Synchronous Machines:

1. $E_{\varphi 1} = 4.44 f N_c K_{w1} \Phi_1$
2. Short circuit ratio: $\frac{I_{fo}}{I_{fs}}$, $X_d = \frac{Maximum\ Voltage}{Minimum\ current}$, $X_q = \frac{Minimum\ Voltage}{Maximum\ current}$, VR=$\frac{V_{nl}-V_{fl}}{V_{fl}}$
3. $\tau_{ind} = \frac{3V_{\phi}E_A sin\delta}{\omega_m X_s}$,$P_{em} = m\frac{E_0 U}{X_d}sin\theta + mU^2\frac{X_d - X_q}{2X_d X_q}sin2\theta$
4. SD=$\frac{n_{nl}-n_{fl}}{n_{fl}}$,

Induction Machines

1. $f_{re} = \frac{P}{120}(n_{sync} - n_m), m_2 = Q_2, N_2 = \frac{1}{2}, k_{dp2} = 1, k_e = \frac{N_1 k_{dp1}}{N_2 k_{dp2}} = \frac{E_1}{E_2}$
2. $F_1 = \frac{m_1}{2}\frac{4}{\pi}\frac{\sqrt{2}}{2}\frac{N_1 I_1}{p}k_{dp1}, F_2 = \frac{m_2}{2}\frac{4}{\pi}\frac{\sqrt{2}}{2}\frac{N_2 I_2}{p}k_{dp2}, k_i = \frac{I_2}{I_1}$
3. $\boldsymbol{V_{TH}} = \boldsymbol{V_{\phi}}\frac{jX_M}{R_1 + j(X_1 + X_M)}, Z_{TH} = \frac{jX_M(R_1 + jX_1)}{R_1 + j(X_1 + X_M)}, R_{TH} \approx R_1\left(\frac{X_M}{X_1 + X_M}\right)^2, X_{TH} \approx X_1$
4. $\tau_{ind} = \frac{\frac{3V_{TH}^2 R_2}{s}}{\omega_{sync}\left[\left(R_{TH} + \frac{R_2}{s}\right)^2 + (X_{TH} + X_2)^2\right]}, s_{max} = \frac{R_2}{\sqrt{R_{TH}^2 + (X_{TH} + X_2)^2}}, \tau_{max} =$

$$\frac{3V_{TH}^2}{2\omega_{sync}\left[R_{TH} + \sqrt{R_{TH}^2 + (X_{TH} + X_2)^2}\right]}$$

DC Machines

1.$V_f = I_f R_f, V_t = E_a \pm I_a R_a, E_a = K_a \phi_d \omega_m, T_e = K_a \phi_d I_a$ $\quad K_a = \frac{pz}{2\pi a}$

Fundamental of electrical machines

$B = \mu H$

$\mu_0 = 4\pi \times 10^{-7}$

$\boldsymbol{E_A = \sqrt{2}\pi N_C \phi f}$

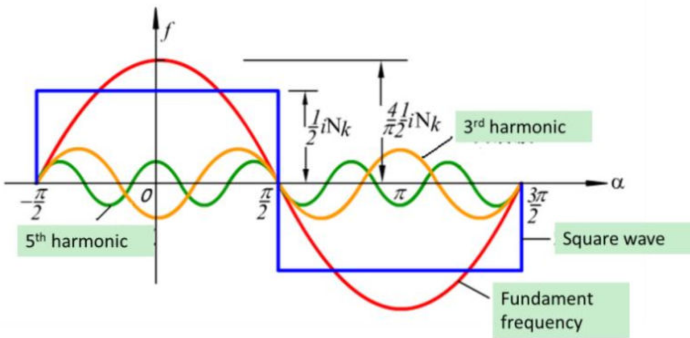
$\alpha = \frac{p \times 360^{\circ}}{Q}$

$E_{\nu} = 4.44\, \nu f N_c k_{p\nu} k_{b\nu} \Phi_{\nu}$

$N_c = \frac{pqN_k}{a}$ (single-layer winding)

$$k_{b\nu} = \frac{\sin q\frac{\nu\alpha}{2}}{q\sin\frac{\nu\alpha}{2}}$$

$k_{p\nu} = \sin(\nu y\frac{\pi}{2})$



$$f(\alpha) = f_{\mathrm{K1}} + f_{\mathrm{K3}} + f_{\mathrm{K5}} + \cdots = \sum_{\nu=1,3,5,\cdots}^{\infty} c_{\nu}\cos\nu\alpha$$

$$c_{\nu} = \frac{1}{\pi}\int_0^{2\pi} f(\alpha)\cos\nu\alpha\, \mathrm{d}\alpha = \frac{4}{\pi}f_{\mathrm{K}}\frac{1}{\nu}\sin\nu\frac{\pi}{2}$$

$$F_{\nu} = \frac{1}{\nu}\frac{3}{2}\frac{4}{\pi}\frac{\sqrt{2}}{2}IN_C k_w$$