

BNEN

Background books

1. Basic Background Books

The following books are basic reference works (in the English language) providing good background information for incoming BNEN students. To be successful in the BNEN program, most (not necessarily all) of the contents of these books should be mastered before starting the program. Some self-study on these subjects is recommended, either before starting the program or during the year.

All listed books are most relevant; the books in **bold** can serve as a priority selection, which can be read if only limited time is available. Those books are recommended for a first reading.

1.1 Mathematics

We assume basic knowledge in elementary algebra (including matrices, determinants and vector spaces), basic calculus (continuity, differentiation, integration, power series, partial differentiation, multiple integration, differential vector analysis —div, curl, grad— etc), analytic geometry, and elementary differential equations.

The following books are recommended:

George B. Arfken & Hans J. Weber,
“Mathematical Methods for Physicists”, 5-th Ed.,
Harcourt, San Diego, 2001

Eugene Butkov
Mathematical Physics
Addison Wesley, Reading, MA, 1968

For those who have forgotten some basic stuff, the following may be helpful:

Very basic / somewhat elementary:
George B. Thomas, Jr & Ross L. Finney,
“Calculus and Analytic Geometry”, 5-th Ed.,
Addison Wesley, Reading, MA, 1982

Somewhat theoretical:
Michael Spivak,
“Calculus”, 3-rd Ed.,
Publish or Perish, Houston, TX, 1994

Less rigorous but very good for insight:

Morris Kline,
“Calculus; and Intuitive and Physical Approach”, 2-nd Ed.,
Dover, Mineola, NY, 1977

The reference work in English on elementary differential equations:

William E. Boyce & Richard C. DiPrima,
“Elementary Differential Equations and Boundary Value Problems”, 7-th Ed.,
Wiley, NY, 2001

1.2 Physics

A variety of good physics textbooks exist. For Nuclear Engineering purposes, especially aspects of thermal physics, fluid physics, kinetic theory & statistical physics, and introductory quantum mechanics are important. Clearly, elementary mechanics is a necessary prerequisite. Electromagnetic aspects are important as a general background, but are not directly needed for (fission-related) Nuclear Engineering applications –although it is very important for those who would want to specialize in nuclear fusion & plasma physics.

The following can serve as examples.

Marcello Alonso & Edward J. Finn
“Fundamental University Physics”
Addison-Wesley Pub Company, Reading Massachusetts
(also translated in several languages; in Dutch 6 Volumes)

Paul M. Fishbane, Stephen Gasiorowicz & Stephen T. Thornton
“Physics for scientists and engineers, 2-nd Ed, extended”
Printice Hall, Upper Saddle River, NJ, 1996

Richard P. Feynman, Robert B. Leighton & Matthew Sands
“The Feynman lectures on Physics”, 3 Vols
Addison-Wesley Publishing Company, Reading, Massachusetts, 1965

Keith R. Symon,
“Mechanics”, 3-rd Ed.,
Addison-Wesley, Reading, Massachusetts, 1971

Kenneth S. Crane,
Modern Physics, 2-nd Ed.,
Wiley, NY, 1996

Robert Eisberg & Robert Resnick
“Quantum Physics of Atoms, Molecules, Solids and Nuclei”, 2-nd Ed.,
Wiley, NY, 1985

Stephen Gasiorowicz,
“Quantum Physics”,
Wiley, NY, 1974

There are very interesting intermediate-level books on electrodynamics. But that subject is not really a prerequisite for (fission-related) Nuclear Engineering. The subject is very important for fusion-related nuclear engineering though:

Paul Lorrain, Dale R. Corson & François Lorrain,
“Electromagnetic Fields and Waves”, 3-rd Ed.,
Freeman, NY, 1988
(Later editions are less appropriate according to WDH.)

David J. Griffiths
“Introduction to Electrodynamics”, 3-rd Ed.,
Prentice Hall, Englewood Cliffs, 1998

Carl T. A. Johnk,
“Engineering Electromagnetic Fields and Waves”
Wiley, NY, 1975

1.3 Chemistry

Elementary chemistry, but very well explained:
Raymond Chang,
“Chemistry”, 3-rd Ed.,
Mc Graw Hill, NY, 1989

A tour de force on Physical Chemistry:
P. W. Atkins,
“Physical Chemistry” 4-th Ed.,
Oxford University Press, Oxford, 1990
(Later editions exist.)

1.4 Thermodynamics, Heat Transfer and Fluid Mechanics

The following books each can serve as a good background to Nuclear-Engineering Applications

Michael J. Moran & Howard N. Shapiro
“Fundamentals of Engineering Thermodynamics”, 3-rd Ed.,
Wiley, NY, 1998

Kenneth Wark, Jr & Donald E. Richards,
“Thermodynamics”, 6-th Ed.,
Mc Graw Hill, NY 1999

Yunus A. Cengel & Michael A. Boles,
“Thermodynamics; an Engineering Approach”, 3-rd Ed.,
Mc Graw Hill, NY, 1998

Frank P. Incropera & David P. DeWitt
“**Fundamentals of Heat and Mass Transfer**”, 4-th Ed.,
Wiley, NY, 1996

John H. Lienhard IV & John Lienhard V
“A Heat Transfer Textbook”, 3-rd Ed.,
Phlogiston Press, Cambridge Massachusetts, 2002
Available on the web: <http://web.mit.edu/lienhard/www/ahtt.html>

Yunus A. Cengel,
“Heat Transfer; a Practical Approach”
Mc Graw Hill, NY, 1998

Robert W. Fox & Alan T. McDonald
“**Introduction to Fluid Dynamics**”; 5-th Ed.,
Wiley, NY, 1998

A very interesting book covering the fields of heat transfer, fluid mechanics and particle diffusion, and hence presenting a unified transport theory (on a macroscopic scale) is the book:

R. Byron Bird, Warren E. Stewart & Edwin N. Lightfoot
“**Transport Phenomena**”, 2-nd Ed.,
Wiley, NY, 2002

(The “red” first edition dates from 1960 and is considered as the “bible” in macroscopic transport phenomena. It is available in most scientific libraries.)

Also of interest is the book (it is a simpler version of the Bird, Stewart & Lightfoot book):

James R. Welty, Charles E. Wicks & Robert E. Wilson
“Fundamentals of Momentum, Heat and Mass Transfer”, 3-rd Ed.,
Wiley, NY, 1984

There are more interesting books available on fluid mechanics, and although they are still only of an intermediate level, they are already somewhat advanced to serve as a prerequisite for Nuclear Engineering (e.g., H. Lamb, L.M. Milne-Thomson, G. K. Batchelor, L.D. Landau & E. M. Lifshitz, a.o.)

1.5 Material Science & Engineering

William. D. Callister, Jr.
“Materials Science and Engineering; an Introduction”, 3-rd Ed.,
Wiley, NY, 1994

James M. Gere & Stephen P. Timoshenko (+)
“Mechanics of Materials”, 3-rd Ed.,
PWS-KENT Pub Company, Boston, 1990

2. More Advanced Books

Many interesting advanced books in all of the above subjects exist. Please contact the BNEN instructors for certain scientific fields.