Medical Physics 501

Radiological Physics & Dosimetry

Course Syllabus

Fall 2017

Instructor: Wesley Culberson, PhD
Office: B1141 WIMR (located in WIMR I basement)
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Office Hours: T, Th 2:30-4:30, or by appointment

Prerequisites: Calculus and Modern Physics

Format: Lectures: MWF: 12:05pm-12:55pm, Room 1022 WIMR

Homework Discussion: Friday 12:55 – 2:10pm

Course Objectives

This class is designed to construct a theoretical foundation for precise ionizing radiation dose calculations in a medical context and prepare first year graduate students for proper scientific presentations of their work. Specifically, a student completing this course will be able to do the following:

1. Understand and apply key concepts specific to energy deposition for both ionizing photon interactions and transport in matter and for energetic charged particle interactions and transport in matter. Radiation sources include radioactivity, x-ray tubes, and linear accelerators.
2. Understand the theoretical details of ion-chamber based dosimetry and of clinical protocols.
3. Perform and present real world style research projects as a group, and present these projects in a typical professional scientific format and style.
4. Achieve an appreciation of the history and potential future developments in ionizing radiation detection and dosimetry.

Recommended Textbook

Introduction to Radiological Physics and Dosimetry, *Frank Herb Attix*, 1986 John Wiley & Sons, Inc. or reprinted in 2004 Wiley VCH

ISBN-10 = 0-471-01146-0, ISBN-13 = 978-0-471-01146-0

{This book is a classic and was written especially for *this* class! Prof. Attix was an early professor in this Medical Physics Department. Whether for therapy, imaging, or health physics, I highly recommend purchasing this book. Extra copies are on reserve in the Medical Physics Department's library.}

Grading Scheme:

A:92-100%; AB:88-91%; B:80-87%; BC:77-79%; C:70-76%; D:60-69%; F:<60

weights:

Final Exam	30%
Midterm Exam	30%
Homework	20%
Group Journal paper	10%
Group Presentation	10%
	100%

Attendance, Participation, and Late Work Policy

Students are expected to attend all scheduled class times. If you feel that you must miss class, please notify the instructor before class. If you miss class it is your responsibility to find out from an informed student what was discussed in class, what assignments were given or discussed, etc. Homework is due at the beginning of class. Late work is subject to grade reduction.

Additional Reading Material:

Anderson, DW, Absorption of Ionizing Radiation, University Park Press, Baltimore MD, 1984

Johns, HE, Cunningham, JR, The physics of Radiology, 4th edition, Charles C Thomas Publisher, Springfield IL, 1983

Evans, RD, The Atomic Nucleus, Krieger Publishing Co., Malabar, Fl, 1955

Knoll, G, Radiation Detection and Measurement, John Wiley and Sons, New York, 1979

Feynman, R, Leighton, RB, Sands, ML, The Feynman Lectures on Physics, Addison-Wesley, 1964

Topic	# of lectures
Introduction: Ionizing radiation, scope of class	1
Introduction: radiation fields	1
Introduction: photon interactions	2
Photoelectric effect	1
Compton effect	1
Pair & triplet production	1
Rayleigh & photonuclear interactions	1
Charged particle collision / energy transfer	1
Unrestricted stopping power	1
Restricted stopping power	1
Charged particle scattering	1
Monte Carlo	2
Midterm Exam	1
Equilibrium: radiation & charged particle	2
Dose from photon & electron beams	2
Dose from radioactive materials	2
Introduction: dosimetry	1
Dosimetry: cavity theory	2
Dosimetry: fundamentals	1
Dosimetry: ion chamber	4
Dosimetry: ion chamber calibration	2
Integrated dosimeters	4
Pulse dosimetry	2
Neutrons	1
Symposium	4
Total =	42