

# Medical Imaging, BE 122

## Syllabus

### Instructor:

Instructor: Prof. Liang Gao  
Email: [gaol@ucla.edu](mailto:gaol@ucla.edu)

Office: EV 4121F

### Instructor Office Hours:

By appointment. Please email Prof. Liang Gao to arrange.

### Teaching Assistants and Office Hours:

Jorge Mora ([jorgetm@g.ucla.edu](mailto:jorgetm@g.ucla.edu))

Discussion Section: Fridays, 11-11:50pm, Online Zoom

### Lecture:

Monday, Wednesday 10:00 – 11:50 am, Online Zoom

### Credit:

4 hours

### Course Website:

Accessible from <https://ccle.ucla.edu/course/view/21S-BIOENGR188-1>

### Pre-Requisites:

Math 33A, Physics 1C or Consent of Instructor.

### Course Objective:

To introduce principles and survey technology and applications in the field of biomedical imaging.

### Instructor Teaching & Learning Philosophy:

I believe and teach that technology is becoming increasingly interdisciplinary, particularly between engineering, medicine, and biology. Your ability to learn and integrate ideas and concepts from multiple disciplines will enable you to investigate and solve many of the new engineering problems we will face in the future.

### Required Textbook:

Fundamentals of Medical Imaging, 3<sup>rd</sup> Edition, by Paul Suetens, Cambridge University Press, 2017.

Classroom lectures will emphasize the main points in the material and allow for discussion. I expect you to read the assigned chapters, but focus on the concepts presented in lecture. Homework and exams will be structured with the assumption that you have read all of the assigned text and handout material.

### Recommended Textbooks for background knowledge in human physiology and cell biology:

Vander, Sherman, Luciano, Human Physiology: The Mechanisms of Body Function, McGraw Hill  
Alberts, et al., Molecular Biology of the Cell, Garland Science, 5<sup>th</sup> Edition

### Other Suggested References:

Webb, Introduction to Biomedical Imaging  
Cho, Jones, and Singh, Foundations of Medical Imaging  
Robb, Biomedical Imaging, Visualization, and Analysis  
Mudry, Biomedical Imaging (Principles and Applications in Engineering)  
Shung, Principles of Medical Imaging  
Webb, The Physics of Medical Imaging  
Epstein, Introduction to the Mathematics of Medical Imaging  
Hendee, Ritenour, Medical Imaging Physics  
Prasad, Introduction to Biophotonics

### Homework:

There will be eight graded homework sets for this course. Homework assignments will be distributed on-line and will be available on-line roughly one week before they are due. Solutions will be posted on the course website. Late homework will be accepted, but 10% will be deducted for each day it is late.

### Biomedical Image Visualization Software:

For this course, we will frequently use MATLAB for completing some problems in the homework sets. If you have never used MATLAB, please contact the TA for introductory material on how to acquire and use MATLAB. We may also incorporate the use of MRICron freeware software and accompanying image datasets for visualizing and analyzing 3-D datasets from different biomedical imaging modalities. This freeware can be downloaded from <<http://www.mccauslandcenter.sc.edu/CRNL/tools>>. You are also welcomed to search for additional datasets on the internet, and share them with the class. Instructions for downloading and using this freeware are available on-line.

**Exams:**

A take-home midterm and a final exam will be given. Both exams will be closed book and closed notes. One page of formula sheet is allowed.

An excuse from the Dean's office is the only acceptable excuse for missing an exam.

**Active class participation reward:**

You will be rewarded for active class participation. If you raise or answer a question during class discussion, it will be considered as an active participation. Please take a note of the questions you asked/answered and what you have learned and email it to TA after each class. You will be rewarded one "star" if your active participations are among the top three in each class. The three students who collect the most "stars" before the Midterm and Final exams will be exempt from Midterm and Final exam, respectively, with full scores. The "star" count will be reset to zero after Midterm.

**Grading:**

Your final grade in this course will be based on your total score on all the components of the course. The total score is broken down into the following components:

Midterm Exam	30%
Final Exam	40%
Homework	30%
<b>Total</b>	<b>100%</b>

**Approximate Grade Scale**

A+, 95-100	B+, 87-89.9	C+, 77-79.9	D+, 67-69.9	
A, 92-94.9	B, 83-86.9	C, 73-76.9	D, 63-66.9	F, 0-59.9
A-, 90-91.9	B-, 80-82.9	C-, 70-72.9	D-, 60-62.9	

**Note:** At the end of the semester, the course grade scale may be adjusted to reflect large breaks between groups of students.

Absences and Excused Grades:

There is no way to make up a missed semester exam. An unexcused absence from a semester exam will be assigned a zero grade. An excused absence requires a letter from the Dean's office. An excused absence from a semester exam will receive an EX grade. At the end of the semester, the EX grade will be replaced with the average of your grades on the other exams and the final.

Grade Disputes:

Grade disputes on homework will be settled at the discretion of the TA. Grade disputes on the semester exams will be settled at the discretion of Prof. Gao. In both cases, the problem in question will be RE-GRADED, making it possible for you to receive a lower score. To dispute an exam grade, you must explain your dispute IN WRITING and staple this to the front of your exam. Prof. Gao will then re-grade your exam.

# BE 188 - Medical Imaging

Spring 2021

Instructor: Prof. Liang Gao

TA: Jorge Mora

Text: Fundamentals of Medical Imaging, 3rd Edition, Paul Suetens, Cambridge University Press

	<u>Date</u>		<u>Book Chapter</u>	<u>Topic</u>	<u>Due</u>
Week 1	March	29	Notes	Course Introduction	
		31	Notes	Visual Perception	
Week 2	April	5	Appendix A, Notes	Fourier Transform (2-D Spatial) & Properties	
		7	1 (Suetens)	Image Properties & Processing	<b>HW #1</b>
Week 3		12	6 (Suetens)	Ultrasound Imaging	
		14	6 (Suetens)	Ultrasound Imaging	<b>HW #2</b>
Week 4		19	6 (Suetens)	Ultrasound Imaging	
		21	2 (Suetens)	X-Ray Imaging	<b>HW #3</b>
Week 5		26	2 (Suetens)	X-Ray Imaging	
		28	2 (Suetens)	X-Ray Imaging	<b>HW #4</b>
Week 6	May	3		<b>Midterm Exam</b>	
		5	3 (Suetens)	Computed Tomography (X-ray)	
Week 7		10	3 (Suetens)	Computed Tomography (X-ray)	
		12	3 (Suetens)	Computed Tomography (X-ray)	<b>HW #5</b>
Week 8		17	4 (Suetens)	Magnetic Resonance Imaging	
		19	4 (Suetens)	Magnetic Resonance Imaging	<b>HW #6</b>
Week 9		24	4 (Suetens)	Magnetic Resonance Imaging	
		26	5 (Suetens)	Nuclear Medicine Imaging	<b>HW #7</b>
Week 10		31	5 (Suetens)	<b>Memorial Day</b>	
	June	2	5 (Suetens)	Nuclear Medicine Imaging	<b>HW #8</b>
				<b>Final Exam (Take home)</b>	

Syllabus content subject to change.