

**RADI 5015**  
**Introduction to the Physics of Diagnostic Imaging**  
**Fall, 2017**

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**CLASS DAYS and TIME:** Include days/start and end times

**CLASSROOM:** MED 625F (Radiology Classroom), 10 AM-11:30 AM, Mondays & Wednesdays

**COURSE FACULTY:** Geoffrey Clarke

**OFFICE LOCATION and HOURS:** MED 625F, Wednesdays 11:30-12:00

**EMAIL:** clarkeg@uthscsa.edu

**TELEPHONE:** 210-336-8335

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

### **COURSE DESCRIPTION AND OBJECTIVES**

An introduction to the theory and applications of diagnostic imaging systems, including radiographic, fluoroscopic, ultrasound, and molecular imaging systems.

**Pre-requisites** – List any pre-requisites for the course

**Semester credit hours** – 3 CU

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

- apply the fundamental knowledge of physics to understanding the basics of radiological imaging processes .
- discuss the concepts underlying various technologies used for medical imaging.
- recount clinical and research applications of each medical imaging modality covered in the course.

### **COURSE ORGANIZATION**

**The main teaching modalities used in this course include:**

- 1) Auditory activities:** listening to oral presentations
- 2) Visual activities:** reading assignments, watching videos, demonstrations, presentations (including graphs & tables)
- 3) Tactile/Kinesthetic:** solving problems, participating in in-class mini-projects

**Materials** – Textbook. Other material will be provided by instructors.

**Computer Access** – Students are required to bring wifi-enabled laptop to class in order to take on-line quizzes and exams.

**Reading Assignments** – Describe and list any reading assignments with bibliographic information; these can also be listed on the class schedule

Textbook reading assignments are listed on class schedule.

Assigned articles will include:

McCollough CH, Leng S, Yu L, Fletcher JG. Dual-and multi-energy CT: principles, technical approaches, and clinical applications. *Radiology*. 2015 Aug 24;276(3):637-53.

Shi WT, Forsberg F. Ultrasonic characterization of the nonlinear properties of contrast microbubbles. *Ultrasound in medicine & biology*. 2000 Jan 31;26(1):93-104.

James ML, Gambhir SS. A molecular imaging primer: modalities, imaging agents, and applications. *Physiological reviews*. 2012 Apr 1;92(2):897-965.

## **ATTENDANCE**

Attendance is expected at every class session. Students should notify course instructor in advance if they are unable to attend a particular class session.

## **TEXTBOOK**

**Required:** The Essential Physics of Medical Imaging, 3rd Edition, 2012, by JT Bushberg, JA Seibert, EM Leidholdt, Jr, and JM Boone

## **GRADING POLICIES AND EXAMINATION PROCEDURES**

Homework 60%; Quizzes = 4x 5% each = 20%; Final Examination 20%

### **Grading System**

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

**HOMEWORK PROTOCOL** – Students are encouraged to work cooperatively on the homework problems, however plagiarism of another student’s work will not be tolerated. Homework sets shall be submitted on the date due. Homework problem sets submitted up to a week late will receive a 50% reduction in grade. Homework sets received more than one week late will receive a grade of 0.

**EXAMINATION PROTOCOL** – Exams may be composed of multiple choice questions. Certain questions will be accompanied by images, so it is imperative that you study images (particularly those presented in class).

No books, backpacks, etc. are permitted in the testing area. Hats must be removed. You will not be allowed to ask questions of the proctor once the examination has started (except to point out potential typographical errors in the exam).

Late Arrival to Exams - Exams will be timed. If you arrive late to an exam, and are given permission to take the exam, you will not be given additional time to complete your test.

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, hangover, 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

## 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 AT UTHSCSA

### **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, based on 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 based on 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

E-mail is allowed.

## USE OF RECORDING DEVICES

Recording devices are allowed.

## ELECTRONIC DEVICES

Students should only use electronic devices such as cell phones, computers, tablets, etc. to perform tasks related to the course, while in class.

**TENTATIVE CLASS SCHEDULE**  
**RADI 6015**  
**Introduction to the Physics of Diagnostic Imaging**  
**FALL and 2016**

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WEEK	DATE	TOPIC	Assignment	Instructor and Modality
Week 1	8/21	Introduction/Radiation & the Atom	Bushberg, Ch. 1 & Ch. 2	Clarke
	8/23	Interactions of Radiation with Matter	Bushberg, Ch. 3	Clarke
Week 2	8/28	Radiographic Image Quality – Pt. 1	Bushberg, Ch. 4	Clarke
	8/30	Radiographic Image Quality – Pt. 2	Bushberg, Ch. 4	Clarke
Week 3	9/4	LABOR DAY HOLIDAY		
	9/6	Medical Imaging Informatics	Bushberg, Ch. 5	Clarke
Week 4	9/11	Production & Creation of Radiographs	Bushberg, Ch. 6, Homework 1	Clarke
	9/13	Digital Radiography	Bushberg, Ch. 7, Quiz 1	Clarke
Week 5	9/18	Mammography- Instrumentation	Bushberg, Ch. 8.1-8.3	Clarke
	9/20	Mammo - Receptors & Dosimetry	Bushberg, Ch. 8.4-8.7	Clarke
Week 6	9/25	X-ray Radiography & Fluoroscopy	Bushberg, Ch. 9	Clarke
	9/27	Interventional Radiology	Handout	Clarke
Week 7	10/2	Computed Tomography–Methods	Bushberg, Ch. 10.2-10.3, Homewk 2	Clarke
	10/4	CT Reconstruction	Bushberg, Ch. 10.4-10.7; Quiz 2	Clarke
Week 8	10/9	CT Image Quality & Artifacts	Handout	Clarke
	10/11	Dosimetry in Projection Imaging & CT	Bushberg, Ch. 11	Clarke
Week 9	10/16	Cone-beam, Quantitative CT	Handout	Clarke
	10/18	Clinical CT Measurements Lab	@CTRC	Clarke
Week 10	10/23	Ultrasound Physics & Transducers	Bushberg, Ch. 14.1-14.4; Quiz 3	Clarke
	10/25	Ultrasound Display & Storage	Bushberg, Ch. 14.5-14.9	Clarke
Week 11	10/30	Doppler US, QC, Bioeffects	Bushberg, Ch. 14.10-14.12	Clarke
	11/1	Bubble Contrast, Harmonic US, 3D US	Handout	Clarke
Week 12	11/6	Nuclear Spectroscopy/Detectors	Bushberg, Chs. 15, 17	Goins
	11/8	Basic Nuclear Medicine Imaging	Bushberg, Ch. 18	Goins
Week 13	11/13	SPECT & PET	Bushberg, Ch. 19	Goins
	11/15	Nuclear Magnetic Resonance	Bushberg, Ch. 12.1-12.4	Clarke
Week 14	11/20	MRI Pulse Sequences	Bushberg, Ch. 12.5-12.8	Clarke
	11/22	THANKSGIVING EVE - NO CLASS		
Week 15	11/27	MRI Artifacts & Bioeffects	Bushberg, Ch. 13.5-13.9	Clarke
	11/29	Molecular Imaging	Handout	Clarke
Week 16	12/6	Optical Imaging	Handout	Goins
	12/8	Course Review		Clarke
Week 17	12/11	<b>FINAL EXAMINATION</b>	Comprehensive	