## PHYSICS 231 – CHAPTER 31: AC CIRCUITS

Current and voltage:

$$I = I_0 \cos(\omega t) \quad , \quad V = V_0 \cos(\omega t + \phi)$$

- resistor of resistance $R$:

$$\phi = 0 \quad , \quad V_0 = I_0 R$$

- inductor of inductive reactance $X_L$:

$$\phi = +90^o \quad , \quad V_0 = I_0 X_L \quad , \quad X_L = \omega L$$

- capacitor of capacitive reactance $X_C$:

$$\phi = -90^o \quad , \quad V_0 = I_0 X_C \quad , \quad X_C = \frac{1}{\omega C}$$

General AC circuit of impedance $Z$:

$$V_0 = I_0 Z \quad , \quad Z = \sqrt{R^2 + (X_L - X_C)^2} \quad , \quad \tan\phi = \frac{X_L - X_C}{R}$$

Rectified average:

$$I_{rav} = \frac{2}{\pi} I_0$$

Root-mean-square:

$$I_{rms} = \frac{I_0}{\sqrt{2}} \quad , \quad V_{rms} = \frac{V_0}{\sqrt{2}}$$

Average power:

$$P_{av} = \frac{1}{2} V_0 I_0 \cos\phi = V_{rms} I_{rms} \cos\phi$$

Transformer:

$$\frac{V_{02}}{V_{01}} = \frac{N_2}{N_1} \quad , \quad V_{01} I_{01} = V_{02} I_{02}$$