Single Phase AC Circuit

$$I_{rms} = \frac{I_m}{\sqrt{2}}$$

$$V_{rms} = \frac{V_m}{\sqrt{2}}$$

$$V(t) = V_m \sin(wt)$$

$$V(t) = V_m \sin(2\pi ft)$$

$$V(t) = V_m \sin(wt)$$

$$I(t) = I_m \sin(2\pi ft \pm \emptyset)$$

$$p.f. = cos\emptyset$$

$$Z = R + j(X_l - X_c)$$

$$|Z| = \sqrt{\{R^2 + (X_l - X_c)^2\}}$$

$$\emptyset = \tan^{-1}\frac{X_l - X_c}{R}$$

$$\cos\emptyset = \frac{R}{|Z|}$$

$$X_l = 2\pi fL$$

$$X_c = \frac{1}{2\pi fC}$$

$$Apparent\ Power\ S = V \times I\ VA$$

$$Active\ Power\ P = VIcos\emptyset\ \ watt$$

$$Reactive\ Power\ Q = VIsin\emptyset\ \ kVAR$$

$$R = Z\cos\emptyset$$

$$X = Z\sin\emptyset$$

Series Resonance frequency

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Parallel Resonance frequency

$$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

Dynamic Impedance

$$Z_D = \frac{L}{CR}$$

Quality Factor

$$Q = \frac{\omega_r L}{R} = \frac{1}{\omega_r CR} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{f_r}{BW}$$

Bandwidth

$$BW = \frac{f_r}{Q} = \frac{R}{L}(radian) = \frac{R}{2\pi L}\ Hz$$
$$= f_h - f_l$$

For Three Phase AC circuit:

Star

$V_L = \sqrt{3}V_{ph}$

$I_L = I_{ph}$

Delta

$V_L = V_{ph}$

$I_L = \sqrt{3}\, I_{ph}$

$Z_{ph} = \frac{V_{ph}}{I_{ph}}$

Power

$P = 3V_{ph}I_{ph}\cos\phi = \sqrt{3}I_L V_L \cos\phi$

$S = 3V_{ph}I_{ph} = \sqrt{3}I_L V_L$

$Q = 3V_{ph}I_{ph}\sin\phi = \sqrt{3}I_L V_L \sin\phi$

Two Wattmeter method

$W_1 = V_L I_L \cos(30° - \Phi)$

$W_2 = V_L I_L \cos(30° + \Phi)$

$$\tan\emptyset = \frac{\sqrt{3}(W_1 - W_2)}{(W_1 + W_2)}(for\ lagging\ pf)$$

$$\tan\emptyset = \frac{-\sqrt{3}(W_1 - W_2)}{(W_1 + W_2)}(for\ leading\ pf)$$