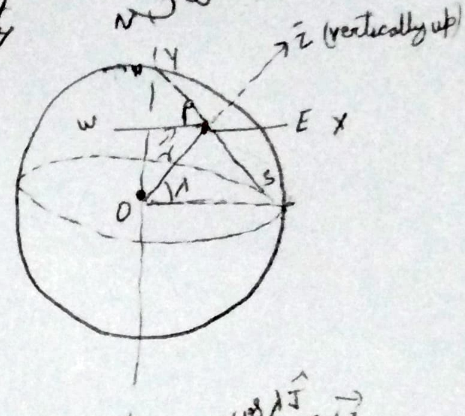
<u>B-Sc - I</u> 24/1/22

Effect of Coriolis force on a particle moving on the surface of earth

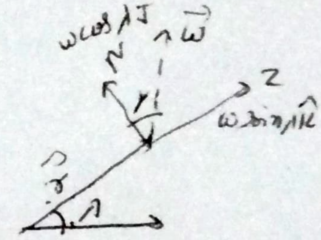
Let a particle moves with velocity $\vec{V}$ in xy plane.



Let its velocity is

$$\vec{V} = V_x \hat{i} + V_y \hat{j} \quad \text{--- (1)}$$

The angular velocity of earth at point P



$$\vec{\omega} = \omega \cos\lambda \hat{j} + \omega \sin\lambda \hat{k} \quad \text{--- (2)}$$

using $\vec{F}_c = -2m(\vec{\omega} \times \vec{v})$

$$= -2m(\omega\cos\lambda \hat{j} + \omega \sin\lambda \hat{k}) \times (V_x \hat{i} + V_y \hat{j})$$

$$= -2m(\omega\cos\lambda V_x(-\hat{k}) + \omega\sin\lambda V_x \hat{j} + \omega\sin\lambda V_y(-\hat{i}))$$

$$= 2m\omega\cos\lambda V_x \hat{k} - 2m\omega\sin\lambda V_x \hat{j} + 2m\omega\sin\lambda V_y \hat{i}$$

$$\vec{F}_c = 2m\omega\sin\lambda(V_y\hat{i} - V_x\hat{j}) + 2m\omega\cos\lambda V_x \hat{k}$$

$$\vec{a}_c = \frac{\vec{F}_c}{m} = \underbrace{2\omega\sin\lambda(V_y\hat{i} - V_x\hat{j})}_{\text{along horizontal}} + \underbrace{2\omega\cos\lambda V_x \hat{k}}_{\text{along vertical}}$$

$$\vec{a}_h = 2\omega\sin\lambda(V_y\hat{i} - V_x\hat{j})$$

$$a_v = 2\omega\cos\lambda V_x \hat{k}$$

— x —