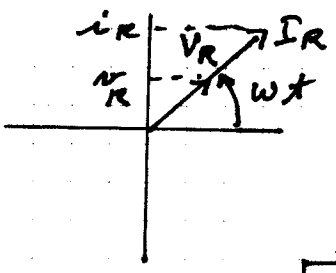
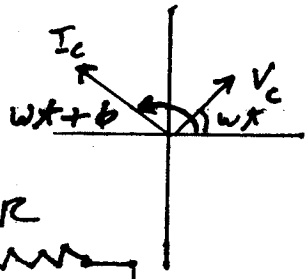
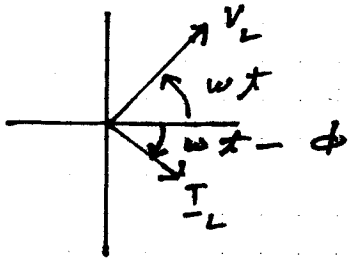
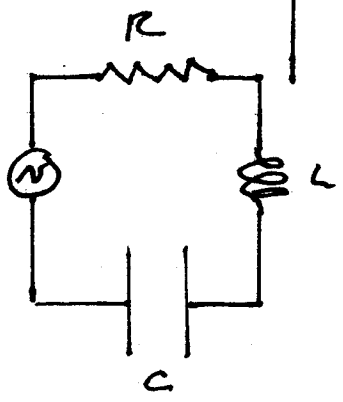
AC CIRCUITS



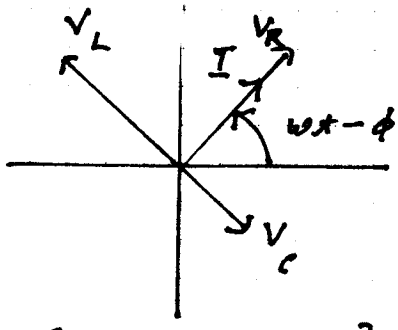






$\mathcal{E} = \mathcal{E}_m \sin \omega t$

$i = I_m \sin(\omega t - \phi)$



THE CURRENT THRU R, L & C I
IDENTICAL. SO ALL VOLTAGES A
RELATIVE TO THE CURRENT TH

Loop Rule

$$\mathcal{E} = V_R + V_C + V_L$$

$$\vec{\mathcal{E}}_m = \vec{V}_R + \overrightarrow{V_L - V_C}$$

OR USING THE PYTHAGOREAN THM

$$\mathcal{E}_m^2 = V_R^2 + (V_L - V_C)^2$$

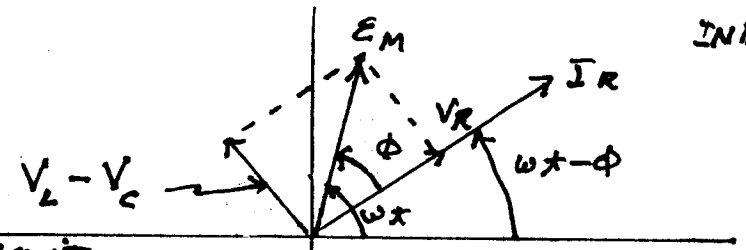
$$\mathcal{E}_m^2 = (IR)^2 + (IX_L - IX_C)^2$$

SINCE $V_R = IR$ $V_L = IX_L$ $V_C = I$

$$I = \frac{\mathcal{E}_m}{\sqrt{R^2 + (X_L - X_C)^2}} = \frac{\mathcal{E}_m}{Z}$$

IMPEDENCE

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

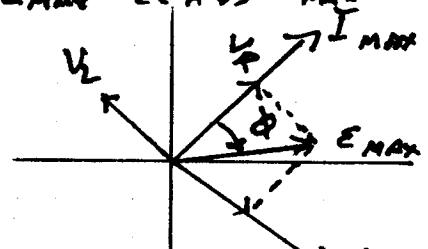


INDUCTIVE CIRCUIT

$\mathcal{E}_M$ LEADS I_{MAX}

CAPACITIVE CIRCUIT

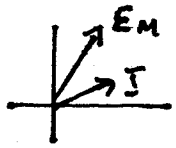
I_{MAX} LEADS $\mathcal{E}_{MAX}$



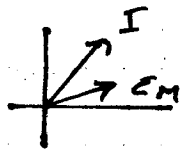
$$\tan\phi = \frac{V_L - V_C}{R} = \frac{IX_L - IX_C}{R} = \frac{X_L - }{R}$$

$$\mathcal{E}_{RMS} = \frac{\mathcal{E}_{MAX}}{\sqrt{2}} \qquad I_{RMS} = \frac{I_{MAX}}{\sqrt{2}}$$

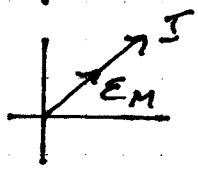
$X_L > X_C$ $\phi > 0$ INDUCTANCE DOMINATES $\mathcal{E}_M$ IS AHEAD OF I

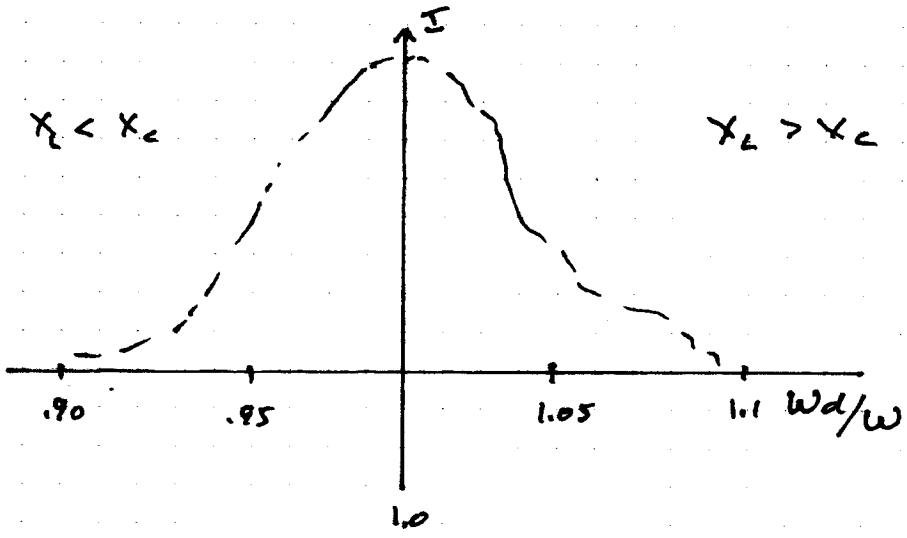


$X_C > X_L$ $\phi < 0$ CAPACTANCE DOMINATES $\mathcal{E}_M$ IS BEHIND I



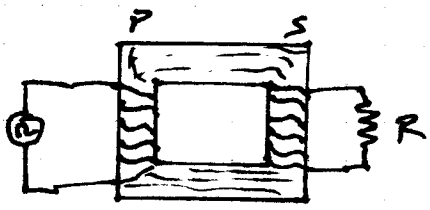
$X_L = X_C$ $\phi = 0$ RESONANCE WHICH MEANS MAXIMUM CURRENT





$$\omega = \frac{1}{\sqrt{LC}}$$

TRANSFORMER



$$V_p = N_p \frac{d\phi}{dt} \qquad V_s = N_s \frac{d\phi}{dt}$$

$$\left(\frac{d\phi}{dt}\right)_p = \left(\frac{d\phi}{dt}\right)_s$$

$$\frac{V_p}{N_p} = \frac{V_s}{N_s}$$

$$V_s = V_p\left(\frac{N_s}{N_p}\right)$$

EXAMPLE I $V_p = 10$ $V_s = 100$ $N_p = 20$ $N_s = \left(\frac{V_s}{V_p}\right) N_p = \frac{100}{10}(20) =$

FURTHERMORE IN A TRANSFORMER ENERGY IS CONSERVED

XIV

$$P_{IN} = P_{OUT}$$

$$V_p I_p = V_s I_s$$

GIVEN $I_p = 15$ AMPS $\quad I_s = \frac{V_p}{V_s} I_p = \frac{10}{100}(15) = 1.5$ AMPS