Formula Sheet

Complex Numbers

Eulers Formula

$$Ae^{j\theta} = A \cdot cos(\theta) + j \cdot A \cdot sin(\theta)$$

Rectangular and Polar Form

$$N = x + jy = r\angle\theta \qquad x = r \cdot \cos(\theta) \quad y = r.sin(\theta) \quad r = \sqrt{x^2 + y^2} \quad \theta = tan^{-1}(\frac{y}{x})$$

Complex Power

$$S = VI^* \qquad S = P + jQ \qquad S = |S|\angle\theta$$

$$Power\ Factor = \frac{P}{|S|}$$
$$= \cos(\theta)$$

Balanced Three Phase Power

$$|S| = \sqrt{3} \cdot |V_{line}| \cdot |I_{line}|$$

$$P = |S| \cdot \cos(\theta)$$
$$Q = |S| \cdot \sin(\theta)$$

Induction Motors

Electromagnetic Torque

$$T = 3\frac{(I_2')^2 R_2'}{s\omega_s}$$

Slip at the pull out point:

$$s = \frac{\pm R_2'}{\sqrt{R_1^2 + (X_1 + X_2')^2}}$$

Synchronous Machines

$$P_{total} = 3V_p I_p \cos\phi. = -3\frac{V_p E_t \sin\delta}{X_a},$$

$$Q_{total} = 3V_p I_p \sin\phi. = 3\frac{V_p (V_p - E_t \cos\delta)}{X_a}$$

RPM to rad/s conversion

$$\omega = N\frac{2\pi}{60}$$