DYNAMICS

K1 Level Questions

MULTIPLE CHOICE QUESTIONS

UNIT- 1

1) A particle projected into the air in any direction and with any velocity such a particle to called a ----

   a) **Projectile**
   b) Velocity
   c) Direction
   d) None

2) The ---------to the angle that the direction in which the particle is initially projected makes with the horizontal plane through the points of projection
   a) Velocity of projection
   b) Angle of projection
   c) Projectile
   d) None

3) The maximum horizontal range is --------
   a) u^2/g
   b) u/g
   c) 2u
   d) u^2

4) The path of a projectile a parabola of lacteous rectum
   a) $2u^2\cos^2\alpha/g$
   b) $2u \sin^2\alpha/g$
   c) $2u \cos^2\alpha$
   d) $2u \cos^2\alpha/2g$

5) The path of projectile in the lacteous rectum is independent of the ----------
   a) Velocity of projection
   b) Initial vertical velocity
   c) Vertical velocity
   d) None

6) The time of flight is ----------
   a) 2u/g
   b) 2u sin α
   c) 2u sin α/g
   d) u sin α

7) The projectile time taken to reach the greatest height ------

a) u sin α
b) u sin α/g
c) sin α/g
d) u/g

8) The vertex of the parabola is the height point of the oath in the projectile is --------
a) u^2sin α/2g
b) u sin α/2g
c) $u^2sin^2α/2g$
d) $u^2sin^2α/g$

9) The only force acting on the projectile is gravity and this acts vertically ------
a) Upward
b) Equal
c) Downward
d) None

10) The ---------- is the velocity with which the particle to projected
a) Velocity of projection
b) Angle of projection
c) Projectile
d) None

UNIT- 2

1.$Є_1=Є_2$ the motion are in ____ phase

a) opposite

b) same

c) negative

d) none of these

2.$Є_1=Є_2=∏$ they are in ____ phase

a) same

b) positive

c) opposite

d) none of these

3.The periodic time of P=____

a) √2∏/μ

b) 2∏/√μ

c) 0

d) 1

4. The distance through which the particle moves through from the centre of motion either side of it is called as_____ of the oscilation

a) velocity

b) frequency

c) amplitude

d) force

5. A differential of the form acceleration = μx where μ is ____ number

a) positive

b) negative

c) opposite

d) none of these

6. Frequency is the reciprocal of the period and is equal to ____

a) √μ/2∏

b) 0

c) 1

d) none of these

7. Given Example of SHM _____

a) pendulum

b) violin

c) both a and b

d) none of these

8. Displacement of SHM_____

a) x=a cos √μt

b)-x= a cos √μt

c) 0

d) none of these

9.Resultant force on the mass

a) mg

b) mg-R

c) mg+R

d) none of these

10.Resultant force on the acceleration

a) mg-R/m

b) mg-R

c) mg+R

d) none of these

UNIT- 3

1). In any curve P= is the (p,r) equation to the spiral
a) r^2 sin α
b) r sin α
c) r sin^2α
d) r^2 sin2α

2).In certain curves the relation between P and R is very simple. Such the relation is called
a) polar equation
b) pedal equation
c) equation of rectangular
d) equiangular spiral

3).When the central acceleration pf the distance there will be different apsidal distances
a) one

b) zero
c) two
d)five

4).The magnitude of radial component of velocity is
a) $\dot{r}$
b) ř
c) ṙθ
d) ṙr

5).The magnitude of transverse component of velocity is
a) $r-\theta r$
b) r-rθ
c) r
d) 1/r[d/dt(r^2 Ǿ)]

6).The magnitude of radial component of acceleration is
a) $-r^2$
b) 1/r[d/dt($r^2\theta$)]
c) ṙ
d) none of the above

7).The magnitude of transverse component of acceleration is
a) 1/r[d/dt(r^2)]
b) ř-rǾ^2
c) 1/r[d/dt(rǾ)]
d) ř

8).The magnitude of the resultant velocity of P
a) $\sqrt{(r^2+r^2)}$
b) $\sqrt{(}$ ř+rǾ)^2
c)zero
d) none

9).The magnitude of the resultant acceleration is
a) $\sqrt{(r^2+r^2}$ Ǿ2)
b) one
c) $\sqrt{(}$ [$-r^2$]^2+[1/r[d/dt(r^2)]]^2
d) zero

10) The polar equation to the equiangular spiral is
a) $r = ae^{\theta\cot\alpha}$
b) $r = ae^{\cot\alpha}$
c) $r = abe^{\cot\theta}$
d) one

UNIT- 4

1. Impulsive force I= ?
   a) Ft
   b) FM
   c) MT
   d) (v-u)

2. Example of impulsive force
   a. A force produced by a hammer-blow
   b. The impact of a bullet on a target
   c. Impact of water on a surface
   d. All of the above

3. An implusive force is measured by its
   a. Impulse
   b. Non impulse
   c. Moment
   d. Magnitude

4. The ----------momentum is generate in motion of a short and gun
   a. Backward
   b. Forward
   c. Front
   d. Back

5. The horizontal forward momentum of the shut is equal the ----------backward momentum of the gun
   a. Horizontal
   b. Vertical
   c. Parallel
   d. Intersect

6. Impact of a bullet on a target is
   a. Kinetic energy
   b. Impulsive force
   c. SHM
   d. Projectiles

7. In impulsive force whether a force is a constant its impulsive equal to
    a. Change of momentum produced
    b. Change KE produced
    c. Impact of two bodies
    d. Loss of KE

8. The principles of conservation of ---------- which is used in dealing with problems in which impacts are impulsive force occur
    a. Linear momentum
    b. Conservation momentum
    c. Change of momentum
    d. None of these

9. The impulsive pressure on the ground is -------- to the number of unit of momentum destroyed per sec
    a. Less than
    b. Greater than
    c. Equal
    d. Unequal

10. Change in momentum of an object is equal to the_____
    a. Internal energy
    b. Entropy
    c. Impulse
    d. enthalpy

UNIT- 5

1. If e=1 the loss of kinetic energy is

a) a)Positive
b) B. Negative
c) C. Zero
d) D. None

2. When velocity is not altered by impact and the angle of rejection is equal to

a) **Angle of incidence**
b) Loss of kinetic energy
c) Velocity
d) e

3. If the value e=1 the body is

a) Inelastic
b) Elastic
c) Equal
d) None

4. A solid body has a……shape

a) Definite
b) Infinite
c) Finite
d) None

5. Bodies which e=0 is said to be Inelastic while

a) e=0
b) **e=1**
c) e=π
d) e=1|2

6. The impulse I on the sphere is measured by the

a) Change in momentum
b) Conservation of momentum
c) Line of impact
d) None

7. A body does not come to its original shape is said to be

a) Perfectly elastic
b) Perfectly Inelastic
c) Impinge directly
d) Impinge obliquely

8.When a body completely regains is shape after a collision it is said to be

a. Perfectly elastic
b. Perfectly elastic
c. Impinge
d. None

9.The mutual action between with during the first portion of the impact is often called

a. Force of restitution
b. Force of compression
c. Force of impact
d. None

10.When two elastic body impinge the time during which the impact lasts may be divided into…….. stages

a) 1
b) 3
c) 5
d) **2**

DYNAMICS

K2- level questions

UNIT- 1

1). Define angle of projection.

The angle of projection is the angle that the direction in which the particle is initially projected makes with the horizontal plane through the point of projection.

2). Define velocity of projection.

The velocity of projection is the velocity with which the particle is projected.

3) Define trajectory

The trajectory is the path which the particle describes.

4). Define range on a plane.

The range on a projectile through the point of projection is the distance between the point of projection and the point where the trajectory meets that point.

5). Define time of flight.

The time of flight is the interval of time that ellipses from the instant of projection till the instant when the particle again meets the horizontal plane through the point of projection.

6). what is the maximum horizontal range?

Maximum horizontal range is u^2/g

7). whether there is any possibilities to get the range greater than u^2/g?

No, there is no angle of projection to get a range greater than u^2/g which is really the maximum range possible.

8). Define range on an inclined plane.

The range on an incline plane is $r=2u^2\cos\alpha\sin(\alpha-\beta)/g\cos^2\beta$.

9). what is the value of maximum range on an inclined plane?

$U^2/g(1+\sin\beta)$.

10). what is the maximum angle of projection on the inclined plane?

$45^0+\beta/2$ is the angle of projection for maximum range on the inclined plane.

UNIT- 2

11). Define force of restitution.

The internal force which acts, when a body tends to recover its original shape after a deformation or compression is called the force of restitution.

12). Define elasticity.

The property which causes a solid body to recover its shape is called elasticity.

13). Define inelasticity.

If a body does not tend to recover its shape, it will cause no force of restitution and such a body is said to be inelastic.

14). If the velocity of a ball which strikes the round is $\sqrt{2gh}$ then its height is

$h = v^2/2g$.

15). Define impinge directly.

Two bodies are said to impinge directly when the direction of motion of each before impact is along the common normal at the point where they touch.

16). Define impinge obliquely.

They are said to impinge obliquely, if the direction of motion of either body or both is not along the common normal at the point where they touch.

17). Define line of impact.

The common normal at the point of contact is called the line of action.

18). what is Newton's experimental law?

When two bodies impinge directly, their relative velocity after impact bears a constant ratio to their relative velocity before impact and is in the opposite direction.

19). what is the coefficient of restitution?

$V_{2-v1/u2-u1 = -e}$

20). Define motion of two smooth bodies perpendicular to the line of impact.

When two smooth bodies impinge, the only force between them at the time of impact is the mutual reaction which acts along the common normal.

UNIT- 3

21). what is principle of conservation of momentum?

The algebraic sum of the momentum of the impinging bodies after impact is equal to the algebraic sum of their moments before impact.

22). Define impact of a smooth sphere on a fixed smooth plane.

A smooth sphere, or particle whose mass is m and whose coefficient of restitution is e, impinges obliquely on a smooth fixed plane; to find its velocity and direction of motion after impact.

23). Define direct impact of two smooth spheres.

A smooth sphere of mass $m_{1 \text{ impinges directly with velocity u, on}}$ another smooth sphere of mass $m_{2; \text{ if the coefficient of restitution is e, to find}}$ their velocities after the impact.

24). Define loss of kinetic energy due to direct impact.

Two spheres of given masses with given velocities impinge directly; to show that there is a loss of kinetic energy and to find the amount.

25).what is the change in kinetic energy in direct impact?

Change in kinetic energy = $1i2_{\ m1m2(u1-u2)2\ (1-e2)/m1+m2.}$

26). Define impact of two smooth spheres.

A smooth sphere of mass $m_{1 \text{ impinges obliquely with velocity u1 on}}$ another smooth sphere of respective mass and velocity; to find the velocities and directions of motion after impact.

27). what is the condition of perfectly elastic spheres?

If the spheres are perfectly elastic, e=1 and the loss of kinetic energy is zero.

28). Define loss of kinetic energy due to oblique impact of two smooth spheres.

Two sphere of masses m moving with velocities u at angles α with their lines of centers, come into collision. To find an expression for the loss of kinetic energy.

29).what is the change in kinetic energy in oblique impact?

Change in kinetic energy = 1U2 m1m2/m1+m2 (1-e2) (u1cosα1-u2cosα2)2.

30). what is the condition for two perfectly elastic spheres impinge?

If two equal perfectly elastic spheres impinge, they interchange their velocities in the direction of the line of centers.

UNIT- 4

31).when the loss of kinetic energy in direct impact becomes zero?

When e=1 i.e.) only when the bodies are perfectly elastic, it becomes zero and hence the kinetic energy is unchanged by impact.

32). what will happen if two perfectly elastic spheres impinge directly?

If two equal perfectly elastic spheres impinge directly, they interchange their velocities.

33).what is the pedal equation of the central orbit?

In certain curves the relation between p (the perpendicular from the pole on the tangent) and r is very simple. Such a relation is called the pedal equation or the (per) equation to the curve.

34).what is the pedal equation of circle pole?

The pole is on the circumference and the equation is $r^2 = 2ap$.

35). what is the pedal equation of parabola pole at focus?

The pedal equation of parabola is $p^2 = ar$.

36).what is the pedal equation of ellipse pole at focus?

The pedal equation of ellipse is $b^2/p^2 = 2a/r-1$.

37). what is the pedal equation of hyperbola pole at focus?

The pedal equation of hyperbola is $b^2/p^2 = 2a/r+1$.

38). Define velocities in central orbit.

In every central orbit the areal velocity is constant and the linear velocity varies inversely as the perpendicular from the centre upon the tangent to the path.

39). what is the differential equation to the central orbit in polar coordinates?

$P = h^2u^2 (u + d^2u/d\Theta^2)$.

40). Define apses.

If there is point A on a central orbit which the velocity of the particle is perpendicular to the radius OA, then the point A is called an apse.

UNIT- 5

41). Define apsidal distances.

The length of OA is the corresponding apsidal distance.

42).define differential equation of central orbits.

A particle moves in a plane with an acceleration which is always directed to a fixed point O in the plane, to obtain the differential equation of its path.

43). Define motion under a central force.

Suppose a particle describes a path, acted on by an attractive force F towards a fixed point O. such a force is called a fixed point O. such a force is called a central force.

44).what is central orbit?

The path describes by the particle is called a central orbit.

45).what is the radial component of velocity?

The radial component of velocity is ŕ.

46). Define simple harmonic motion.

When a particle moves in a straight line so that its acceleration is always directed towards a fixed point in the line and proportional to the distance from that point, its motion is called simple harmonic motion.

47). Define periodic time.

The period or periodic time of a simple harmonic motion is the interval of time that elapses from any instant till a subsequent instant when the particle is again moving through the same velocity in the same direction.

48). Define frequency.

Frequency is the reciprocal of the period.

49). what is amplitude?

The unit of frequency is known as amplitude. It depends only on the constant μ which is the acceleration at unit distance from the centre.

50). what is the transverse component of velocity?

The transverse component of velocity is $r\dot{\theta}$.

DYNAMICS

K3 LEVEL QUESTIONS

UNIT- 1

1) Characteristics of motion of a projectile (with Diagram).
2) Determine when the horizontal range of a projectile is maximum given the magnitude u of the velocity of projectile.
3) To show that velocity at any point p of a projectile is equal in magnitude to the velocity in following freely from the direction from the point.
4) Given the magnitude of the velocity of projection to show that there are two direction of projections for the possible on for the particle so as to read a given point.
5) To find the greatest distance of the projectile from the inclined plane and Show that is attained in of the total time of flight.
6) To determine when the range on the inclined is maximum given the magnitude u of the velocity of a projection.
7) If the greatest height attained by a particle to a quarter of its range on the horizontal plane through the point of projection.
8) A stone is thrown with a velocity of 39.2m/sec at 30˚ to the horizontal. Find at what time it will be at a height of 14.7m ($g=9.8m/s^2$).
9) If the range of the horizontal plane is equal to the height to which the velocity of projection is due. Show that the angle to projection is 15˚ or 75˚.
10) At what angle should evalue we thrown with the velocity of $14\sqrt{6}$m/s to reach the top of the distance 40m away from the point of projection (g=9.8m/s).

UNIT- 2

11) Show that the energy of a system executing S. H. M proportional to the square of the amplitude and the frequency.
12) A horizontal shelf moves vertically with S. H. M whose complete period is one second. Find the greatest amplitude in centimeters. It can have so that an object resting on the shelf may always remaining contact.
13) Derive change of origin in simple harmonic motion.
14) If the range on the horizontal plane is equal to the height to the velocity projection is due. Show that the angle is projection is 15' or 75’.
15) If the distance x of a point moving on a straight line measured from a fixed origin if and it’s velocity were connected by relation v2=25-x2. Show that the motion is S. H. M. Find the period and amplitude of motion
16) Derive general solution of a S. H. M equation.

17) Show that the resultant of two simple harmonic motion in the same direction and of equal periodic time. The amplitude of one being twice that of the other and it's phase a quarter of a period is advance,is a simple harmonic motion is amplitude $\sqrt{5}$ times that of a that of the first and whose phase is in advance of the first by tan-1 2/2π of a period.
18) The displacement X of a particle moving along a straight line is given by X=a cos n t +b sin n t .show that the motion is simple harmonic with amplitude √a2+b2 and period 2π/n.
19) A particle is moving with S. H. M and while making an oscillations from one extreme position to the either it's distance from the center of oscillations at three consecutive seconds are x1, x2, x3. Prove that the period of oscillations is 2π/cos-1(x1+x3/2x2).

UNIT- 3

20) Derive the geometrical representation of simple harmonic motion.
21. Write a note on equiangular spiral.
22. State and prove perpendicular from the pole and the tangent formula in polar coordinates.
23. State and prove pedal equation of the central orbit.
24. Find the law of force towards the pole under which curve $r^n=a^n\cos n\theta$ can be described.
25. A particle moves in an ellipse under a force which is always directed towards its focus. Find the law of force, the velocity at any point of the path and its periodic time.
26. A particle moves in a curve under a central attraction so that its velocity at any point is equal to that in a circle at the same distance and under the same attraction. Show that the path is an equiangular spiral and that the law of force is that of the inverse cube.
27. Derive velocities in a central orbit.
28. Derive equations of motion in polar co-ordinates.
29. Derive velocities and acceleration in polar co-ordinates.
30. The velocity of a particle along and perpendicular to a radius vector from a fixed origin are λr^2 and $\mu\theta^2$ where μ and λ are constants. Show that the equation to the path of the particle is $\frac{\lambda}{-}$+ c=$\frac{\mu}{-}$. Where c is a constant.

UNIT- 4

31. State and proof loss of kinetic energy in impact
32. A 100 GM cricket ball moving horizontally at 24 m per sec was hit straight pack with a speed of 15 m per sec if the contact lasted 1/20 sec find the average force execrated by the bat.
33. Defined motion of a shot and gun

34. A jet of water leaves a nozzle of 3 cm diameter a speed of 2m/sec and impinges normally on a plane inelastic wall so that the velocity of the water is destroyed on reaching the wall. Calculate the GM weight the thrust on the wall.
35. Centimeters of rain fall in a certain district in 24 hours assuming that the drops fall freely from a height of 109 meters. Find the pressure on the ground per square kilometer of thee district .
36. Define impulse and impulsive force?
37. Define loss of kinetic energy after impact and before impact.
38. A body of mass 3 mgs. Moving at 15 cm per sec. overtakes a body of mass 2 gms. Moving at 5 cm.per sec. in the same direction. If the bodies coalesce find the velocity of the compound body after impact.
39. Ahammer of mass 210kg. falls through 2.5 meters and comes to rest after striking a mass of iron, the duration of the blow being $1/50^{th}$ of a second ; find the force, supposing it to be uniform , which is exerted by the hammer on the iron.
40. Explain the impact of two bodies.

UNIT- 5

41. State and prove experimental law

42. Find the velocities of two smooth sphere after direct impact

43. Explain impact of a smooth sphere on a fixed smooth plane.

44. State and prove direct impact of two smooth sphere.

45. Define obliquely impact of two smooth spheres.

46. Define obliquely impact &direct impact.

47. Define principle of conversation of momentum.

48. Motion of two smooth bodies perpendicular to the line of impact.

49. A balls of mass 8 gm moving with a velocity of 10 cm per second impinges directly on another of mass 24 gm. Moving at 2 cm per sec in the same direction. If e=1/2 ,find the velocities after impact. Also calculate the loss in kinetic energy.

50. Define corollary of impact of smooth sphere on fixed smooth plane.

DYNAMICS

K4 Level Questions

UNIT- 1

1. To show that the path of a projectile(in vaccum) is a parabola.

2. A particle is thrown over a triangular from one end of the horizontal base and grazing the vertex falls on the other end of the base. If A&B are the base angle r and α the angle of projection. Then show that,
   $\tan\alpha=\tan A + \tan B$
3. Show that for a given initial velocity of projection there are in general two possible direction of projection so as to obtain a given horizontal range.
4. Show that the greatest height which a particle with a initial velocity v can reach on a vertical wall at a distance 'a' from the point of projection to $V^2/2g - ga^2/2v^2$. pove that the greatest above the point of projection attained by the particle in its flight is $V^2/2g(v^4+g^2a^2)$.
5. To show that the range of a inclined plane with diagram.

UNIT- 2

6. Derive simple harmonic motion in a straight line
7. Show that composition of two S.H.M of the same interval and in the same straight line
8. Show that composition of two S.H.M of the same period in two perpendicular direction
9. Show that geometrical representation of a S.H.M.
10. State and prove Differential equation of central orbit.

UNIT- 3

11. Derive pedal equation of some of the well known curves

I) Circle-pole at any point.

II) Parabola-pole at focus.

III) Ellipse (or) Hyperbola-pole at focus.

IV) Equiangular spiral

12. A particle moves with a acceleration $\mu\{3au^4-2(a^2-b^2)u^5\}$ and is projected from an apse at a distance (a+b) with a velocity $\sqrt{\mu}/a+b$. prove that the equation to its orbit is $r=a+b\cos\theta$.

13. A smoth straight thin cube revolves with uniform angular velocity ω in a vertical plane one extremely which is fixed . It at 0 time that tube be horizontal and a particle inside it be at a

distance ‘ a’ form the fixed end and be moving with velocity v along the tube, show that the distance at time t is,
A cos h ωt + ($\frac{v}{}$ - $\frac{g}{}$) sin h ωt +$\frac{g}{}$ sin ωt.

14. A particle moves with a central acceleration equal to u÷(distance)^5 and is projected from an apse at a distance ‘a’ with a velocity equal to n times that which would be accured in falling from infinity. Show that the other apsidal distance is $\frac{}{\sqrt{}}$.

15. A shot of mass m penetrates a thickness t of a fixed plate of mass μ. If m were free to move and the resistance supposed to be uniform show that the thickness is penetrated is M_i/M+m.

UNIT- 4

16. A short of mass 100 kg is fixed with the velocity of 250 m/sec . from a gun of mass 400 quantity find the velocity of recoil of the gun if the gun is resting on an incline of 3 in 5 velocity of recoil of the gun.
17. Proof loss of kinetic energy in impact? Motion of a shot and gun
18. A gun of mass m fires a shell of mass , the elevation of thee gun being α . if he gun can recoil freely in the horizontal direction show that the angle θ which the path of shell initially makes with the horizontal is given by the equation tanθ_2(1+m/M) tanα. Further assuming that the whole energy of the explanation is transferred to the shell and gun show that the muzzle energy of the shell is less than what is would be if the gun were fixed in to the m:M+m cos^{2}θ
19. A mass M after falling freely through the distance “a” beings to relies a man m greater than it shelf and connected with it by mean answer of an in extensible string passing ever a fixed pulley show that M will returned to its original position at the end of time 2m/M-m (2a/g)$^{1/2}$ find also with fraction on of K.E of M is destroyed at the instant when m is jet into motion.
20. Loss of kinetic energy due to direct impact of two smooth sphere.

UNIT- 5

21. Explain loss of kinetic energy due to obliquely impact of two smooth sphere.

22.A smooth circular table is surrounded by a smooth rim whose interior surface is vertical show that a ball projected along the table from a point a on rim in a direction making an angle α with the radius through a will return to the point of projection after two impact if tanα=e(3/α)/√1+e+e2.

23.Two equal marble balls A, B lie in a horizontal circular groove at the opposite ends of a diameter n is projected along the groove and after time t, impinges on B, Show that a second impact takes place after a further interval 2t/e.

24. Explain fundamental laws of friction.

25. If h and h' be the greatest height in the two parts of the projectile with a given velocity for a given range prove that $R=4\sqrt{hh'}$