GOVERNMENT ZIRTIRI RESIDENTIAL SCIENCE COLLEGE

Subject : Mathematics
Paper name : Mechanics
Paper No : MATH/VI/CC/11
Semester : Sixth

A. Multiple choice questions

1. Two equal and unlike parallel forces whose lines of action are not the same are said to constitute a

   (a) Torque
   (b) Moment
   (c) Zero couple
   (d) None of the above.

2. The least force *P* required to pull a body up an inclined plane inclined at an angle a to the horizontal is
   (a) $P = W\sin(\alpha - \lambda)$
   (b) $P = W\sin(\alpha + \lambda)$
   (c) $P = W\cos(\alpha - \lambda)$
   (d) $P = W\cos(\alpha + \lambda)$.

3. A system of force in a plane is equilibrium, if the algebraic sum of the
   (a) Resolved parts in any two parallel direction vanish
   (b) Moment of all the forces with respect to each of the three collinear points are zero
   (c) Moments about each of the two given points not vanished.
   (d) Resolved parts in any two perpendicular directions vanish.

4. Three coplanar forces acting on a rigid body are in equilibrium if
   (a) Two of them forms a couple
   (b) the resultant R vanishes
   (c) all three meet at a point
   (d) two of them meet at a point.

5. If D is any point on the base AB of ΔABC and if CD divides AB into two parts in the ratio m:n and the angle C, into two angles α and β. If θ be the angle with CD makes with AB, then
   (a) (m+n) cotθ = mcotα - ncotβ
   (b) (m+n) cotθ = mcotα + ncotβ
   (c) (m+n) cotθ = mcotA - ncotB
   (d) None of the above.

6. The weight W_1 and W_2 and center of gravity $G_1$and G_2 of two parts of the body , then the center of gravity of the whole body is
   (a) $\bar{x} = \frac{W_1x_1+W_2x_2}{W_1+W_2}$
   (b) $\bar{x} = \frac{W_1x_1-W_2x_2}{W_1+W_2}$
   (c) $\bar{x} = \frac{W_1x_1+W_2x_2}{W_1-W_2}$

(d) $\bar{x} = \frac{W_1x_1 - W_2x_2}{W_1 - W_2}$.

7. Center of gravity of the remaining parts when a circular disc of radius r is cut out of a circle described on the radius of the disc as diameter

   (a) r
   (b) $\frac{r}{6}$
   (c) $\frac{r}{3}$
   (d) $\frac{r}{2}$.

8. Moment of inertia of a solid sphere about a diameter is
   (a)$\frac{4}{3}Ma^2$
   (b) $\frac{1}{4}Ma^2$
   (c) $\frac{2}{5}Ma^2$
   (d) $\frac{1}{2}Ma^2$.

9. The moment of inertia of a circular ring about a diameter is_____ of the moment of inertia of a circular ring through the center and perpendicular to its plane.
   (a) Double
   (b) Half
   (c) One-fourth
   (d) One-sixth.

10. The moment of inertia of a plane lamina about its axis about its axis perpendicularto its plane is equal to _____ .of the moment of inertia about any two axes in the plane that intersect on the first axes.
   (a) the product
   (b) its half
   (c) the sum
   (d) its double.

11. If a curve moves in a curve s=ctanθ with a uniform speed v, then its normal acceleration at the point (c,$\frac{\pi}{4}$) is
   (a) $\frac{v^2}{c}$
   (b) $\frac{v^2}{2c}$
   (c) $\frac{v}{2c}$
   (d) $\frac{v}{c}$

12. If time t is retarded as a function of the velocity v, then the rate of decrease in acceleration is given by
    (a) $f^4 \frac{d^2t}{dv^2}$
    (b) $f^3 \frac{d^2t}{dv^2}$
    (c) $f^2 \frac{d^2t}{dv^2}$
    (d) $f \frac{d^2t}{dv^2}$.

13. If a particle moves so that its normal acceleration is always zero , then the path is
    (a) a circle
    (b) a straight line
    (c) a parabola
    (d) a conic.

14. The rate of change of velocity of a particle moving in a cycloid is constant then,
    (a) The tangential acceleration is constant
    (b) The normal acceleration is constant
    (c) The resultant acceleration is constant
    (d) None of the above.

15. The velocity of a point moving in a plane curve varies as the radius of the curvature , then the direction of motion revolves with
    (a) constant angular velocity
    (b) increasing angular velocity
    (c) retarded angular velocity
    (d) none of the above.

16. The curve path described by the projectile is called
    (a) projectile
    (b) range
    (c) course
    (d) trajectory

17. If a particle is falling down under gravity in a medium its resistance varies as the _____ of velocity.
    (a) square
    (b) cubic
    (c) half
    (d) none of the above.

18. If h and h' be the greatest heights in the two path of a projectile with a velocity for a given range R ,then
    (a)$R = \sqrt{4hh'}$
    (b) $R = \sqrt{2hh'}$

(c) $R = 4\sqrt{hh'}$
(d) $R = 4hh'$

19. The least velocity with which a body can be projected to have a horizontal range R is
(a) $R\sqrt{g}$
(b) $\sqrt{Rg}$
(c) $\sqrt{\frac{R}{g}}$
(d) $\sqrt{\frac{g}{R}}$.

20. A particle of mass m is let fall from a height h in a medium whose resistance is mk (velocity)^2. The terminal velocity of the particle is given by
(a) $\sqrt{\frac{h}{g}}$
(b) $\sqrt{\frac{g}{h}}$
(c) $\sqrt{\frac{k}{g}}$
(d) $\sqrt{\frac{g}{k}}$.

21. If e be the coefficients of the restitution of collision of two perfectly elastic bodies, then
(a) e = -1
(b) e = 1
(c) e = 0
(d) e = $\frac{1}{2}$.

22. A smooth sphere of mass m strikes a plane normally and is rebound. If e is the coefficient of restitution , then the loss of its original KE during the impact is
(a) $\frac{1}{2}e^2$
(b) $\frac{1}{2}(1 - e^2)$
(c) $\frac{1}{2}(1 + e^2)$
(d) None of the above.

23. Two perfectly inelastic body of mass m and 2m moving in the same direction with di
(a) circle
(b) straight line
(c) hyperbola
(d) parabola.

24. The sphere m_1 impinges obliquely on another sphere m_2 which is at rest, if $m_1=em_2$ then the two sphere will move at an angle _____ to each other.
    (a) 30
    (b) 60
    (c) 90
    (d) 120

25. The height to which a ball rebounds when dropped from a height h cm on a horizontal floor is
    (a) eh
    (b) e^2h
    (c) e^3h
    (d) $\frac{h}{e}$

B. Fill in the blank

1. In case of limiting equilibrium of a body on a rough surface, if F be the limiting friction at the point of contact, R be the normal reaction between the bodies and the coefficient of friction, then, $\frac{F}{R}=$_____ .

2. The maximum value of the friction is called_____ .

3. ABCD is a square and forces 3, 7, $5\sqrt{2}$ respectively act along AB, AD, and AC respectively. The magnitude of the resultant force is _____ .
4. The center of gravity of a uniform circular arc in the form of quadrant of a circle is $\bar{x}=$_____ .

5. The distance from origin O of the center of gravity of the quadrant of circle of radius *a* is _____ .
6. Moment of inertia of a uniform triangular lamina about one side is_____ .

7. The velocity at t=3 if the displacement of a particle moving in a straight line $s=t^4-3t^2-2t-13$ is_____ .

8. The velocities of a moving point parallel to the axes of x and y are u=ey and v=ex respectively then the path is_____ .

9. The greatest height attain by the projectile thrown with a velocity u at an angle α with the horizontal is _____ .

10. For a given velocity of projection the maximum range down an inclined plane is three times the range up the inclined plane , then the inclination of the plane to the horizontal is _____ .
11. The time to reach the greatest height is $\frac{u}{\sqrt{2}g}$whrn a particle is projected with a velocity u from the ground at an angle_____ .
12. If f is a continuous function of t_1, then the average value of f over the interval [0,t] is called the _____ of f.
13. A ball of 100gm is thrown horizontally with the velocity 20ms^{-1} and return straight by a wall with velocity 10cms^{-1}, then the force exerted by the wall is_____ dynes.
14. A ball of mass 4 kg moving with a velocity 100cms^{-1} overtakes a ball of mass 6kg moving with a velocity 50cms^{-1} in the same direction. If e= $\frac{1}{2}$, the velocity of the ball after impact is_____ .
15. A smooth sphere impinges directly with velocity u on another sphere of equal masses at rest. If the spheres are perfectly elastic, then the velocity of the second sphere after collision will be_____ .

Key Answers

A. Multiple choice questions

1. (a)	2. (b)	3. (c)	4. (c)	5. (a)
6. (a)	7. (b)	8. (c)	9. (b)	10. (c)
11. (b)	12. (b)	13. (c)	14. (c)	15. (a)
16. (d)	17. (a)	18. (c)	19. (b)	20. (d)
21. (b)	22. (b)	23. (d)	24. (c)	25. (b)

B. **Fill in the blanks**

1. tan α or μ
2. limiting friction
3. $4\sqrt{13}$
4. $\frac{2\sqrt{2}a}{\pi}$
5. $\frac{4\sqrt{2}a}{3\pi}$
6. $\frac{1}{6}Mp^2$
7. 54
8. Conic section
9. $(u^2 \sin^2 \alpha)\frac{1}{2g}$
10. 30°
11. 45°
12. Time average

13. 3000
14. $V_1=55cms^{-1}$ or $V_2=80cms^{-1}$
15. u