Electrical Machines Formulas

1. $I = \frac{dq}{dt}$
2. $R = \rho \frac{\ell}{A}$
3. $I = \frac{V}{R}$
4. $P = VI = I^2R = \frac{V^2}{R}$ (DC or AC R only)
5. $R = R_1 + R_2 + \ldots + R_n$ (Resistors, Series)
6. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_1} + \ldots + \frac{1}{R_n}$ (Resistors, Parallel)
7. $W = Pt$
8. $\mathcal{F} = NI$
9. $\Phi = \frac{\mathcal{F}}{\mathcal{R}}$
10. $L = \frac{N^2}{\mathcal{R}} = N\frac{\Delta\phi}{\Delta I}$
11. $V_L = L\frac{di}{dt} = N\frac{d\phi}{dt}$
12. $L = L_1 + L_2 + \ldots + L_n$ (Inductors, Series)
13. $\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_1} + \ldots + \frac{1}{L_n}$ (Inductors, Parallel)
14. $W = \frac{1}{2}LI^2$ (Inductor)
15. $\tau = \frac{L}{R}$ (Inductor)
16. $I_C = \frac{E}{R}\left(1 - e^{-\frac{tR}{L}}\right)$ (DC, Inductor)
17. $V_C = E\left(e^{-\frac{tR}{L}}\right)$ (DC, Inductor)
18. $C = \frac{q}{V}$ (Capacitor)
19. $W = \frac{1}{2}CV^2$ (Capacitor)
20. $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_1} + \ldots + \frac{1}{C_n}$ (Capacitors, Series)
21. $C = C_1 + C_2 + \ldots + C_n$ (Capacitors, Parallel)
22. $V_C = E\left(1 - e^{-\frac{t}{RC}}\right)$ (DC, Capacitor)
23. $I_C = \frac{E}{R}e^{-\frac{t}{RC}}$ (DC, Capacitor)
24. $T = \frac{1}{f}, \quad f = \frac{1}{T}$
25. $\omega = 2\pi f$
26. $X_L = \omega L = 2\pi f L$
27. $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$
28. $Z = |\mathbf{Z}|$
29. $Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$ (Series)
30. $\frac{1}{Z} = \sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2}$ (Parallel)

Electrical Machines Formulas

31. $f = \dfrac{1}{2\pi\sqrt{LC}}$ (at Resonance)

32. $\text{THD} = \dfrac{\sqrt{I_2^2 + I_3^2 \ldots + I_n^2}}{I_1}$ (similar for V or P)

33. $Q = Q_L - Q_C$

34. Recall Impedance Triangle (R, X, Z, θ)

35. Recall Power Triangle (P, Q, S, θ)

36. Recall SOH CAH TOA and Pythagorean Theorem

37. $Q_L = VI = I^2 X_L = \dfrac{V^2}{X_L}$ (AC across inductor)

38. $Q_C = VI = I^2 X_C = \dfrac{V^2}{X_C}$ (AC across capacitor)

39. $S = VI = I^2 Z = \dfrac{V^2}{Z}$ (AC across impedance)

40. $pf = \dfrac{P}{S} = \cos\theta$

41. $1 \text{ HP} = 746 \text{ W}$

42. $P_{1\phi} = VI\ pf$

43. $P_{3\phi} = 3P_{1\phi},\ \ Q_{3\phi} = 3Q_{1\phi},\ \ S_{3\phi} = 3S_{1\phi}$

44. $S_{3\phi} = 3V_\phi I_\phi = \sqrt{3} V_L I_L$

45. $P_{3\phi} = S_{3\phi}\ pf = \sqrt{3} V_L I_L\ pf$

46. $\eta = \dfrac{P_{\text{out}}}{P_{\text{in}}}$ (book uses λ)

47. $V_L = \sqrt{3} V_\phi,\ \ I_L = I_\phi$ (Wye Connection)

48. $V_L = V_\phi,\ \ I_L = \sqrt{3} I_\phi$ (Delta Connection)