Philip Kosky
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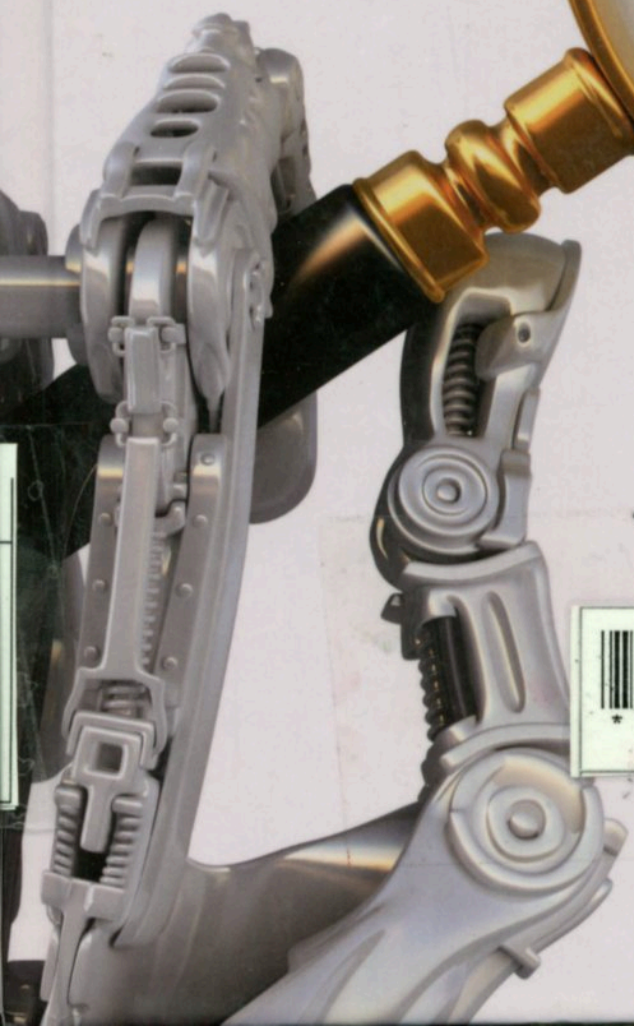
Exploring Engineering

An Introduction to Engineering and Design



Fourth Edition

AP

Physical Constants and Unit Conversion Factors*

PHYSICAL CONSTANTS

Avogadro's Number,
$N_A = 6.023 \times 10^{26}$ molecules/kgmole
Standard Gravitational Acceleration
$g = 32.174$ ft/s^2 $= 9.807$ m/s^2
Newton's Second law Constant,
$g_c = 32.174$ lbm·ft/(lbf·s^2) (English units)
$= 1$ (integer) [0] (MKS units)
Universal Gas Constant,
$R = 1545.35$ ft·lbf/(lbmole·R)
$= 8314.3$ J/(kgmole·K)

LENGTH

1 m $= 3.2808$ ft $= 39.37$ in $= 100$ cm
1 cm $= 0.0328$ ft $= 0.394$ in $= 10^{-2}$ m
1 km $= 1000$ m $= 0.6215$ miles $= 3281$ ft
1 in $= 2.540$ cm $= 0.0254$ m
1 ft $= 12$ in $= 0.3048$ m

AREA

1 m^2 $= 10^4$ cm^2 $= 10.76$ ft^2 $= 1550$ in^2
1 ft^2 $= 144$ in^2 $= 0.0929$ m^2 $= 929.05$ cm^2
1 cm^2 $= 10^{-4}$ m^2 $= 1.0764 \times 10^{-3}$ ft^2 $= 0.155$ in^2
1 in^2 $= 6.94 \times 10^{-3}$ ft^2 $= 6.452 \times 10^{-4}$ m^2 $= 6.452$ cm^2

VOLUME

1 m^3 $= 35.313$ ft^3 $= 6.1023 \times 10^4$ in^3 $= 264.171$ gallon
1 liter (L) $= 10^{-3}$ m^3 $= 0.0353$ ft^3 $= 61.03$ in^3
1 gallon $= 231$ in^3 $= 0.13368$ ft^3 $= 3.785 \times 10^{-3}$ m^3
1 ft^3 $= 1728$ in^3 $= 0.02832$ m^3 $= 7.4805$ gallon
1 in^3 $= 16.387$ cm^3 $= 1.6387 \times 10^{-5}$ m^3

MASS

1 kg $= 1000$ g $= 2.2046$ lbm $= 0$ 0.0685 slug
1 lbm $= 453.6$ gram $= 0.4536$ kg $= 3.108 \times 10^{-2}$ slug
1 slug $= 32.174$ lbm $= 1.459 \times 10^4$ gram $= 14.594$ kg

MASS DENSITY

1 lbm/ft^3 $= 16.0187$ kg/m^3
1 kg/m^3 $= 0.062427$ lbm/ft^3 $= 10^{-3}$ g/cm^3
1 g/cm^3 $= 1$ kg/liter $= 62.4$ lbm/ft^3 $= 10^3$ kg/m^3

FORCE

1 newton $= 10^5$ dyne $= 1$ kg·m/s^2 $= 0.225$ lbf
1 lbf $= 4.448$ newton
1 poundal $= 1$ lbm ft/s^2 $= 0.031081$ lbf

ENERGY

1 joule $= 1$ newton·m $= 1$ kg·m^2/s^2 $= 9.479 \times 10^{-4}$ Btu
1 kJ $= 1000$ joule $= 0.9479$ Btu
1 Btu $= 1055.0$ joule $= 1.055$ kJ $= 778.16$ ft·lbf

POWER

1 watt $= 1$ joule/s $= 1$ kg·m^2/s^3 $= 1.3405 \times 10^{-3}$ hp
1 kW $= 1000$ watt $= 73.7.3$ ft·lbf/s $= 1.3405$ hp
1 Btu/hr $= 0.293$ watt $= 0.2161$ ft·lbf/s $= 3.93 \times 10^{-4}$ hp
1 hp $= 550$ ft·lbf/s $= 33{,}000$ ft·lbf/min $= 746$ watt

ELECTRICAL UNITS

1 watt $=$ J/s $= 1$ V·A $= 621$ lumens at 5500 A
1 kilowatt hour $= 3412$ Btu $= 1.341$ horsepower hour
1 volt $= 1$ joule/coulomb $= 1$ watt/amp $= 1$ ohm·amp
1 amp $= 1$ coulomb/second

*This table follows the conventional conversion table format that emphasizes its readability and may not accurately represent the appropriate number of significant figures (as explained in the text).

The Engineering Ethics Decision Matrix

This is an example of one particular Engineering Ethics Decision Matrix

Options → NSPE Canons ↓	Go along with the decision	Appeal to higher management	Quit your job	Write your state representative	Call a newspaper reporter
Hold paramount the safety, health and welfare of the public.					
Perform services only in the area of your competence					
Issue public statements only in an objective and truthful manner					
Act for each employer or client as faithful agents or trustees					
Avoid deceptive acts					
Conduct themselves honorably . . .					

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Academic Press is an imprint of Elsevier

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This new edition of *Exploring Engineering: An Introduction to Engineering and Design* has been expanded and reorganized to cover industrial engineering and aeronautical engineering, and now includes a deeper discussion of nuclear engineering. With its broad coverage of today's many engineering specialities, *Exploring Engineering* provides students with an opportunity to explore the fundamental principles that form the basis of the engineering profession, and to understand how these principles apply within a structured design process.

KEY FEATURES

- NEW: Chapters on Industrial Engineering and Aeronautical Engineering
- NEW: Chapter on engineering design team building in the "Hands-On" design section
- NEW: Content on engineering drawing and sketching and sustainable engineering
- NEW: Expanded content in the Nuclear Energy, Defining the Problem, Generation of Alternative Concepts, and Detailed Design chapters
- An Engineering Ethics Decision Matrix is introduced in Chapter 1 and used throughout the book to pose ethical challenges and explore ethical decision-making in an engineering context
- Lists of "Top Engineering Achievements" and "Top Engineering Challenges" help put the material in context and show engineering as a vibrant discipline involved in solving societal problems

ABOUT THE AUTHORS

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ISBN 978-0-12-801242-0

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An imprint of Elsevier

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