IMPORTANT: This syllabus form should be submitted to OAA (gsbs_academic_affairs@uth.tmc.edu) a week before the start of each semester.

NOTE to STUDENTS: If you need any accommodations related to attending/enrolling in this course, please contact one of the Graduate School's 504 Coordinators, Cheryl Spitzenberger or Natalie Sirisaengtaksin. We ask that you notify GSBS in advance (preferably at least 3 days before the start of the semester) so we can make appropriate arrangements.

Term and Year: **Summer 2024** Course Number and Course Title: **GS02 1223: Diagnostic Medical Physics II** Credit Hours: **1** Meeting Location: **UT MDACC Main Building** Building/Room#: **FCT 14.5059 (Room 4)**	**Program Required Course: Yes** **Approval Code: Yes** **(If yes,** the Course Director or the Course Designee will provide the approval code.) Audit Permitted: **Yes** Classes Begin: **May 20, 2024** Classes End: **August 9, 2024** Final Exam Week: **August 12-15, 2024**

Class Meeting Schedule

Day	Time
Tuesdays and Thursdays	**10:00-11:30 a.m.**

Course Director: Name and Degree: **R. Jason Stafford, PhD** Title: **Professor** Department: **Imaging Physics** Institution: ***MDACC*** Email Address: JStafford@mdanderson.org Contact Number: 713-745-5082 **Co-Course Director:** Name and Degree: Title: **Associate Professor** Department: **Imaging Physics** Institution: ***MDACC*** Email Address: RRBouchard@mdanderson.org Contact Number: 713-745-0626	**Instructor/s** 1. **R. Jason Stafford, PhD** Institution: MDACC Email Address : JStafford@mdanderson.org 2. **Richard Bouchard, PhD** Institution: MDACC Email Address : RRBouchard@mdanderson.org 3. **Chris Walker PhD** Institution: MDACC Email Address: CMwalker@mdanderson.org 4. **Bryan Taylor, PhD** Institution: MDACC Email Address BTaylor9@mdanderson.org

NOTE: Office hours are available by request. Please email me to arrange a time to meet.	5. **Joshua Yung, PhD** Institution: MDACC Email Address: JYung@mdanderson.org

Course Description:

This course provides graduate students with a foundation in the fundamental physics, principles of image formation,a nd reconstruction, instrumentation, safety, and quality assurance of ultrasound and magnetic resonance imaging.

Textbook/Supplemental Reading Materials

- Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidhodt, Jr, and John M. Boone, The Essential Physics of Medical Imaging, Third Edition. ~$205
- Douglas Christensen, Ultrasonic Bioinstrumentation, John Wiley & Sons, 1991, ISBN 978-0471604969. ~$240

Course Objective/s:

Upon successful completion of this course, students will

***Specific Learning Objectives*:**

1. Outlline and review fundamental physics underlying Ultrasound & MRI.
2. Describe and explailn key principles of Ultrasound & MR image formation and contrast.
3. Name common Ultrasound & MR acquisition techniques and explain underlying physical principles of opeation, advantages, and disadvantages.
4. Identitfy common Ultrasound & MRI artifacts and quality control methodologies.
5. Recognize key safety risks in Ultrasound & MRI and explain underlying physical principles.

Student Responsibilities and Expectations:

Students enrolled in this course will be expected to perform the following activities each week:

1. Read, process, and review (student) material from assigned reading in textbooks or provided literature.
2. Complete assigned homework and participate in discussions of assignments in class.
3. Prepare for and take course quizzes based on course lectures/ readings.
4. Participate in and contribute to course discussions during lecture, review sessions
5. Participate in and complete assigned work in laboratory sessions
6. Prepare for and take a final examination based on lecture and some reading material.

Students are expected to complete all assigned reading material prior to class. While you may work and discuss all course materials and assignments in groups, all assignments must be your own. Plagiarism and failure to properly cite scientific literature and other sources will not be tolerated and are grounds for dismissal from the course and further GSBS disciplinary action. Cheating or engaging in unethical behavior during examinations (quizzes and exams) will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

Grading System: **Letter grade (A-F)**

Student Assessment and Grading Criteria : *(May include the following:)*

Percentage	Description
Homework **(35 %)**	**Homework, projects,and laboraroty**
Midterm Exam **(33 %)**	**Ultrasound Exam**
Final Exam **(32 %)**	

Summer 2024 CLASS SCHEDULE - see attached

ULTRASOUND (1.5hr courses)

1	Ultrasound introduction: history of ultrasound, modern uses and fundamentals of ultrasound physics	Bouchard
2	Interactions with tissue I: derivation of the acoustic wave equation	Bouchard
3	Interactions with tissue II: introduction to acoustic scattering and absorption	Bouchard
4	Beamforming I: design and performance features of a modern ultrasound array transducer	Bouchard
5	Beamforming II: derivation of an array-based ultrasound diffraction pattern and description of factors ultrasound resolution	Bouchard
6	Ultrasound imaging I: technical workflow to generate a B-mode image on a modern ultrasound system	Bouchard
7	Ultrasound imaging II: ultrasound imaging features and modalities (e.g., Doppler imaging)	Bouchard
8	Ultrasound imaging artifacts: explanation regarding the source and appearance of common ultrasound imaging artifacts	Bouchard
9	Ultrasound quality assurance & safety: methodology used to conduct QA plan on a modern ultrasound system	Bouchard
10	Advanced ultrasound: an in-depth introduction to two new ultrasound imaging modalities, elasticity and photoacoustic imaging, with an emphasis on the modality-specific physics and hardware	Bouchard
	Exam 1 (mid-term): Ultrasound physics	Bouchard

MRI (1.5hr courses)

11	Introduction to Magnetic Resonance	Stafford
12	Basic MR & Signal Generation Concepts	Stafford
13	Pulse Sequences I: Spin Echo	Stafford
14	Image Formation & Reconstruction I	Stafford
15	Signal, Contrast & Noise in MRI	Stafford
16	MR Instrumentation	Stafford
17	MR Artifacts & Principles of MR Quality Assurance	Stafford
18	Pulse Sequences II: Magnetization Preparation	Stafford
19	Pulse Sequences III: Fast Imaging & Clinical Applications	Stafford
20	Advanced MRI: Physiology & Function	Stafford
21	MR Safety for Medical Physicists	Stafford
	Exam 2 (final): MRI physics	Stafford

To be arranged:
Instructors: Drs. Walker, Taylor, Yung.
LAB 1: Introduction to Ultrasound
LAB 2: Basic Pulse Sequences & Contrast
LAB 3: ACR Phantom Analysis