Electrical Engineering Formulas

Ohms Law

Formula

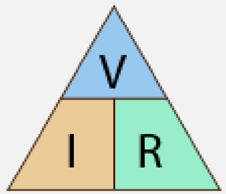
Ohm's law :

$$V = IR \qquad I = \frac{V}{R} \qquad R = \frac{V}{I}$$

V ⟶ Voltage (V)

I ⟶ Current (A)

R ⟶ Resistance (Ω)



Rectifier Efficiency

Formula

$$\eta = \frac{P_{dc}}{P_{ac}} \times 100$$

η → Rectifier Efficiency

P_{dc} → DC output power

P_{ac} → AC input power

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Ripple Factor

Formula

Ripple Factor :

$$\text{Ripple Factor} = \frac{\text{RMS Voltage}}{\text{DC Voltage}} \times 100$$

getcalc.com

Single Phase AC Power

Formula

Single phase :

$$\text{Horsepower} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \text{Eff}}{745.7}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes} \times \text{PF}$$

$$\text{Kilowatts} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF}}{1000}$$

$$\text{Kilowatt-hours} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \text{hours}}{1000}$$

$$\text{KVA} = \frac{\text{Volts} \times \text{Amperes}}{1000}$$

KVA ⟶ Kilo-Volts-Amperes

PF ⟶ Power Factor

Eff ⟶ Efficiency

Two Phase AC Power

Formula

Two phase :

$$\text{Horsepower} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \text{Eff} \times 2}{745.7}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes} \times \text{PF} \times 2$$

$$\text{Kilowatts} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times 2}{1000}$$

$$\text{Kilowatt-hours} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \text{hours} \times 2}{1000}$$

$$\text{KVA} = \frac{\text{Volts} \times \text{Amperes} \times 2}{1000}$$

KVA ⟶ Kilo-Volts-Amperes

PF ⟶ Power Factor

Eff ⟶ Efficiency

getcalc.com

Three Phase AC Power

Formula

Three phase :

$$\text{Horsepower} = \frac{\text{Volts} \times \text{Amperes} \times \sqrt{3} \times \text{PF} \times \text{Eff}}{745.7}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes} \times \text{PF} \times \sqrt{3}$$

$$\text{Kilowatts} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \sqrt{3}}{1000}$$

$$\text{Kilowatt-hours} = \frac{\text{Volts} \times \text{Amperes} \times \text{PF} \times \text{hours} \times \sqrt{3}}{1000}$$

$$\text{KVA} = \frac{\text{Volts} \times \text{Amperes} \times \sqrt{3}}{1000}$$

KVA ⟶ Kilo-Volts-Amperes

PF ⟶ Power Factor

Eff ⟶ Efficiency

DC Power

Formula

DC Power:

$$\text{Horsepower} = \frac{\text{Volts} \times \text{Amperes} \times \text{Eff}}{745.7}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

$$\text{Kilowatts} = \frac{\text{Volts} \times \text{Amperes}}{1000}$$

$$\text{Kilowatt-hours} = \frac{\text{Volts} \times \text{Amperes} \times \text{hours}}{1000}$$

Eff ⟶ Efficiency

getcalc.com

Power Factor

Formula

$$\text{Power Factor} = \frac{\text{True Power}}{\text{Apparent Power}}$$

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Torque to Horsepower (hp)

Formula

$$\text{Horsepower} = \frac{\text{Torque}_{\text{in-lb}} \times \text{Speed in RPM}}{63{,}025}$$

$$\text{Horsepower} = \frac{\text{Torque}_{\text{ft-lb}} \times \text{Speed in RPM}}{5{,}252}$$

$$\text{Horsepower} = \frac{\text{Torque}_{\text{Nm}} \times \text{Speed in RPM}}{9{,}550}$$

getcalc.com

Horsepower (hp) to Torque

Formula

$$Torque_{in\text{-}lb} = \frac{\text{Power in HP} \times 63{,}025}{\text{Speed in RPM}}$$

$$Torque_{ft\text{-}lb} = \frac{\text{Power in HP} \times 5{,}252}{\text{Speed in RPM}}$$

$$Torque_{Nm} = \frac{\text{Power in KW} \times 9{,}550}{\text{Speed in RPM}}$$

$Torque_{in\text{-}lb}$ → Torque in US Customary Units

$Torque_{Nm}$ → Torque in SI Units

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Cylindrical Coil Inductance

Formula

$$L = \frac{\mu_0 N^2 \pi r^2}{\ell}$$

If $N = n\ell$

$$L = \frac{\mu_0 N^2 \pi r^2}{\ell} = \mu_0 n^2 \ell \pi r^2 = \mu_0 n^2 \ell A$$

- L → Inductance of a Cylindrical Coil
- μ → permeability of free space
- ℓ → length of wire used in coil
- N → number of turns in coil
- r → radius of coil cross section
- A → cross-sectional area of coil

Equivalent Resistance - Series & Parallel Circuit

Formula

Equivalent Resistance (R_{eq}) :

for series connection :

$$R_{eq} = R_1 + R_2 + R_3$$

for parallel connection :

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

R_{eq} ⟶ Equivalent Resistance

R_1 ⟶ resistance of resistor R_1

R_2 ⟶ resistance of resistor R_2

R_3 ⟶ resistance of resistor R_3

Equivalent Capacitance - Series & Parallel Circuit

Formula

Equivalent Capacitance (C_{eq}) :

for series connection :

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

for parallel connection :

$$C_{eq} = C_1 + C_2 + C_3$$

C_{eq} → Equivalent Capacitance

C_1 → capacitance of capacitor C_1

C_2 → capacitance of capacitor C_2

C_3 → capacitance of capacitor C_3

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Equivalent Inductance - Series & Parallel Circuit

Formula

Equivalent Inductance (L_{eq}) :

for series connection :

$$L_{eq} = L_1 + L_2 + L_3$$

for parallel connection :

$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

L_{eq} ⟶ Equivalent Inductance

L_1 ⟶ inductance of inductor or coil L_1

L_2 ⟶ inductance of inductor or coil L_2

L_3 ⟶ inductance of inductor or coil L_3

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Equivalent Impedance - RLC Series Circuit

Formula

Impedance for RLC Series :

$$Z_{RL\text{-}series} = \sqrt{R^2 + X_L^2}$$

$$Z_{RC\text{-}series} = \sqrt{R^2 + X_C^2}$$

$$Z_{LC\text{-}series} = \sqrt{(X_L - X_C)^2}$$

$$Z_{RLC\text{-}series} = \sqrt{R^2 + (X_L - X_C)^2}$$

$$X_L = 2\pi fL$$

$$X_C = \frac{1}{2\pi fC}$$

Equivalent Impedance - RLC Parallel Circuit

Formula

Impedance for RLC Parallel :

$$\frac{1}{Z_{RL\text{-}parallel}} = \sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{X_L}\right)^2}$$

$$\frac{1}{Z_{RC\text{-}parallel}} = \sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{X_C}\right)^2}$$

$$\frac{1}{Z_{LC\text{-}parallel}} = \sqrt{\left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2}$$

$$\frac{1}{Z_{RLC\text{-}parallel}} = \sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2}$$

$$X_L = 2\pi fL$$

$$X_C = \frac{1}{2\pi fC}$$

Voltage Drop

Formula

$$Voltage_{drop} = I \times Z$$

$Voltage_{drop}$ → Voltage Drop

I → current in Amps

Z → impedance in ohms

getcalc.com

Magnetic Field Strength

Formula

$$\phi = K_f \times I_f$$

ϕ ⟶ Magnetic Field Strength

K_f ⟶ magnetic field constant

I_f ⟶ field current