APPH E4010x Introduction To Nuclear Science *3 pts*. Prerequisites: Mathematics V1202 and E1210 and Two Semesters of General Physics V1201-02 or their equivalents.

This introductory course is for individuals with an interest in medical physics and other branches of radiation science. Topics covered include: the Rutherford nuclear atom; properties of the nucleus. Radioactivity: decay chains, types of decay, half-lives, dating. Nuclear reactions, compound nucleus, cross sections. Models for alpha and beta decay; model of deuteron; scattering and nuclear forces. Interaction of radiation with matter, and detection of nuclear radiation. Artificial radioactivity, neutrons, neutron reactions, and neutron slowing down; moderators.

Instructor: Prof. Mike Mauel
                   `<mailto: mauel@columbia.edu>`
                   Room 200 S. W. Mudd Bldg

Time: Tuesday: Room 414 Pupin Laboratories
                   5:00 PM – 7:30 PM

Grading: Weekly homeworks (10%),
                   Three open-book quizzes. 90-minutes, (3 x 30%)

Textbook:

Nuclear Physics: Principles and Applications is an introduction to the basic theory and applications of modern nuclear physics. Aimed at students taking a first course in nuclear physics, the text is divided into two broad sections. The first part provides a general introduction to nuclear physics, whilst the latter half focuses on some of the most important and current applications, including nuclear medicine, instrumentation and energy from fission and fusion. Written from an experimental point of view, this text offers the reader many practical examples and problems to help encourage understanding. Although, complex material treatments are avoided, derivations of formulae are given as necessary, but with a minimum mathematical complexity.

Carefully written and structured, this book will appeal to science and engineering students who require an understanding of the fundamental principles of nuclear physics and its applications.
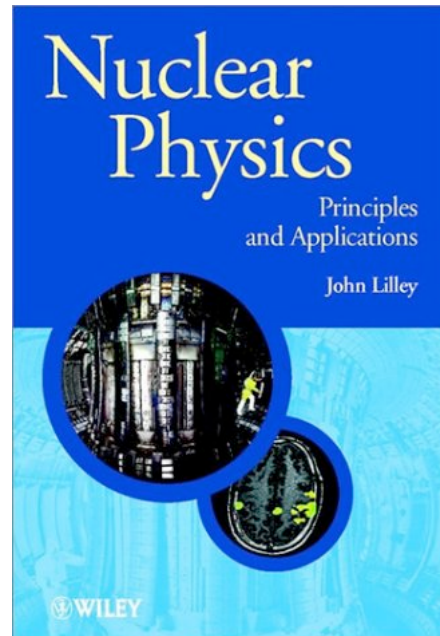
Paperback: 412 pages ; Dimensions (in inches): 0.97 x 9.58 x 6.64
Publisher: John Wiley & Sons; 1 edition (June 8, 2001)
ISBN: 047197936

# *Very* Optional Textbooks (Not Necessary for Course)

Physics for Diagnostic Radiology is a compact primer to help radiologists prepare for Part One of the Fellowship examination of the Royal College of Radiologists in Britain, and for medical physicists and radiographers in training, but also suitable for candidates for the American College of Radiology accreditation. Seven authors contribute their knowledge of their specialties, providing an analytical approach to the physics needed in the wide range of imaging techniques available. They incorporate changes in the field and the exam since the 1987 first edition, and also expand to a larger readership.

This reference book will *not be covered* in the same way as our textbook (Lilley), but it adds materials appropriate to medical physics students.
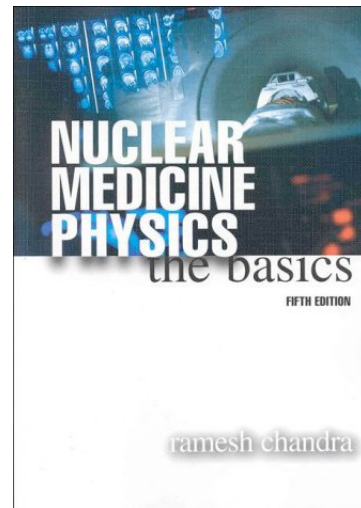
Paperback: 446 pages; Dimensions (in inches): 0.95 x 9.65 x 7.45
Publisher: Institute of Physics Publishing; 2nd edition (April 15, 1999)
ISBN: 0750305916
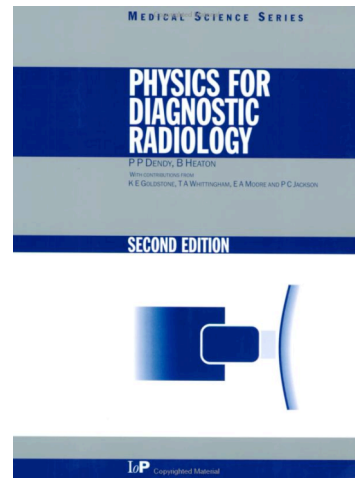
Nuclear Medicine Physics: The Basics is an introductory book on physics and related basic sciences of nuclear medicine. The book is designed primarily for residents in radiology and nuclear medicine and students studying nuclear medicine technology. Coverage includes nuclides and radioactive processes, detection of radiation, emission computed tomography, and safe handling of materials. Formerly titled , this fifth edition is organized for fast access to material, and contains new and revised material on areas such as radiopharmaceuticals, scintillation cameras, and SPECT. New learning features include chapter key points, use of both SI and CGS units, and two new reference appendices.

This is a much more compact (and less expensive) version of the supplemental text above. It is a bit like "Cliffs Notes" for medical physics (very nice.)

- **Paperback:** 182 pages; Dimensions (in inches): 0.40 x 9.99 x 7.01
- **Publisher:** Lippincott Williams & Wilkins; 5th edition (January 15, 1998)
- **ISBN:** 068330092X

AP 4010 Introduction to Nuclear Science
Fall 2004

Course Outline:

1. Overview and Introduction (Ch. 1)

2. Passage of Radiation through Matter (Ch. 5)

3. Radiation Detectors and Instruments (Ch. 6)

4. Nuclear Structure (Ch. 2)

5. Nuclear Instability (Radioactive decay) (Ch. 3)

6. Nuclear Reactions (Ch. 4)

7. Biological effects of radiation (Ch. 7)

8. Nuclear Medicine (Ch. 9)

9. Industrial Nuclear Science (Ch. 8)

10. Nuclear power from fission and fusion (Ch. 10 and 11)

Quizzes:

(Each quiz will last 90 minutes, and begin at the start of class…)

October 5
November 9
December 7 (Last day of class)

Make-up Class (?):

I would like to schedule at least one make-up class (maybe a Thursday evening). Please send me suggestions when this may be convenient for you.