* Earth: A non-Inertial (rotating) frame:

Earth spins about its axis, therefore, therefore it is a non-inertial frame.

Angular velocity of earth's spining motion is

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{24h} = 7.27 \times 10^{-5} \text{ rad/sec.}$$

Due to rotation of earth following effects arise-

(a) All objects on earth's surface experience centrifugal force which is directed away from the axis of rotation.

(b) All objects moving on earth's surface experiences coriolis force in addition to centrifugal force.

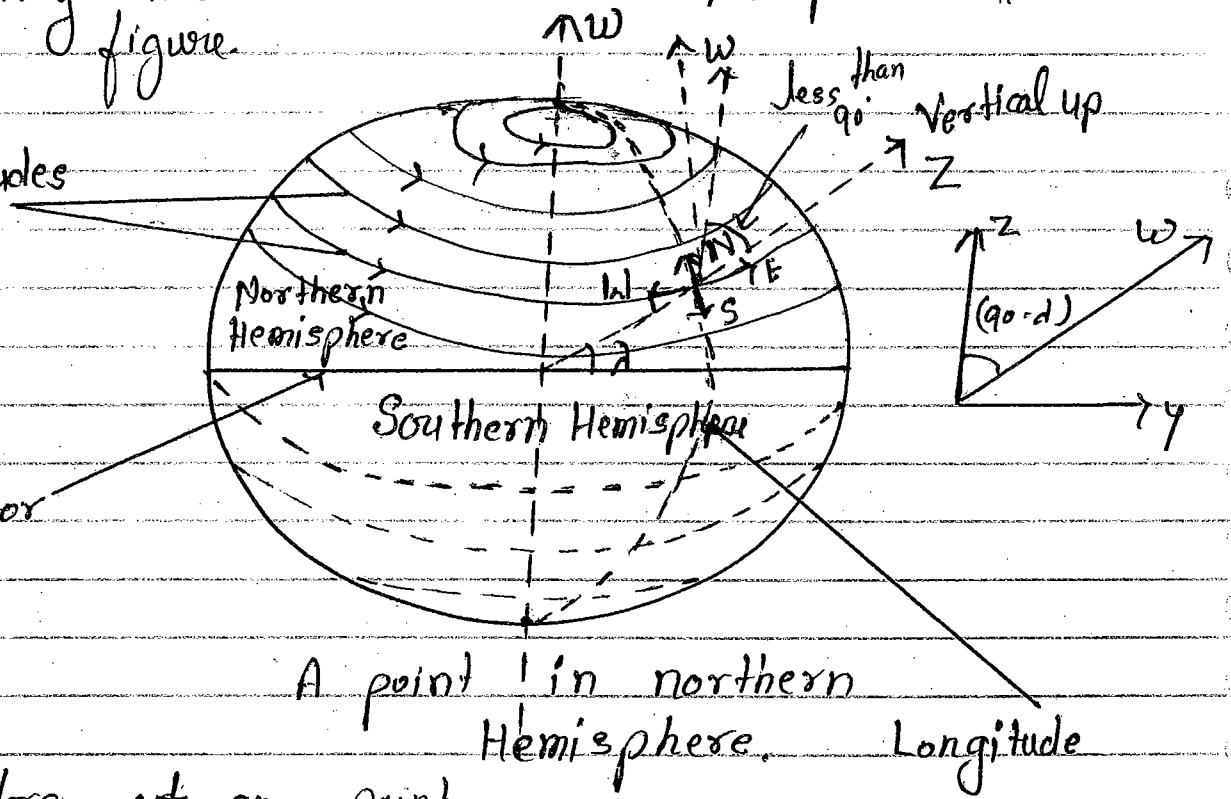
(c) An obsebver standing on earth's surface notices that on all objects a centrifugal and a coriolis force ($if\ v' \neq 0$) act irrespective of the location of the object. ~~This~~ That is the object which is being observed by the observer may or may not be on the earth's surface. for example we on the earth, see that the ~~Sun~~ Sun rises and sets. If we analyse the dynamice of the sun we will find that Sun experiences a centrifugal force away from the earth and a coriolis force towards the earth.

Coordinate System on Earth's Surface:-

To analyse dynamics of objects from earth's surface we define local cartesian co-ordinate system as follows-

(i) +X-axis: Along local east, -X axis: Along local west
(ii) +Y-axis: Along local north, -Y axis: Along local south
(iii) +Z-axis: Along local vertical upward
-Z-axis: Along local vertical downward.

Therefore angular velocity vector of earth's spining motion lies in Y-Z plane as shown in figure.



A point in northern Hemisphere.

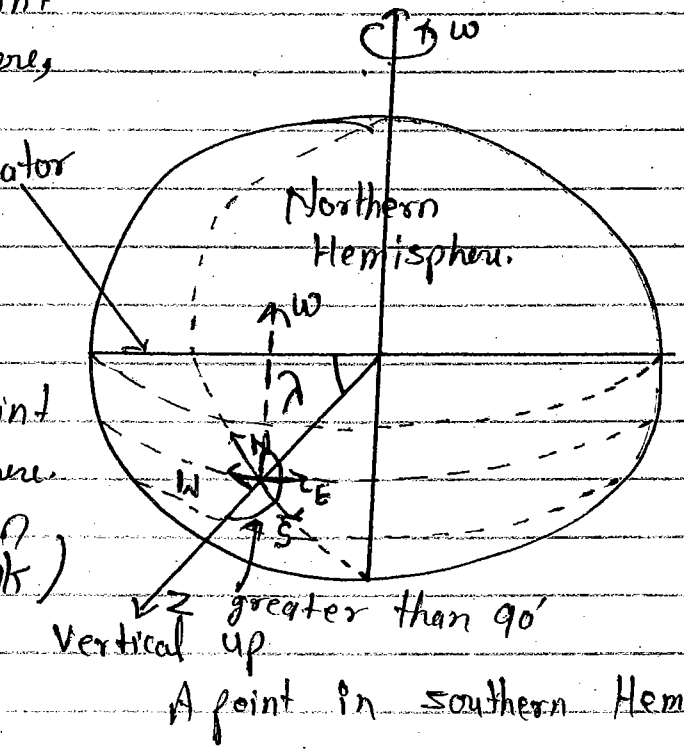
Therefore, at any point in northern hemisphere,

$\vec{\omega} = \omega(\cos\lambda\,\hat{j} + \sin\lambda\,\hat{k})$

When λ is latitude of the point.

And at any point in southern hemisphere.

$\vec{\omega} = \omega(\cos\lambda\,\hat{j} - \sin\lambda\,\hat{k})$



A point in southern Hemisphere.