

working of an antenna

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The theory of antenna is based on a very fundamental part of physics. Whenever charges are accelerated they radiate EM energy.

That means if we have an e^- and it is accelerated then it radiates.

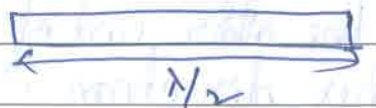


Larmor's equation

If the e^- is stationary or travelling with uniform velocity then it does not radiate EM energy.

Based on this the whole theory of antenna is developed. Naturally Maxwell's equations are involved.

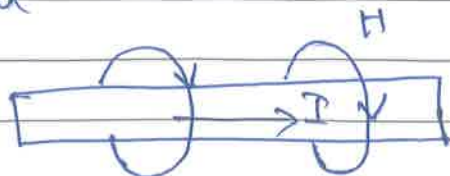
Let's provide a sinusoidal signal to a dipole of length $\lambda/2$ (wire).

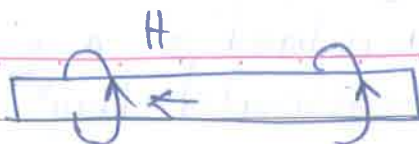


This cycle of signal is repeated and the current goes back and forth on the dipole.

This current is time varying and these are accelerating or decelerating.

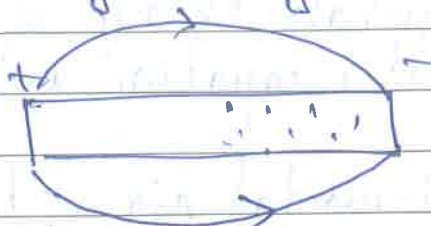
The time varying current produces time varying magnetic field.



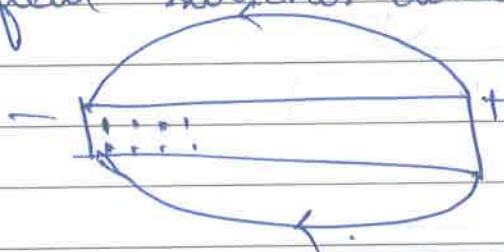


The magnetic field increases in one direction, attains max. value and started decreasing.

Next let's look at the creation of electric field. As the e^- are moving back and forth, the dipole ~~is being~~ charges at the ends are changing.



Electric fields are being created. As the e^- move to the other end of the dipole the electric field switches direction.



Now both the Electric and magnetic fields are time varying.

$\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$ Now time varying electric field creates a ~~time~~ varying magnetic field.

$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ time varying magnetic field creates an electric field.

