

Fundamentals of Medical Imaging (BENG 444 / ENAS 544)

Monday/Wednesdays 9:00AM to 10:15AM, Dunham Lab 102

Course objectives:

Review of basic engineering and physical principles of common medical imaging modalities including MRI, X-ray, CT, PET, SPECT, ultrasound, and optical imaging. Additional focus on clinical applications and cutting-edge technology development.

Instructors:

Gigi Galiana, PhD (Magnetic Resonance Imaging, Optical Imaging)

Dana Peters, PhD (Magnetic Resonance Imaging, Ultrasound Imaging)

Chi Liu, PhD (X-ray, CT, and Nuclear Imaging)

1	1/17, Wednesday	Course introduction, History of Imaging & MRI hardware	Galiana
2	1/19, Friday	Field trip—tour/hands on MRI @ MRRC (meet in TAC Lobby, 300 Cedar street).	Galiana/Peters
3	1/22, Monday HW problems	Foundations of MRI: Bloch equations and NMR	Peters
4	1/24, Wednesday	Math review: Fourier transform, digitization, etc.	Galiana
5	1/29, Monday HW problems	Spatial Localization and Making an Image	Galiana
6	1/31, Wednesday	Acceleration and Artifacts	Galiana
7	2/5, Monday HW problems	Contrast mechanisms	Peters
8	2/7, Wednesday	Cardiac & Body MRI	Peters
9	2/12, Monday HW problems	Brain MRI and Applications (Guest lecture)	Constable
10	2/14, Wednesday	Field-trip --Hands on MRI @MRRC (meet in TAC lobby, 300 Cedar Street). Student experiments and trouble-shooting	Galiana
11	2/19, Monday HW problems	Optical Imaging	Galiana
12	2/21, Wednesday	Optical Imaging Applications (Guest lecture)	Joerg Bewersdorf
13	2/26, Monday HW problems	Ultrasound	Peters
14	2/28, Wednesday	Cardiac Ultrasound Clinical Applications (Guest lecture, and hands-on experiments)	Lissa Sugeng
15	3/5, Monday	Review Class	
16	3/7, Wednesday	MID TERMS exam	
17	3/26, Monday	Field trip—interventional suite	Peters
18	3/28, Wednesday	Nuclear physics and X-Ray systems	Liu
19	4/2 Monday HW problems	CT systems and reconstruction	Liu
20	4/4 Wednesday	Multimodality breast imaging (Guest lecture)	Liane Philpotts
21	4/9 Monday HW problems	C-arm cone-beam CT and interventional applications (Guest lecture)	MingDe Lin
22	4/11 Wednesday	SPECT and PET systems	Liu
23	4/16 Monday HW problems	PET and SPECT reconstruction and quantitative imaging	Liu
24	4/18 Wednesday	Multimodality and application specific imaging	Liu
25	4/23 Monday HW problems	State of the art & what's next?	Liu
26	4/25 Wednesday	Field trip of PET Center and YTRIC	Liu
27	5/7 Monday 2pm	Final Exam	

Homework problems are posted on Monday by 5pm and are due one week later.

Determination of grades: 10 homework sets: 5% each (50% total)

2 exams: 25% midterm exam, 25% final exam