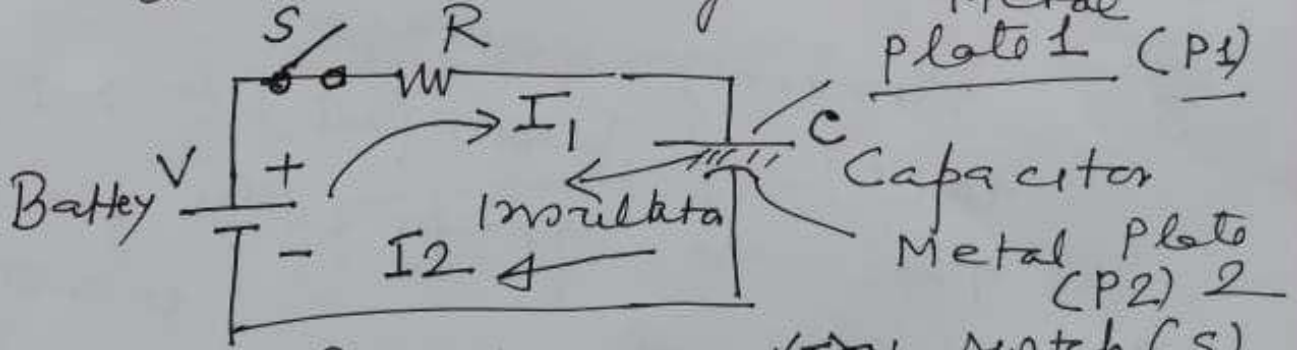
Satellite & Mobile communication Network

1. Electromagnetic wave:
   (i) $\vec{E}$ field (Electrical field)
   (ii) $\vec{H}$ field (Magnetic field.
   (iii) Both are vectors
   (iv) $\vec{E}$ field and $\vec{H}$ field produced naturally at right angle
   (v) Direction of propogation of Electromagnetic field is at right angle to the plane of $\vec{E}$ & $\vec{H}$ field.

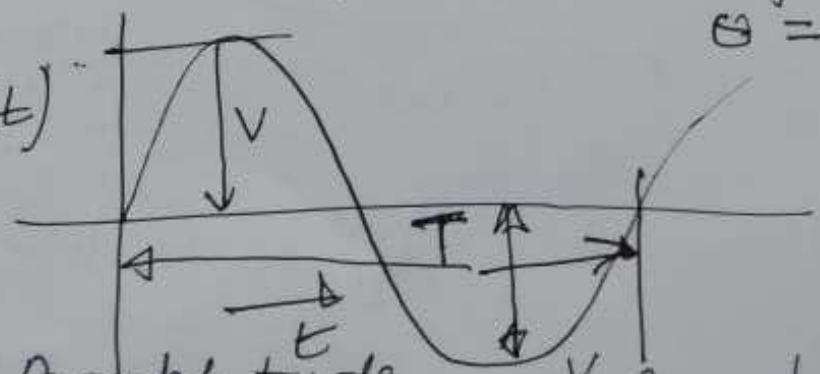
2. Constant voltage source



   (i) Initial current (I_1) ON switch (S) ON $= \frac{V}{R}$ = Conduction current
   (ii) This shall put +ve charge (Q) on P1 plate
   (iii) create an electric field
   (iv) E through insulator. This electric field will

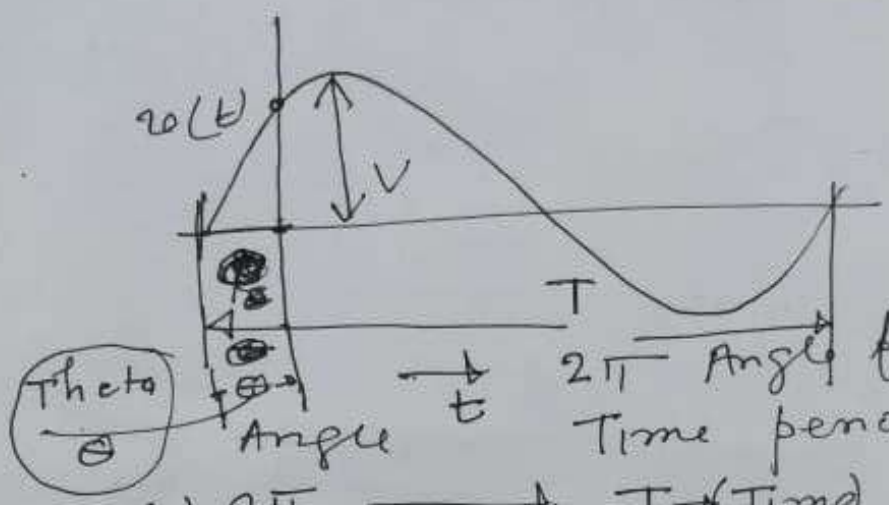
E ∧ shall displace positive charge ⊕ from (P_2)
P_2
(V) So there will be current from plate P_2
(VI) According to kirchoff law
$I_1 = I_2$
(VII) No current really flows through the insulator of capacitor
(VIII) But to justify kirchoff law there must be some virtual current through the insulator. This virtual current is known as the displacement current.

3. Varying voltage
$v(t) = V \sin(2\pi f t + \Phi)$
This is graphically presented as



V = Amplitude
T = Time period. $f = \frac{1}{T}$ = cyclic frequency

with $\phi = \theta$



(i) $2\pi \longrightarrow T$ (Time)

$1 \longrightarrow \frac{T}{2\pi}$

$\theta = \frac{T}{2\pi} \times \theta$ radian

(ii) We say This ~~angle~~ sine wave is leading by an Angle θ w.r.t earlier wave.

(iii) Thr Three parameters of sine wave

~~A = Amplitude~~

$v(t) = V \sin 2\pi(ft + \phi)$

~~v~~ $v(t) =$ Instantaneous value of the sine wave

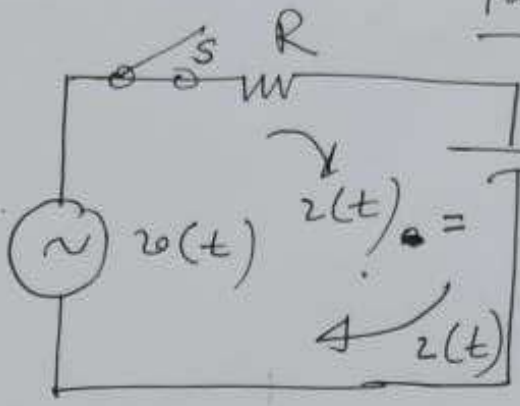
Remember All Through

$V =$ Amplitude

$f = \frac{1}{T} =$ cyclic frequency

$\phi =$ Phase Angle.

(4)



$$= \frac{v(t) - v_c(t)}{R}$$

displacement current $= i(t)$

~~Initially $v_c(0) = 0$ As ... v~~

(i) Say switch S on at $t = 0$ and capacitor voltage

$$v_c(0^-) = 0$$

$$v_c(0) = 0$$

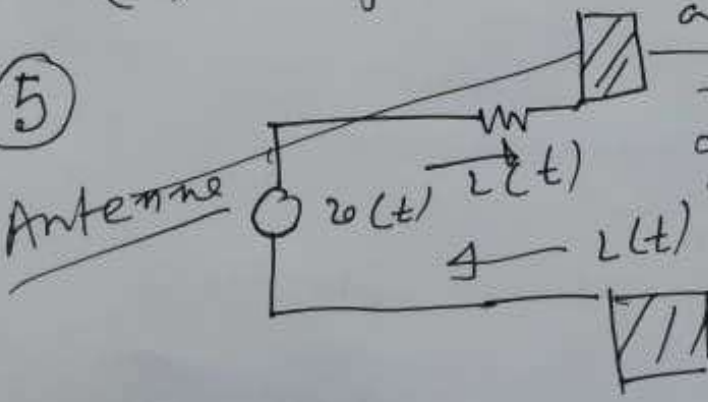
(ii) As capacitor can not charge instantaneously

(2i) at t = current $v_c(t)$ = some positive value

(ii) $$i(t) = \frac{v(t) - v_c(t)}{R}$$

(iv) Displacement current $= i(t)$

(5)



Time varying conduction current in circuit = $i_c(t)$

Time varying displacement current in space (air) = $i_d(t)$.

(6) (i) Initially there should be (insulator) time varying $\vec{e}(t)$ in space (sinosoid if $v(t)$ is sinosoid.

(ii) Results time varying displacement current in space = $i_d(t)$

(iii) $i_d(t) \Rightarrow$ according to Biot-Savat law will give rise to magnetic field (time varying) $\vec{h}(t)$

(iv) If $v(t)$ is sinosoid then $\vec{e}(t)$ and $\vec{h}(t)$ shall also be sinosoid.

(v) So in space there shall be $\vec{e}(t)$ and $\vec{h}(t)$ $\Rightarrow$ Electromagnetic field $\Rightarrow$ shall travell in all directions.

(7) Receiving antenna:-