

RADI 6030
Physics of Radiotherapy
Fall 2020

CLASS DAYS and TIME: Mondays and Wednesdays (8:15 – 9:30am)

CLASSROOM: Virtual (Microsoft Teams and Canvas)

COURSE FACULTY: Daniel Saenz, PhD (saenzdl@uthscsa.edu)

TA: Colton Baley (baley@livemail.uthscsa.edu)

OFFICE LOCATION and HOURS: By Appt. Office: G236

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READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.

COURSE DESCRIPTION AND OBJECTIVES

Theory, design, and operation of radiation producing equipment used in radiation therapy. Exposure and absorbed dose calculations, patient dosimetry, treatment planning, and use of computers in radiation therapy.

Pre-requisites – None

Semester credit hours – 3

By the end of this course, each student should be able to:

- Demonstrate that they understand how x-rays are generated and how radiation producing machines are used in the clinic.
- Demonstrate that they understand the physical and mathematical principles of the different radiation interactions as well as their clinical significance.
- Demonstrate that they understand how dose distributions are generated and how scatter analysis is performed.
- Demonstrate that they understand how to perform dosimetry calculations related to treatment planning.
- Demonstrate that they understand the fundamentals of modern day radiation therapy treatment techniques and associated equipment.

COURSE ORGANIZATION

The course is designed as an introduction to radiation therapy fundamentals and covers the first half of the primary reference which is the book by Faiz Khan on “The Physics of Radiation Therapy”. Lectures will be given in the form of slide presentations, together with discussion. There is a list of reading materials and references that the students are responsible to read. A quiz will be given at the end of each unit. All materials will be available on CANVAS, including the quizzes. The students will need to have a laptop or tablet device to take the quizzes in the classroom

Materials – See below under the Textbooks section

Computer Access – The presentations are given in the common lecture format and are accompanied by Pdf converted PowerPoint slide files. You are responsible for all information included in the lecture materials. However, you should not assume that all testable lecture material is found only in the posted materials. That is, lectures may be expanded and enhanced during in-class presentations. So, take good notes because any information discussed in class is considered testable.

Reading Assignments – Required reading assignments are posted in the schedule of class meetings (shown below) and are

never considered optional. Unless specifically noted by the instructor, anything in the required readings, whether emphasized in class or not, is considered testable on exams. Mandatory readings are primarily found in the required textbook (see below). However, occasionally a reading assignment will be given that is posted online or sent to you via email attachment.

ATTENDANCE

In order to achieve the expected level of competency, students must be fully engaged. Therefore, attendance for every class session is expected. It is recognized that a student may occasionally arrive late to class due various reasons. However, chronic lateness is considered an unprofessional behavior that disrupts the learning environment for everyone else in the classroom.

TEXTBOOKS

Required:

- The Physics of Radiation Therapy, 4th Edition, Faiz M. Khan; Lippincott, Williams & Wilkins, 2009
- Med. Phys. 26, 1847 - 1870 (1999), TG-51 Protocol for Clinical Reference Dosimetry of High-Energy Photon and Electron Beams.
- Med. Phys. 22(2), 209-234, 1995, TG-43, "Dosimetry of Interstitial Brachytherapy Sources"; British Journal on Radiology, Supplement 25, 1996

Recommended References:

- Med. Phys. 10(6), 741-765, 1983, TG-21, "A Protocol for Absorbed Dose from High Energy Beams"
- Med. Phys. 18(1), 73-109, 1991, TG-25, "Clinical Electron Beam Dosimetry"
- Attix, Introduction to Radiological Physics and Radiation Dosimetry, John Wiley and Sons, 1986
- Hendee, William R. & Geoffrey S. Ibbott, Radiation Therapy Physics, 2nd Edition, Mosby, St. Louis, MO, 1996
- ICRU Report 50, Prescribing, Recording, and Reporting Photon Beam Therapy, International Commission on Radiation Units and Measurements, Bethesda, MD, 1993.
- NCRP Report #49, Structural Shielding Design and Evaluation for Medical Use of X-rays and Gamma rays of Energies up to 10MeV, National Council on Radiation Protection and Measurements, Washington D.C., 1976
- NCRP Report #51, Radiation Protection Design Guidelines for 0.1-100MeV Particle Accelerator Facilities, National Council on Radiation Protection and Measurements, Washington D.C., 1977
- Kahn, F., Treatment Planning in Radiation Oncology, Williams & Wilkins, 1998

GRADING POLICIES AND EXAMINATION PROCEDURES

Testable material comes from 3 main sources: Lecture presentation, reading assignments and in class discussion. Final letter grades will be based on the multiple choice type quizzes, homework, and a final exam that will be scheduled throughout the semester.

Make-up Examinations: A student who must miss a scheduled exam for a serious reason must request an excused absence from the Course Director. Acceptable "serious reasons" usually involve serious illness or injury to the student (doctor's excuse may be required) or the student's family member. Examples of unacceptable reasons include: Not prepared or incomplete studying, over-sleeping, heavy traffic or any travel delays, other appointments or scheduled professional or personal commitments. If it is determined that missing an exam is justified, a make-up examination will be scheduled. The make-up exam will be given as soon as possible at a time designated by the Course Director. Any student who misses an exam and does not receive an excused absence **will receive a grade of zero for that exam.**

Grading System

A = 90-100% B = 80-89% C = 70-79% F = < 69%

Your grade will come from weekly homeworks (33.3%), weekly quizzes (33.3%), and the final (33.3%).

REQUESTS FOR ACCOMODATIONS FOR DISABILITIES

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with

Disabilities Act (ADA, form 100). to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at <http://uthscsa.edu/eeo/request.asp>.

ACADEMIC INTEGRITY AND PROFESSIONALISM

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at <http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/>

Title IX Defined:

Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.”

University of Texas Health Science Center San Antonio’s Commitment:

University of Texas Health Science Center San Antonio (UTHSCSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSCSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567- 2800. Additional information may be obtained at <http://students.uthscsa.edu/titleix/>

EMAIL POLICY

Every student is issued a University e-mail address and account at the time of enrollment. As a matter of University Policy, communications between students and faculty that occur using the student’s University e-mail address is considered official business. Therefore, students are expected to check their university email inboxes on a regular basis so that any announcements, instructions, or information regarding this course will be received in a timely way. Missed communications due to inadequate monitoring of incoming emails on the University’s email server will never be a valid excuse for unsatisfactory academic progress.

USE OF RECORDING DEVICES

Recording of lectures and other learning activities in this course by any means (e.g., video, audio, etc.) is only permitted if approved by the instructor or required for compliance with Americans with Disabilities Act (ADA).

ELECTRONIC DEVICES

Cell phones must be silenced and out of sight during all class meetings and exams. Computers and electronic tablets are allowed only for participating in classroom activities (e.g., viewing slides presented in lecture or conference materials). No texting, emailing, web-surfing, gaming, or any use of electronic devices that is not directly connected with classroom activities is permitted.

TENTATIVE CLASS SCHEDULE

RADI 6030

Physics of Radiotherapy

Fall 2020

| Week | | |
|---------|------------|---|
| Week 1 | 8/24/2020 | Structure of Matter |
| | 8/26/2020 | Completion of Chapter |
| Week 2 | 8/31/2020 | Nuclear Transformations - CB |
| | 9/2/2020 | Completion of Chapter - CB |
| Week 3 | 9/7/2020 | HOLIDAY |
| | 9/9/2020 | Production of X-rays |
| Week 4 | 9/14/2020 | Clinical Radiation Generators - CB |
| | 9/16/2020 | Completion of Chapter - CB |
| Week 5 | 9/21/2020 | Interactions of Ionizing Radiation |
| | 9/23/2020 | Completion of Chapter |
| Week 6 | 9/28/2020 | Measurement of Ionizing Radiation - CB |
| | 9/30/2020 | Completion of Chapter - CB |
| Week 7 | 10/5/2020 | Quality of X-ray beams |
| | 10/7/2020 | Completion of Chapter |
| Week 8 | 10/12/2020 | Measurement of Absorbed Dose - CB |
| | 10/14/2020 | Completion of Chapter - CB |
| Week 9 | 10/19/2020 | Dose Distribution and Scatter Analysis |
| | 10/21/2020 | Completion of Chapter |
| Week 10 | 10/26/2020 | A System of Dosimetric Calculations |
| | 10/28/2020 | Completion of Chapter |
| Week 11 | 11/2/2020 | Treatment Planning I |
| | 11/4/2020 | Completion of Chapter |
| Week 12 | 11/9/2020 | Treatment Planning II |
| | 11/11/2020 | Completion of Chapter |
| Week 13 | 11/16/2020 | Treatment Planning III |
| | 11/18/2020 | Completion of Chapter |
| Week 14 | 11/23/2020 | HOLIDAY |
| | 11/25/2020 | HOLIDAY |
| Week 15 | 11/30/2020 | Electron Beam Therapy - CB |
| | 12/2/2020 | Completion of Chapter |