

## **BME 4531: Medical Imaging**

1. **Description:** (3 credit hours) – Medical imaging technologies from a biomedical engineering perspective. The physics, mathematics, instrumentation and clinical applications of all common medical imaging modalities including x-ray radiography, computed tomography (CT), ultrasound imaging, positron emission tomography (PET), and magnetic resonance imaging (MRI) will be discussed. Emerging imaging modalities including optical imaging, fluorescence imaging and photoacoustic imaging will also be introduced.
2. **Pre-requisites and Co-requisites:** MAC 2313, MAP 2302, PHY2049.
3. **Course Objectives:**
  - Develop basic knowledge of the commonly used and emerging biomedical imaging modalities including x-ray/CT, nuclear medicine, ultrasound, magnetic resonance imaging and optical imaging.
  - Develop an understanding of general issues in medical imaging that span the common modalities.
  - Develop a competence in the fundamental analytical and computational tools used in medical imaging.
4. **Contribution of course to meeting the professional component:** 3 credits of engineering topics (no design component).
5. **Relationship of course to program outcomes:**
  - (a) ability to apply knowledge of math, science, engineering
  - (f) understanding professional, ethical responsibility
  - (i) recognition of need for and ability to engage in life-long learning
  - (j) knowledge of contemporary issues
  - (k) ability to use techniques, skills, modern engineering tools for engineering practice
6. **Instructor:** David Gilland
  - a. Office location: room 111 Building 1917 (BME/Medical Physics)
  - b. Telephone: 273-0302
  - c. E-mail address: gilland@ufl.edu
  - d. Web site: [www.bme.ufl.edu/people/gilland\\_david](http://www.bme.ufl.edu/people/gilland_david)
  - e. Office hours: email for appointment
7. **Teaching Assistant:** Xiaoshuang Shi (xsshi2015@ufl.edu)
8. **Meeting Times:** M W F, period 5 (11:45-12:35)
9. **Class/laboratory schedule:** course meets three 50 minute sessions per week

10. **Meeting Location:** 227 NSC

11. **Material and Supply Fees:** None

12. **Textbooks and Software Required**

Title: The Essential Physics of Medical Imaging

Author: Bushberg, Seibert, Leidholt, Boone

Publication date and edition: 2012, 3<sup>rd</sup> edition; Wolters Kluwer

ISBN number: 978-1-4511-1810-0

Additional reading material will be handed out in class.

13. **Recommended Reading:** N/A

14. **Course Outline**

Week	Topic
<u>PART 1: Analytical methods</u>	
1	Overview of medical imaging, clinical modalities
2	Image display, spatial resolution, PSF
3	Convolution, MTF
4	Deconvolution filtering
5	Fourier Transform
6	Image contrast, noise
7	Contrast-to-noise ratio, ROC
8	Review, Midterm (Oct. 12)
<u>PART 2: The Modalities</u>	
9	X-ray imaging
10	Computed Tomography
11	Image reconstruction
12	Nuclear medicine
13	Ultrasound
14	MRI
15	Review, Final (Dec. 7)

15. **Attendance and Expectations:** On time class attendance is required. Chronic tardiness or absence will negatively impact the final grade.

Expectations:

- Be to class on time.
- no cell phone disruptions or e-device distractions.
- turn in homework on time and make legible

- better late than never
- ask for help if you need it

**16. Grading:**

55% Homework, quizzes, class participation  
20% Exam 1  
25% Exam 2

**17. Grading Scale:**

A = 94 – 100  
A- = 90 – 93.99  
B+ = 87 – 89.99  
B = 83 – 86.99  
B- = 80 – 82.99  
C+ = 77 – 79.99  
C = 73 – 76.99  
C- = 70 – 72.99  
D = 61 – 69.99

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

**18. Make-up Exam Policy** – Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Exams can be rescheduled for an individual due to sickness or religious holidays. The instructor ***must*** be notified in advance.

**19. Honesty Policy** – UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

See <http://www.dso.ufl.edu/sccr/procedures/honorcode.php>

Unless otherwise stated, all homework for this class must be done individually. ***In this class it is a violation of the Academic Honesty code to obtain assistance on homework assignments from other individuals without acknowledging such.***

20. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
21. **UF Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
  - Career Resource Center, Reitz Union, 392-1601, career and job search services.
  - SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling
  - Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling
  - Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling
22. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.
23. Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.