**ENGG104 Formula Sheet**

$$I = \frac{Q}{t} = \frac{\text{Coulombs}}{\text{seconds}} = Amperes$$

$$V(\text{Volts}) = \frac{W(\text{Joules})}{Q(\text{Coulombs})}$$

$$R = \rho \frac{l}{A}(1 + \alpha_{20}\Delta\text{T}) \text{ ohms}, \Omega$$

G = 1/R

V = IR

$$P = \frac{W}{t}$$

P = VI = V(V/R) = $V^2/R$ = $(IR)^2/R$ = $I^2R$

Resistors in parallel

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_N}}$$

Current Divider Rule

$$I_x = \frac{R_T}{R_x} I_T$$

$R_T$ is the total parallel resistor

Special case for two parallel resistors

$$I_1 = I_T \times \frac{R_2}{R_1 + R_2}$$

$$I_2 = I_T \times \frac{R_1}{R_1 + R_2}$$

Voltage Divider Rule

$$V_x = E \frac{R_x}{R_T}$$

$$C = \frac{Q}{V}$$

$C$ = farads (F)
$Q$ = coulombs (C)
$V$ = volts (V)

$$C = \epsilon_O \epsilon_r \frac{A}{d} \qquad \text{(farads, F)}$$

$$W_C = \frac{1}{2} C V^2$$

$$P = W/t$$

$$i_c = \frac{E}{R} e^{-t/RC}$$

$$v_c = E(1 - e^{-\frac{t}{RC}})$$

$$\tau = R\,C$$

$$L = \frac{\mu N^2 A}{l}$$

$\mu$ = permeability (Wb/A · m)
$N$ = number of turns (t)
$A$ = $m^2$
$l$ = m
$L$ = henries (H)

$$e = L \frac{di}{dt}$$

$$i_L = \frac{E}{R}(1\text{-}e^{-\frac{t}{L/R}})$$

$$v_L = E e^{-\frac{t}{L/R}}$$

Time constant $\tau = \frac{L}{R}$

$$W_L = \frac{1}{2} L i^2$$

$$P_{ac} = \frac{I_m^2 R}{2} - \frac{I_m^2 R}{2} \cos 2\omega t$$

$$I_{rms} = \sqrt{\frac{\int_0^T i^2(t)dt}{T}}$$

$$X_L = \omega L$$

$$X_C = \frac{1}{\omega C}$$

### Rectangular to Polar

$$Z = \sqrt{X^2 + Y^2} \tag{14.20}$$

$$\theta = \tan^{-1}\frac{Y}{X} \tag{14.21}$$

### Polar to Rectangular

$$X = Z\cos\theta \tag{14.22}$$

$$Y = Z\sin\theta \tag{14.23}$$