Electronic and Electrical Engineering

Principles and Practice

Third edition

Lionel Warnes

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Dedicated to Alexis Warnes

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Physical constants

The speed of light in a vacuum, c	3×10^8 m/s
The permeability of free space or the magnetic constant, μ_0	$4\pi \times 10^{-7}$ H/m
The permittivity of free space or the electric constant, ϵ_0	8.85×10^{-12} F/m
Planck's constant, h	6.626×10^{-34} J.s
Boltzmann's constant, k	1.38×10^{-23} J/K
The magnitude of the electronic charge, q	1.6×10^{-19} C
The ice point	273.2 K

Notes: $c = 1/\sqrt{(\mu_0\epsilon_0)}$. Impedance of free space, $Z_0 = \sqrt{(\mu_0/\epsilon_0)} = 377 \Omega$. The above, where approximated, are accurate to $\pm 0.14\%$.

Unit prefixes

a	atto	10^{-18}
f	femto	10^{-15}
p	pico	10^{-12}
n	nano	10^{-9}
μ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^3
M	mega	10^6
G	giga	10^9
T	tera	10^{12}
P	peta	10^{15}
E	exa	10^{18}

Notes: Order is important, so that 1 ms.V = 1 millisecond-volt while 1 V.m.s = 1 volt-metre-second; for clarity a dot may be used to separate the different units. Lower and upper case styles for units and prefixes must be carefully followed: 1 K.gm = 1 Kelvin-gram-metre, while 1 kg.m = 1 kilogram-metre and 1 kg = 1 kilogram; 1 mS = 1 millisiemens, 1 ms = 1 millisecond. Note also that 1 mm² = 1 square mm = 10^{-6} m². Submultiples in denominators should be removed to the numerator, so that 1 pF/mm² becomes 1 μ F/m².

Units

Base units

quantity	unit	symbol	dimension
Mass	kilogram	kg	M
Length	metre	m	L
Time	second	s	T
Current ampere	A	I	

Derived units

quantity	unit	symbol	dimensions
frequency	hertz	Hz	T^{-1}
speed	metre/second	m/s	LT^{-1}
acceleration	metre/sec/sec	m/s^2	LT^{-2}
force	newton	N	MLT^{-2}
work, energy	joule	J	ML^2T^{-2}
power	watt	W	ML^2T^{-3}
charge	coulomb	C	TI
potential	volt	V	$ML^2T^{-3}I^{-1}$
resistance	ohm	Ω	$ML^2T^{-3}I^{-2}$
conductance	siemens	S	$M^{-1}L^{-2}T^3I^2$
capacitance	farad	F	$M^{-1}L^{-2}T^4I^2$
inductance	henry	H	$ML^2T^{-2}I^{-2}$
magnetic field	ampere/metre	A/m	$L^{-1}I$
flux density	tesla	T	$MT^{-2}I^{-1}$
magnetic flux	weber	Wb	$ML^2T^{-2}I^{-1}$