ECE/BIOE 380 Biomedical Imaging
Fall 2024

Syllabus

Instructor:

Instructor: Pengfei Song, Ph.D., Associate Professor of Electrical and Computer Engineering, Bioengineering
Email: songp@illinois.edu
Phone: 217-300-9763

TA:

Yike Wang, PhD candidate at ECE and Song Lab
Office hours: Mondays & Wednesdays 1:00 pm to 2:00 pm (from September 2nd to December 11th)
ECEB 2036

Pre-Requisites:

Math 285 or Math 286 or Consent of Instructor.

Course Objective:

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

Course Website:

Accessible from https://courses.grainger.illinois.edu/ece380/fa2024/
Campuswire link: https://campuswire.com/p/G4B7D652B

Lecture:

Time: Tuesdays & Thursdays, 9:30 – 10:50 am

Credit:

3 hours

Zoom link: https://illinois.zoom.us/j/88399746656?pwd=HjZ0jkvWapbcAXzLBF1NpisHGL7pVf.1

Meeting ID: 883 9974 6656

Password: 169220

Attendance to all lectures will be required. Exceptions will be made on a case-by-case basis.

Recommended Textbook:

The Essential Physics of Medical Imaging, 4th Edition, by Bushberg *et al*., LWW, 2020.
Fundamentals of Medical Imaging, 3rd Edition, by Paul Suetens, Cambridge University Press, 2017.

The lecture slides will be your main source of studying materials, but I strongly encourage you to read the assigned chapters associated with the suggested textbooks.

Homework:

There will be 8 graded homework sets for this course. Homework assignments will be distributed on-line and will be graded with Gradescope. Solutions will be posted on the course website. Late homework will **NOT** be accepted. Detailed homework assignment schedule and deadline are given in the class schedule.

Please register on Gradescope using your real name and your Illinois email account with your netID. The site is FERPA compliant. **The entry code to the course on Gradescope is VDWNKZ.**

Software:

For this course, we will occasionally use MATLAB for completing some problems in the homework sets. If you have never used MATLAB, please contact the TA for how to acquire and use MATLAB.

Exams:

Two mid-term exams will be given as noted in the class schedule.

A final exam will be given at 1:30-4:30PM, Friday, Dec. 13 in ECEB 3013 (during finals week). All exams will be closed book and closed notes.

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

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 exams	40%
Final Exam.	30%
Homework	30%
Total	**100%**

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.

Absences and Excused Grades:

An unexcused absence from exams will be assigned a zero grade. An excused absence requires a letter from the Dean's office. A makeup exam may be scheduled for an excused absence.

Grade Disputes:

Grade disputes on all the assignments and exams will be settled at the discretion of the instructor and TA. You can use the regrade requests on Gradescope to request for a regrade. Detailed written justifications for the regrade need to be provided or otherwise the regrade will not be processed.

Other statements:

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.

Academic Integrity

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: https://studentcode.illinois.edu/article1/part4/1-401/. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at https://odos.illinois.edu/community-of-care/resources/students/religious-observances/ to request appropriate accommodations. This should be done in the first two weeks of classes.

Disability-Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to https://www.disability.illinois.edu. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously

undiagnosed disability. You may access these by visiting the DRES website and selecting “Request an Academic Screening” at the bottom of the page.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Anti-Racism and Inclusivity

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (https://bart.illinois.edu/). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Counseling and help:

If you need mental health counseling or help, don’t hesitate to contact the Counseling Center (https://www.counselingcenter.illinois.edu) which provides services to address emotional, interpersonal, and academic concerns. The Center also provides emergency service (https://www.counselingcenter.illinois.edu/emergency-0). Another option that you have is to contact the ECE department advising office (Jen Merry, merry@illinois.edu, 217-333-9710), or the advising office in your perspective department if you are not an ECE student. Of course you can always contact me if you have any concerns or need any help.

Date		Lecture no.	Book chapter	Topic	HW hand out	HW due
August	27	1	1 (Bushberg)	Intro to Biomedical Imaging		
	29	1	**No class**			
September	3	2	Notes	Fourier Transform and Properties I	**HW #1 (L1-2)**	
	5	2	Notes	Fourier Transform and Properties II		
	10	3	1 (Suetens); 4.1-4.5, 4.7-4.9 (Bushberg)	Basic physics review, Image Properties and Processing	**HW #2 (L3)**	**HW #1 (L1-2)**
	12	3	2 (Suetens); 6.1-6.2, 7.1-7.2, 7.5 (Bushberg)	Basic physics review, Image Properties and Processing		
	17	4	2 (Suetens); 6.1-6.2, 7.1-7.2, 7.5 (Bushberg)	X-Ray Imaging	**HW #3 (L4)**	**HW #2 (L3)**
	19	4	2 (Suetens); 6.1-6.2, 7.1-7.2, 7.5 (Bushberg)	X-Ray Imaging		
	24	**No class**				
	26	**Mid-term exam 1 (L1-L3), 7-8:30PM ECEB 3081 (no class)**				
October	1	4	2 (Suetens); 6.1-6.2, 7.1-7.2, 7.5 (Bushberg)	X-Ray Imaging		
	3	5	3 (Suetens); 10.1-10.5 (Bushberg)	Computed Tomography (X-ray)	**HW #4 (L5)**	
	8	5	3 (Suetens); 10.1-10.5 (Bushberg)	Computed Tomography (X-ray)		**HW #3 (L4)**
	10	5	3 (Suetens); 10.1-10.5 (Bushberg)	Computed Tomography (X-ray)		
	15	5	3 (Suetens); 10.1-10.5 (Bushberg)	Computed Tomography (X-ray)		
	17	6	4 (Suetens); 12 (Bushberg)	Magnetic Resonance Imaging	**HW #5 (L6, Pt1)**	**HW #4 (L5)**
	22	6	4 (Suetens); 12 (Bushberg)	Magnetic Resonance Imaging		
	24	6	4 (Suetens); 12 (Bushberg)	Magnetic Resonance Imaging		
	29	6	4 (Suetens); 12 (Bushberg)	Magnetic Resonance Imaging	**HW #6 (L6, Pt2)**	**HW #5 (L6, Pt1)**
	31	6	4 (Suetens); 12 (Bushberg)	Magnetic Resonance Imaging		
November	5	**Mid-term exam 2 (L4-L6 pt1), 7-8:30PM ECEB 3081 (no class)**				
	7	7	5 (Suetens); 14.1-14.7 (Bushberg)	Ultrasound Imaging	**HW #7 (L7)**	**HW #6 (L6, Pt2)**
	12	7	5 (Suetens); 14.1-14.7 (Bushberg)	Ultrasound Imaging		
	14	7	5 (Suetens); 14.1-14.7 (Bushberg)	Ultrasound Imaging		
	19	7	5 (Suetens); 14.1-14.7 (Bushberg)	Ultrasound Imaging		
	21	8	6 (Suetens); 15, 16.1-16.2, 18.1, 19.1-19.3 (Bushberg)	Nuclear Medicine Imaging	**HW #8 (L8)**	**HW #7 (L7)**
	26	**Thanksgiving break**				
	28	**Thanksgiving break**				
December	3	8	6 (Suetens); 15, 16.1-16.2, 18.1, 19.1-19.3 (Bushberg)	Nuclear Medicine Imaging		
	5	8	6 (Suetens); 15, 16.1-16.2, 18.1, 19.1-19.3 (Bushberg)	Nuclear Medicine Imaging		
	10	**No class**				**HW #8 (L8)**
	12	**Reading day**				
	13	**Final exam (L1-8); 1:30-4:30 PM, ECEB 3013**				