DYNAMICS. 16SCCMM14

Unit - 1:

1. Define Relative Velocity:

The displacement of B relative to A $= X_B - X_A$ and the rate of this displacement is called the velocity of B relative to A.

$\therefore$ The velocity of B relative to A

$$= \frac{d}{dt}(X_B - X_A) = \frac{dX_B}{dt} - \frac{dX_A}{dt} = V_B - V_A.$$

2. Define Variable acceleration.

When the change of velocity in equal times are either not equal in magnitude or are not in the same direction, the acceleration is said to be variable.

3. Define acceleration of a particle.

The acceleration of a particle at any instant is given by the ratio of the change in its velocity which occurs in a very short interval of time including that instant to the interval, when the interval is made sufficiently small.

4. Find the components in two fixed perpendicular directions.

A velocity u is equivalent to a velocity $u\cos\theta$ along a line making an angle θ with its own direction, together with a velocity $u\sin\theta$ perpendicular to the direction of the first component.

When a given velocity is resolved into two components in two mutually $\perp$ directions, the components are referred so as the resolved parts in the corresponding directions.

(5) Define (i) Displacement and (ii) velocity:

(i) The displacement of a moving point in any interval of time is its chang of position.

(ii) The velocity of a moving point is the rate of displacement.

Unit - (2)

(1) ~~SHM~~ what is meant by a SHM?

Simple Harmonic motion is meant by a SHM.

The oscillations of a simple pendulum and the transvers vibrations of a plucked violin string are examples of simple harmonic motion.

(2) Define a horizontal range.

The range on the horizontal plane through the point of projection.

The horizontal range

$$R = \frac{2u^2 \sin\alpha \cos\alpha}{g} = \frac{u^2 \sin 2\alpha}{g}$$

(3) Write down the two Fundamental principle

* The horizontal velocity remains constant throughout of motion.

* The vertical component of the velocity will be subject to a retardation g.

These two main principles will help us to study the motion of a projectile.

(4) A Particle is projected with a velocity of 9.6 m at an angle of 30°, find the time of flight.

Time of flight $= \frac{2u \sin\alpha}{g}$

Given.

$u = 9.6$ m, $\alpha = 30°$, $g = 9.8$ m/sec^2.

$$= \frac{2 \times 9.6 \times \sin 30°}{9.8} = \frac{2 \times 9.6 \times \frac{1}{2}}{9.8}$$

$= 0.9795 = 1$ sec (nearly).

(5) Define angle of Projection and velocity pro

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.

Velocity projection:-

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

Unit - ③.

① When we say that two bodies are impinge obliquely.

Usually, in most problems on oblique impact, one of the spheres is at rest.

② Write down the 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. If two bodies impinge obliquely, their relative velocity resolved along their common normal after impact bears a constant ratio to their relative velocity before impact, resolved in the same direction, and is of opposite sign.

$$\frac{V_2 - V_1}{u_2 - u_1} = -e.$$

③ State the principle of conversation of momentum for a particle.

The algebraic sum of the momenta of the impinging bodies after impact is equal to the algebraic sum of their momenta before impact, all momenta being measured along the common normal.

④ Write down Direct impact of two smooth spheres.

A smooth spheres of mass m_1, impinges directly with velocity u_1 on another smooth sphere of mass m_2, moving in the same direction with velocity u_2; if the coefficient of restitution is e. to find their velocities after impact.

(5) 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.

Unit - (4)

(1) write down any one of the kepler's laws on planetrary motion.

(i) The law of ellipses:

* The path of the planets about the sun is elliptical in shape, with the center of the sun being located at one focus.

(ii) The Law of Equal Areas:

An imaginary line drawn from the center of the sun to the center of the planet will sweep out equal areas in equal intervals of time.

(iii) The Law of Harmonies.

The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distance from the sun.

(2) ~~Def~~

(2). Define an apse on a central orbit.

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

(3). Define the periodic time of a S.H.M?

The period or the 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 position with the same velocity in the same direction.

(4). If the displacement of a moving point at any time be given by an equation of the form $x = a\cos wt + b\sin wt$, show that the motion is a S.H.M.

$$x = a\cos wt + b\sin wt \rightarrow (1)$$

we have to show that the acceleration varies directly as the displacement. Diff (1) with r.to t,

$$\frac{dx}{dt} = -aw\sin wt + bw\cos wt \rightarrow (2)$$

$$\frac{dx^2}{dt} = -aw^2\cos wt - bw^2\sin wt$$

$$= -w^2(a\cos wt + b\sin wt)$$

$$= -w^2 x \rightarrow (3)$$

The constant μ of the S.H.M $= w^2$.

$$\therefore \text{period} = \frac{2\pi}{\sqrt{\mu}} = \frac{2\pi}{w} = \frac{2\pi}{2} = \pi \text{ secs.}$$

5. Define simple Harmonic motion in a straight line.

when a particle moves in a straight line so that it's accelaration is always directed towards a fixed point in the line and proportional to the distance from that point, the motion is called S.H.M.

Unit - 5

1. Find the (p,r) equation to the equi-angular spiral

Now for the equiangular spiral, at any point p on it the angle ϕ is constant.

Let $\phi = \alpha$, Then $\tan\phi = \tan\alpha$, (ie) $r\frac{d\theta}{dr} = \tan\alpha$

fing $\log r = \theta \cot\alpha + c$.

$r = ae^{\theta \cot\alpha}$.

2. Write down the radial and transverse component of velocities.

	Magnitude	Direction	Sense
(i) Radial components of velocity.	$\dot{r}$	Along the radius vector	In the direction in which r increases.
(ii) transverse components of velocities.	$r\dot{\theta}$	Perpendicular to the radius vector.	In the direction in which θ increases.

(3). Define a simple equivalent pendulum which we have

The simple pendulum is only idealistic, whatever be considered above is only idealistic, that simple pendulum the shap of the pendulum, that simple pendulum which oscillates in the same time as the given pendulum is called the simple equivalent pendulum.

(4). Write down equation of motion in polar co-ordinates?

If R and S are the components of the external force acting on a particle of mass m in the radial and transverse directions, we have the equations $R = m(\ddot{r} - r\dot{\theta}^2)$,

and $S = m.\frac{1}{r}.\frac{d}{dt}(r^2\dot{\theta})$.

(5). write the podal equation of the central orbit

We can get the (p, r) equation to a central orbit,

$$P = \frac{h^2}{p^3} \cdot \frac{dp}{dr}$$

is the (p,r) equation (or) the pedal equation to the central orbit.