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B.Sc (Part-I) Hons

Coriolis Force:-

The fictitious force which acts on a particle when it is in motion relative to a rotating frame of refrence, is called Coriolis force, after the name of its discoverer. It is given by $-2m(\vec{\omega} \times \vec{v}_r)$. where $\vec{\omega}$ is the angular velocity of the rotating frame and $\vec{v}_r$ is the velocity of the particle relative to it.

Example of Coriolis force:-

(i) When a body is in motion relative to the rotating frame of refrence of the earth, the fictitious Coriolis force comes into play and two case of interest arise. (a) when the body is just dropped from rest so as to fall freely under the action of gravitational force and (b) when it is given a large horizontal velocity, as in the case of a projectile.

Case(a) - The horizontal components of the Coriolis force acting on the freely falling body deflects it a little from its truely vertical path. The vertical components obviously produces no such

deflection but only affects the value of 'g'.

The horizontal displacement x of the body due to coriolis force in latitude ϕ is given by

$$x = \left(\frac{8}{9g}\right)^{1/2} h^{3/2} \omega \cos\phi$$

where ω is angular velocity of the earth.
At the equator $\phi = 0$, $\sin\phi = 0$ and $\cos\phi = 1$

$$\therefore x = \left(\frac{8}{9g}\right)^{1/2} \omega h^{3/2}$$ which is maximum

It always directed the positive direction of the axis or towards the east.

Case(b):- If the horizontal velocity of the body be sufficiently large, so that it covers fairly large horizontal distance, the small coriolis force gets sufficient time to act upon it, making the position vector turn a constant rate of $-\omega \sin\phi$. Since in the norther hemisphere, ϕ is positive this rotation appear to in the clock-wise when viewed from above and the projectile gets deflected towards the right. Similarly, the projectile gets deflected towards the left in the southern hemisphere. This is known as Ferel's law.

(2) Foucault's pendulum:- It is intersting example of coriolis force. The rotation of the earth results in a coriolis force coming into play due to the horizontal motion of the bob relative to it. Acting in a direction perpendicular to that of the velocity of the bob, it causes precession of the plane of its oscillation, which rotates with an angular velocity $-\omega \sin\phi$ in latitude ϕ. This is called Foucault effect.