Q- An Airplane with a wing span of 50 m is flying horizontally with a uniform speed of 360 km hr^{-1} in earth's total magnetic field is 5.4×10^{-5} Wb m^{-2} and the angle of dip is 30°. Calculate the emf induced across the tips of the wings.

When a conducting material moves in a magnetic field the electrons in the material experience a force in the direction perpendicular to the direction of motion and the field both. This force drives conduction electrons of the material on one side of the material and gives rise a potential difference across the material which can flow current in external circuit and hence called EMF.

When a conducting wire moves such that it crosses magnetic flux an EMF (e) is developed across it which is given by

$$e = \vec{l}\,.\,(\vec{v} \times \vec{B})$$

Here l is the length of the wire, B is the magnetic field present in the region and v is the velocity of the wire.

Now here l = 50 m is the wing span which is horizontal, v = 360 km\hr = 100 m/s is the velocity of the airplane horizontal but perpendicular to the wing span and B = 5.4×10^{-5} Wb m^{-2} is the magnetic field making angle $\theta = 30^0$ with the horizontal then

$$e = \vec{l}\,.\,(\vec{v} \times \vec{B}) = l\,(v\,B\sin\theta)$$

Or $e = 50 * 100 * 5.4 * 10^{-5} * 0.5 = 0.135\ V$