= \sqrt{M^2_x + M^2_y + M^2_z} \\ &= \sqrt{80^2 + (-160)^2 + (-160)^2} = 240 \text{ units}\end{aligned}$$

2. In the above problem, find the angles made by the moment along x, y and z axes

$$\begin{aligned}\phi_x &= \cos^{-1}(M_x/M) = \cos^{-1}(80/240) = 70.52^\circ \\ \phi_y &= \cos^{-1}(M_y/M) = \cos^{-1}(-160/240) = 131.8^\circ \\ \phi_z &= \cos^{-1}(M_z/M) = \cos^{-1}(-160/240) = 131.8^\circ\end{aligned}$$

3. Find the unit vector along the force $\overrightarrow{F} = 2\mathbf{i} + 3\mathbf{j} + 5\mathbf{k}$

$$\begin{aligned}\text{Unit vector } \lambda &= 2\mathbf{i} + 3\mathbf{j} + 5\mathbf{k} / \sqrt{2^2 + 3^2 + 5^2} \\ &= 0.324\mathbf{i} + 0.489\mathbf{j} + 0.811\mathbf{k}\end{aligned}$$

4. Define the term couple?

A couple is that two forces are of equal magnitude opposite sensed parallel forces, which lie in the same plane.

5. What are the characteristics of a couple?

1. The algebraic sum of the forces is zero.
2. The algebraic sum of the moments of the forces about any point is the same and equal to the moment of the couple itself.

6. State Varignon's theorem?

Varignon's theorem: if a number of coplanar forces are acting simultaneously on a body, the algebraic sum of the moments of all the forces about any point is equal to the moment of the resultant force about the same point.

7. Define moment of a force?

The moment of a force about a point is defined as the turning effect of the force about that point.

$$\text{Moment} = \text{Force} \times \text{Perpendicular distance}$$

8. For what condition the moment of a force will be zero?

A force produces zero moment about an axis or reference point which intersects the line of action of the force.

9. What is the difference between a moment and a couple?

The couple is a pure turning effect which may be moved anywhere in its own plane, or into a parallel plane without change of its effect on the body, but the moment of a force must include a description of the reference axis about which the moment is taken.

10. What is the difference between a fixed vector and a free vector?

A force which is applied at a particular location on a body is a fixed vector.

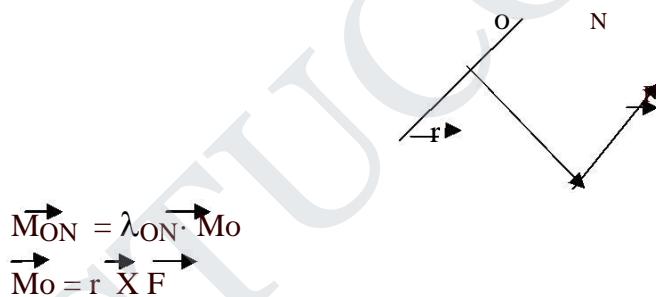
Example: A moment.

A force which can be moved anywhere in its own plane or in a parallel plane without change in its effect on the body is called free vector.

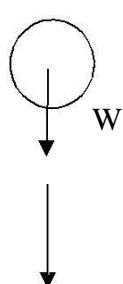
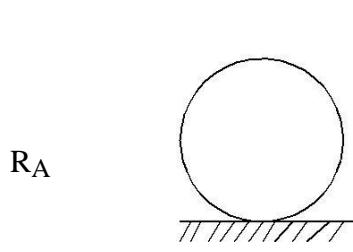
Example: A couple.

11. Explain the concept of moment of a force about an axis.

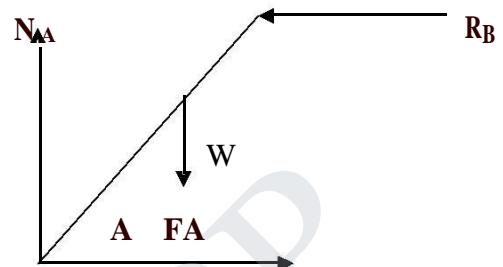
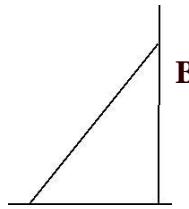
Moment of a force about an axis is a measure of the tendency of the force to rotate a body about that axis. If M_O is the moment of the force F about O , then moment of the force about the axis ON is,

**12. State the requirements for equilibrium of a body acted upon by a parallel force system?**

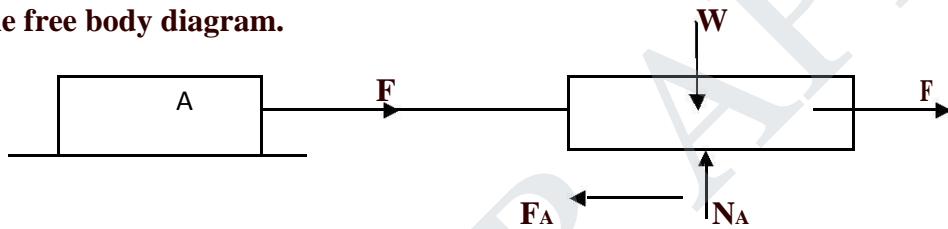
1. The algebraic sum of the forces is zero.i.e., $\sum F = 0$.
2. The algebraic sum of the moments about any point is zero. i.e., $\sum M = 0$.

13. Draw the free body diagram of a ball (sphere) of weight W, resting on a frictionless plane surface shown below.

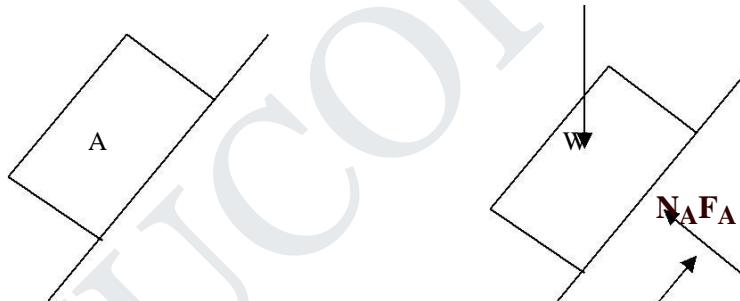
14. Draw the free body diagram of a ladder of weight W , leaning against a smooth wall, shown below.



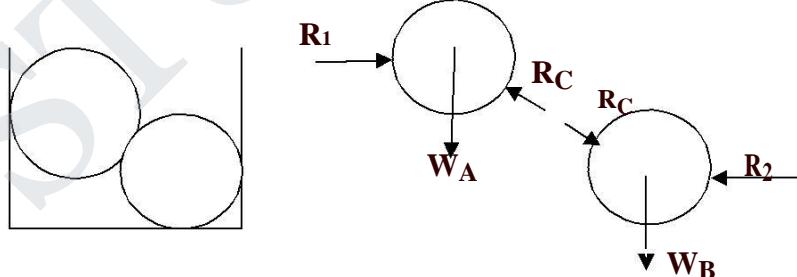
15. A block of weight W , kept on a levelled rough surface is acted upon by a tensile force F . Draw the free body diagram.



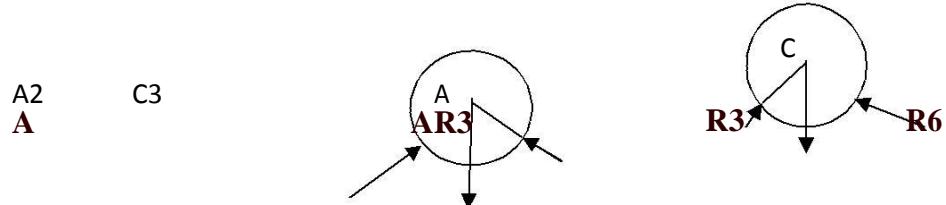
16. If the above block rests on an inclined rough surface, draw the free bodies diagram

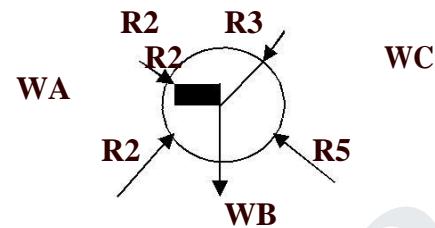
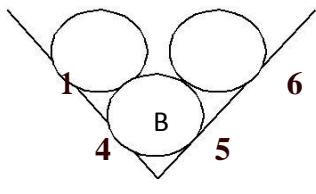


17. Refer the figure shown below and draw the free body diagram



18. Refer the figure shown below and draw the free body diagram





19. What are the necessary and sufficient conditions for the equilibrium of a rigid body in three dimensions?

$$\begin{array}{ll} \sum F_X = 0 & \sum M_X = 0 \\ \sum F_Y = 0 & \sum M_Y = 0 \\ \sum F_Z = 0 & \sum M_Z = 0 \end{array}$$

20. What are the common types of supports used in two dimensions?

1. Roller support
2. Hinged support
3. Fixed support

21. What are the common types of supports used in three dimensions?

1. Ball support
2. Ball and Socket support
3. Fixed (or Welded) support

22. Define equilibrant?

The force which brings the system of forces into equilibrium is called equilibrant. It is equal to the resultant force in magnitude collinear but opposite in nature.

23. What are the common types of loads?

1. Point load (or concentrated load)
2. Uniformly distributed load
3. Uniformly varying load

24. What is statically determinate structure?

A structure which can be completely analysed by static conditions of equilibrium ($\sum H = 0$; $\sum V = 0$ and $\sum M = 0$) alone is statically determinate structure.

UNIT -III **Properties of Surfaces and Solids**

1. Define Centre of Gravity.

Centre of Gravity is an imaginary point at which the entire weight of the body is assumed to act.

2. Define Centre of mass.

Centre of mass is the point where the entire mass of a body is assumed to be concentrated.

3. Define Centroid.

Centre of gravity of a plane figure is referred as centroid. Centroid is the point at which the entire area of the figure is assumed to be concentrated

4. Differentiate centroid and Centre of gravity

Centroid is the geometric property of geometrical figures line, area and volume. Centre of gravity is the physical property of a body like wire, rod, disc and solids

5. When centroid and centre of mass coincide?

Centroid and centre of mass coincide when the density of the material is uniform throughout the body.

6. State the methods of determining the centre of gravity?

1. By Geometrical considerations
2. Graphical method
3. Integration method
4. Method of moments

7. Write the expressions to find the co-ordinates of centroid by integration method?

For plane figure $\bar{X} = \frac{\int x s dA}{\int dA}, \quad \bar{Y} = \frac{\int y s dA}{\int dA}$

For solid figure, $\bar{X} = \frac{\int x s dm}{\int dm}, \quad \bar{Y} = \frac{\int y s dm}{\int dm}$

8. Write the expressions to find centroid of a composite plane figure?

$$\bar{x} = \frac{\text{sum of first moment of the area about } y \text{ axis}}{\text{Total area}}$$

$$= \frac{a_1 x_1 \pm a_2 x_2 \pm}{a_1 \pm a_2}$$

$$\bar{y} = \frac{\text{sum of first moment of the area about } y \text{ axis}}{\text{Total area}}$$

$$= \frac{a_1 y_1 \pm a_2 y_2 \pm}{a_1 \pm a_2}$$

9. The centre of gravity of an equilateral triangle with each side measuring 'a' is _____ from any of the three sides. (Ans: $a/2\sqrt{3}$)**10. State Pappus and Guldinus theorems.**

Theorem I: The area of the surface generated by revolving a plane curve about a non intersecting axis in the plane of the curve is equal to the product of length of the curve and the distance travelled by the centroid G of the curve during revolution.

$$A = L(\bar{x}\theta)$$

Theorem II: The volume of the solid generated by revolving a plane area about a non intersecting axis in its plane is equal to the product of area and length of the path travelled by centroid G of the area during revolution. $V = A(\bar{x}\theta)$

11. What is Axis of revolution?

The fixed axis about which a plane curve (may be of an arc, straight line etc.,) or a plane area is rotated is known as axis of revolution

12. Define Axis of Symmetry?

The axis about which similar configuration exist with respect to shape, size and weight on either side is known as axis of symmetry. It may be horizontal, vertical or inclined

13. Define moment of inertia of a body.

Moment of inertia (I) about an axis is the algebraic sum of the products of the elements of mass and the square of the distance of the respective element of mass from the axis.

14. Define Radius of gyration

Radius of gyration of any Lamina defined as the distance from the elemental parts of the lamina would about a given axis may be given axis at which all the have to be placed, so as not to alter the moment of inertia about the given axis.

Radius of gyration $k = \sqrt{I/A}$

Where I = Moment of inertia

A = Total area of the plane

15. State parallel axis theorem?

Parallel axis theorem states that “ if the moment of inertia of a plane area about an axis through its centroid be denoted by I_G , the moment of inertia of the area about an axis AB, parallel to the first and at a distance ‘ h ’ from the centroid is given by ,

$$I_{AB} = I_G + Ah^2$$

16. State perpendicular axis theorem?

It states that “if I_{XX} and I_{YY} be the moment of inertia of a plane section about two perpendicular axis meeting at ‘O’ the moment of inertia I_{ZZ} about the axis Z-Z perpendicular to the plane and passing through the intersection of X-X and Y-Y is given by the relation,

$$I_{ZZ} = I_{XX} + I_{YY}$$

17. Define polar moment of inertia?

The second moment of area about a pole 'O' is called the polar moment of inertia (I_p).

$$I_p = I_{XX} + I_{YY}$$

18. Unit of moment of inertia is _____ (Ans: mm⁴ (or) cm⁴ (or) m⁴)

19. Radius of gyration of a plane area with respect to X-X axis (K_x) is ----- $\sqrt{I_{XX}/A}$

20. Radius of gyration of a plane area with respect to Y-Y axis (K_y) is ----- $\sqrt{I_{YY}/A}$

21. Radius of gyration of a plane area with respect to polar axis (K_o) is ----- $K_x^2 + K_y^2$

22. Mass moment of inertia, I_{XX} =----- (ans:

23. The Radius of gyration of the mass of a body with respect to x-x axis is $\sqrt{I/m}$

24. Polar moment of inertia of a circle of diameter, d is ----- (ans: $A = \pi d^2/32$)

25. Moment of inertia of a rectangle about the base is ----- times that of through the centre of gravity (ans: 4)

26. The product of inertia of a rectangle of a plane figure about XX axis and YY axis I_{XY} = -
(Ans: $\int xy \, dA$)

27. The unit of product of inertia is same as that of ----- (Ans: moment of inertia)

28. Product of inertia of a rectangle about their edges= ----- (Ans: $b^2 h^2 / 4$)

29. Parallel axis theorem concerning to product of inertia is ----- ($I_{MN} = I_{xy} - \bar{A}\bar{x}\bar{y}$)

30. Second moment of area with respect to a set of perpendicular axes is known as-----
(Ans: Product of inertia)

31. The axes about which the product of inertia is zero are called----- (Ans: principal axes)

32. Moment of inertia with respect to the principal axes is known as-----
(Ans: Principal moment of Inertia)

33. Mass M.I of thin plate about any axis----- (Ans: volume x Density x Area M.I of the plate about the same axis)

UNIT-IV **Dynamics of Particles**

1. Define 'speed'

The rate of change of displacement of a body irrespective of its direction is called speed. It's a scalar quantity

2. Define velocity

The rate of change of displacement of a body with respect to its surroundings in a particular direction is called the velocity. It is a vector Quantity.

3. Define acceleration

The rate of change of velocity of a body is called acceleration.

4. Define uniform acceleration

If a body moves in such a way that its velocity changes equal in magnitude in equal intervals of time, the body is said to be moving with a uniform acceleration.

5. Define variable acceleration.

If a body moves in such a way that its velocity changes unequal in magnitude in equal intervals of time, the body is said to be moving with a variable acceleration.

6. Write the equations of plane motion?

$$1. v = u + at$$

$$2. s = ut + \frac{1}{2}at^2$$

$$3. v^2 = u^2 + 2as$$

Where

v=Final velocity

u =Initial velocity

a=acceleration

t=time taken for displacement

S=distance travelled.

7. Write the equations of motion of a body under the force of gravity?

$$1. v = u + gt$$

$$2. h = ut + \frac{1}{2}gt^2$$

$$3. v^2 = u^2 + 2gh$$

8. Write the equations of motion of a body against the force gravity?

$$1. v = u - gt$$

$$2. h = ut - \frac{1}{2}gt^2$$

$$3. v^2 = u^2 - 2gh$$

9. Distance travelled by a body in the n^{th} second of its motion is ----- ($(u+a/2(2n-1))$)**10. Define projectile**

A particle, moving under the combined effect of vertical and horizontal forces is called a projectile

11. Define trajectory

12. Define Angle of projection

The angle with the horizontal, at which a projectile is projected is known as the angle of projection.

13. Define Range of projectile

The distance between the point of projection and the point where the projectile strikes the ground is known as the Range of projectile.

14. Define velocity of projection?

The velocity with which a projectile is projected is called velocity of projection.

15. Define Time of Flight?

The total time taken by a projectile to reach maximum height and return back to the ground is known as time of flight.

16. Define energy?

It is the capacity to do work

17. Define potential energy?

It is the energy possessed by a body, for doing work, by virtue of its position

18. Define kinetic energy?

It is the energy possessed by a body, for doing work, by virtue of its motion.

19. State the law of conservation of energy?

It states that, "The energy can neither be created nor destroyed, though it can be transformed from one form into any of the form in which the energy can exist."

20. Define power.

21. What is rectilinear motion?

The rate of doing work is called power

The motion of a particle is said to be rectilinear, if it moves along a straight line.

22. What is curvilinear motion?

The motion of a particle is said to be curvilinear, if it moves along a curved path.

22. State the principle of conservation of linear momentum.

It states that, if the resultant force acting on a particle is zero, then the linear momentum of the particle remains constant ie, Final momentum = Initial momentum.

23. States Law of conservation of angular momentum.

The sum of the moments about '0' of the forces acting on the particle is equal to twice the rate of change of angular momentum of the particle about '0')

24. State the principle of work and energy.

It states that "when a particle moves from position, S₁ to S₂ under the action of a force F, the change in kinetic energy of the particle is equal to the force F"

25. What is conservative force?

A force F is said to be conservative, when the force components are derivable from a potential and the work done by the force F between any two points is independent of the path followed

26. States Theorem of conservation of energy.

When a particle is acted upon by conservative forces, the sum of the particle's kinetic and potential energy remains constant during the motion

27. Define Impulse of a force.

When a large force acts over a short period of time, that force is called an impulsive force

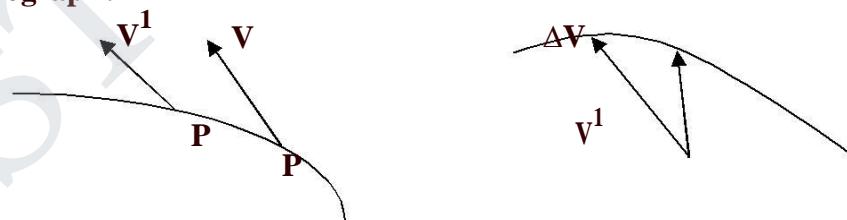
Thus, Impulse force $\int_{t_1}^{t_2} F dt$

28. What is co-efficient of restitution?

The ratio of the magnitude of the impulses during the restitution period and deformation period is known co-Efficient of restitution.

29. Define Time of restitution?

It is defined as the time taken by two bodies to regain the original shape, after impact.

30. What is hodograph?

Let a particle has a velocity V at time t and a velocity V' ($= V + I:\!l V$) at P and P' respectively as shown in fig (a). To study the time rate of change, the two velocity vectors are plotted such that their tails are located at the fixed point '0' and their arrow heads touch points on the dashed curve as shown in fig (b) This curve is called as Hodograph.

31. Define average velocity.

It is the ratio of displacement and time interval.

Change in position/ Change in time

It can be either positive or negative.

32. Define Instantaneous velocity

It is the limit of average velocity as the increment of time approaches zero. It can be either positive or negative.

33. State D' Alembert's principle.

It states that “The system of forces acting on a body in motion is in dynamic equilibrium, with the inertia force of the body”.

34. What is work-energy equation?

$$P.S = W/2g(v^2 - u^2)$$

P- Force, S-distance travelled

W- Weight of the body, g- acceleration due to gravity

v- Final velocity, u- initial velocity

35. What is Impulse - momentum equation?

$$F.t = m(v - u)$$

F- Impulsive force

m- Mass of the body

v- Final velocity

u- Initial velocity

36. What is line of impact?

It is an imaginary line passing through the point of contact and normal to the plane of contact.

37. What is direct impact?

In direct impact, the velocities of the two colliding bodies, before collision are collinear with the line of impact.

38. What is oblique Impact?

In oblique Impact, the velocities of the two colliding bodies, before collision are not collinear with the line of impact

39. What is central impact?

In central impact, the line of impact passes through the mass centres of the bodies

40. What is Non-central Impact?

In Non - central impact, the line of impact does not pass through the mass centres of the bodies.

41. What is direct central impact?

In direct central impact, the velocities of the colliding bodies are directed along the line of impact and the line of impact passes through the mass centres of the colliding bodies

42. What is oblique central impact?

In Oblique central impact, the velocities of the colliding bodies are not directed along the line of impact but the line of impact passes through the mass centres of the colliding bodies.

43. State Newton's law of collision.

It states that "for two colliding bodies, their relative velocity of separation bears a constant ratio to their relative velocity of approach"

UNIT – V

Friction

1. Define friction

Friction may be defined as a force of resistance acting on a body which prevents or retards slipping of the body relative to a second body or surface with which it is in contact

2. Define static friction

Static friction between two bodies is the tangential force which opposes the sliding of one body relative to the other.

3. Define Dynamic friction or Kinetic Friction.

Dynamic friction is the tangential force between two bodies after motion begins

4. Define Angle of Friction.

Angle of friction is the angle between the line of action of the total reaction of one body on another and the normal to the common tangent between the bodies when motion is impending.

5. Define Limiting Friction

Limiting friction 'F' is the maximum value of static friction that occurs when motion is impending.

6. Define Co-efficient of static friction.

Coefficient of static friction is the ratio of the Static friction to the normal reaction

7. Define coefficient of Dynamic friction.

Coefficient of Dynamic friction is the ratio of the Dynamic friction to the normal reaction

8. Define Angle of repose

Angle of repose (α) is the angle to which an inclined plane may be raised before an object resting on it will move under the action of the force of gravity

9. Define cone of friction.

It is defined as the right circular cone with vertex at the point of contact of the two bodies (or surface) axis in the direction of normal reaction (R) and semi vertical angle equal to angle of friction.

10. Define Solid Friction or Dry Friction.

If between two surfaces, no lubrication (oil or grease) used, the friction that exists between two surfaces is called solid friction.

11. What is the sliding friction?

It is the friction, experienced by a body when it slides over another body.

12. What is Rolling Friction?

It is the friction, experienced by a body when it rolls over the other.

13. State the Laws of static friction?

- a) The force of friction always acts in a direction opposite to that in which the body tends to move.
- b) The Magnitude of the force of friction is equal to the force, which tends to move the body.
- c) Limiting friction bears a constant ratio to the normal reaction between the two surfaces
- d) The force of friction is independent of the area of contact between the two surfaces
- e) The force of friction depends upon the roughness of the surfaces.

14. State the laws of Dynamic friction?

- a) The force of friction always acts in a direction, opposite to that in which the body is moving.
- b) The magnitude of the kinetic friction bears a constant ratio to the normal reaction between the two surfaces.
- c) For moderate speeds, the force of friction remains constant and it decreases with the increase of speed.

15. What is impending motion?

The motion is said to be impending if the applied forces are such that the body is just about to slide

16. State the laws of solid friction?

Laws of static friction

- a) The force of friction always acts in a direction opposite to that in which the body tends to move.
- b) The Magnitude of the force of friction is equal to the force, which tends to move the body.
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Laws of Dynamic friction

- a) The force of friction always acts in a direction, opposite to that in which the body is moving.
- b) The magnitude of the kinetic friction bears a constant ratio to the normal reaction between the two surfaces.
- c) For moderate speeds, the force of friction remains constant and it decreases with the increase of speed.

17. once a body just begins to slide, it continues to slide, because

(Ans: The frictional force becomes less)

18. The force of friction between two bodies in contact is always-----

(Ans: Normal to the surface of their contact)

19. The ratio between the tensions in the tight side and slack side of a flat belt drive increases -----

(Ans: Exponentially as the angle of lap increases)

20. Coefficient of static friction is ----- than coefficient of dynamic friction.

(Ans: Greater)

21. Maximum value of the angle coefficient of friction as of friction is related -----

(Ans: $\tan \phi = \mu$)

22. Angle of repose is equal to----- (Ans: Angle of friction)

23. When a screw is said to be self locking

If the friction angle is larger than the lead angle of screw, the load will remain in place even after the removal of effort. This Condition is said to be self locking.