GENERAL

electrical engineering formulas cheat sheet

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Introduction

Electrical engineering is a field where precision and quick access to key equations can mean the difference between a successful design and a costly mistake. Whether you're a student tackling a challenging exam, a professional drafting a circuit schematic, or an enthusiast building a DIY project, having a reliable reference for the most frequently used formulas is invaluable. A well crafted **electrical engineering formulas cheat sheet** serves as a compact, at a glance guide that saves time, reduces errors, and boosts confidence.

In this article, we'll explore why such a cheat sheet is indispensable, outline the essential categories of equations you should include, and provide practical advice on how to create, customize, and effectively use your own reference. By the end, you'll have a comprehensive understanding of the core formulas, along with a step by step plan to build a personalized cheat sheet that fits your workflow.

Why a Cheat Sheet Is Essential for Electrical Engineers

Electrical engineering courses and professional work demand quick recall of complex relationships between voltage, current, resistance, impedance, power, and magnetic fields. A cheat sheet offers several advantages:

- Time Efficiency – Instead of hunting through textbooks or online resources, you can glance at a single page to find the exact equation you need.
- Reduced Cognitive Load – With formulas readily available, you can focus on problem solving and design decisions rather than memorizing every detail.
- Error Minimization – A standardized reference reduces the risk of typos or incorrect substitutions that can lead to faulty designs.
- Learning Reinforcement – The process of compiling a cheat sheet forces you to review and internalize each formula, reinforcing your understanding.
- Portable Knowledge – Whether you're on a lab bench, in a classroom, or traveling, a compact cheat sheet is always at hand.

Core Electrical Engineering Formulas

Below is a curated list of the most frequently used equations, organized into key subfields. For each formula, we provide the standard notation, a brief description, and typical applications.

Direct Current (DC) Fundamentals

P = V × I = I² × R = V² / R – Three equivalent forms for calculating power dissipated in a resistor.

" V = 0 – The algebraic sum of all voltages around any closed loop in a circuit equals zero.

" I = 0 – The sum of currents entering a node equals the sum leaving it.

Series: R_total = R • + R , + …
Parallel: 1/R_total = 1/R • + 1/R , + …

Alternating Current (AC) and Impedance

S = V × I* = P + jQ – Apparent power (S) is the product of voltage and complex conjugate of current. Real power (P) and reactive power (Q) are its components.

PF = cos(<b’ Ò ò Å7Â b & F–ò öb &V Â ðwer to apparent power, indicating efficiency.

Inductive Reactance: X_L = <”À
Capacitive Reactance: X_C = 1/(<”2•

f € = 1 / (2< !¢„Ä2’’ b `requency at which inductive and capacitive reactances cancel.

Power Systems and Transmission

9Eb Ò ’ r …" ² ¥,’ b Total voltage drop accounting for both resistance and reactance.

I_sc = V / Z_total – Current during a fault, where Z_total includes source and fault impedances.

Capacitance needed: C = (I × sin(<eööÆB’ Ò ’ r 6–â*ƒ* Æ_new)) / (2< b r V)

Electronics – Semiconductors and Amplifiers

Common Emitter: ;" Ò •ô2 ò •ô" b & F–ò öb 6öÆÆV7F÷" 7W'&VçB Fò & 6R 7W'&VçBà

A_v = -g_m × R_C – Where g_m = I_C / V_T.

<B Ò " r 2 b FWFW mines the charging/discharging rate of a capacitor.

Low pass: f_c = 1 / (2< $2•
High pass: same formula with R and C swapped.

Electromagnetics

B = ;Â „„ ² Ò’ b &VÆ F–öç6†— &WGpeen magnetic field intensity (H), magnetization (M), and flux density (B).

L = ;Â ë" ò Â b Where N is turns, A is cross sectional area, and l is length.

M = k " (L •L ,) – Coupling coefficient (k) times the geometric mean of individual inductances.

W = ½ L I²

Control Systems and Signal Processing

H(s) = Y(s) / X(s) – Describes system response.

Plot of poles of H(s) as a parameter varies, used for stability analysis.

Magnitude and phase versus frequency, derived from H(j<’’à

f_s "e 2B – Sampling frequency must be at least twice the bandwidth to avoid aliasing.

How to Use a Cheat Sheet Effectively

Having a cheat sheet is only the first step; using it efficiently is where the real benefit lies. Here are proven strategies:

- Organize by Context – Group formulas by application (e.g., DC circuits, AC analysis, power systems). When you’re working on a specific problem, you’ll know exactly which section to consult.
- Include Units and Typical Ranges – Adding a note about the units (V, A, :’Â ,Â `, etc.) and typical value ranges

helps prevent unit mismatch errors.

- Highlight Common Mistakes – For each formula, list the most frequent pitfalls (e.g., forgetting the negative sign in Faraday's Law or misapplying the power factor correction).
- Use Visual Cues – Bold or underline key variables, or use color coding to differentiate between voltage, current, and impedance.
- Keep it Updated – As you learn new concepts, add them to the sheet and remove outdated or rarely used equations.
- Practice Retrieval – Periodically test yourself by covering the formulas and recalling them from memory, reinforcing learning.

Creating Your Own Customized Cheat Sheet

Below is a step by step guide to building a cheat sheet that reflects your personal learning style and professional needs.

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