

COURSE SYLLABUS

1 ECE 5252 - Medical Imaging

2 Meeting Information

3 credits, 3 contact hours Example: (Two 75-minute lectures)

a. **Section 001:**

Lecture: TR 1000-1115, **DRSDCK-B70**

3 Course Instructor(s), TA(s)

a. **Section 001:**

Class Instructor: [Liesl Klein](#)

Office Hours: M11-12 R 11:30-12:30, or by appt.

TA: None

4 Textbook

. OPTIONAL.

a. **Other Supplemental Materials:** "Introduction to Biomedical Imaging" Andrew Webb, IEEE Press Series

"Principles of Magnetic Resonance Imaging" Dwight G. Nishimura

5 Specific Course Information

a. **Catalog Description**

Principles of structural and functional medical imaging modalities: X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), ultrasound and optical imaging. Fundamentals of biomedical image analysis: image acquisition and display, image enhancement, segmentation and registration as used in medical imaging applications. Prerequisites: EGR 2021 or equivalent.

b. **Prerequisites:** Engineering 2021; **Co-requisites:** None

c.

6 Learning Objectives

a. Students will be able to:

- (a) explain, in their own words, the mechanics of several biomedical imaging modalities.
- (b) employ basic formulas related to the image processing of biomedical imaging modalities.
- (c) explore ethical considerations surrounding the use of imaging modalities.
- (d) use standard literature review techniques to learn more about a chosen topic.
- (e) write a cohesive literature review of a specialized imaging modality.
- (f) present their own knowledge to others in an effective manner.

ABET Student Outcomes															
b.	1a	1b	2a	2b	2c	2d	3	4a	4b	4c	5	6a	6b	7a	7b
							X	X	X	X				X	X

The above student outcomes are defined by the Accreditation Board for Engineering and Technology (ABET) as:

- 3. an ability to communicate effectively with a range of audiences
- 4a. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global and societal contexts
- 4b. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in economic contexts
- 4c. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in environmental contexts
- 7a. an ability to acquire new knowledge as needed, using appropriate learning strategies
- 7b. an ability to apply new knowledge as needed, using appropriate learning strategies

7 List of Covered Topics

- 1. - X-ray basics and instrumentation
- 2. - CT basics and image processing
- 3. - Ultrasound basics and instrumentation
- 4. - MRI basics, physics, image processing, and instrumentaiton
- 5. - Literature Review on an imaging specialty of the students' choice

8 Tentative Schedule

Tentative schedules for all sections follow. Be sure to refer to the schedule for your specific section, if more than one is provided.

Tentative Schedule for All Sections

Class	Topics	Assignments
Class 1 - 1/13	Intro and XRays	
Class 2 - 1/15	Xray tissue interaction	
Class 3 - 1/20	Xray Instrumentation	
Class 4 - 1/22	Xray Quiz	
Class 5 - 1/27	CT	
Class 6 - 1/29	Projection	
Class 7 - 2/2	CT Quiz	
Class 8 - 2/5	Ultrasound Intro	
Class 9 - 2/10	Ultrasound	
Class 10 - 2/12	Ultrasound Quiz	
Class 11 - 2/17	MRI Intro/Overview	
Class 12 - 2/19	MRI Physics	
Class 13 - 2/24	MR Quiz	
Class 14 - 2/26	MR Imaging	
Class 15 - 3/10	MRI Excitation	
Class 16 - 3/12	MRI Instruments	
Class 17 - 3/17	Catch-up/PET	
Class 18 - 3/19	Intro to Lit Review	Topic Selection
Class 19 - 3/24	Lit Reviews	3 Paper Summary 1
Class 20 - 3/26	Work day	3 Paper Summary 2
Class 21 - 3/31	Work day	Intro Section Draft
Class 22 - 4/2	Work day	First body paragraph draft
Class 23 - 4/7	Guest Lecture - Dr. Vike	
Class 24 - 4/9	Work day	First full draft
Class 25 - 4/14	Work day (writing center?)	
Class 26 - 4/16	Work day	
Class 27 - 4/21	Presentations	slides due
Class 28 - 4/23	Presentations	
Class 29 - 4/28	Presentations	
Class 30 - 4/30	CATS/ "free class"	final draft due

9 Grading Policy

All assignments and quizzes will be graded with a rubric. The total points in the course total 1000 and all student grades will be by the points earned out of 1000.

Xray quiz - 100pt

CT quiz- 100pts

Ultrasound quiz- 100pts

MR quiz- 100pts

Topic selection-10pts

3 paper summary-50pts

3 paper summary- 50pts

Intro version 1- 90pts

Body version 1- 100pts

Full draft version 1- 100pts

Presentation- 100pts

Final draft- 100pts

This course has no final exam, only a presentation and final literature review.

Letter grade scale: A(93–100), A–(90–92), B+(87–89), B(83–86), B–(80–82), C+(77–79), C(73–76), C–(70–72), D+(67–69), D(63–66), D–(60–62), F(<60)

10 HW Assignment and Laboratory Report Submission Policy

Late work is not accepted, unless prior arrangements are made with the instructor. Part of this course is to build independent learning skills. As such, a major portion of the course grade is dependent on an independent literature review assignment. There will be regular check-in points with the instructor throughout the course. However, it is expected that students spend some time outside of class each week working on their literature review. The check-in assignments are to ensure students are staying on track, but are not reflective of all work that goes towards a high-quality literature review.

Review the University’s AI policy. While AI may be used for idea generation, it is expected that all assignments and final drafts be the student’s own words and work. AI cannot be relied upon for accurate information, and particularly citations.

11 Attendance Policy

General Rules

The full version of the official Villanova class attendance policy is posted at <https://live-villanova-catalog.cleancatalog.io/class-attendance>, but the main points are as follows.

Students should attend every class, but attendance will not be taken. Students are responsible for learning any information they missed in class. Students should make arrangements prior to class for missing quizzes. All other missed quizzes will be evaluated on a case-by-case basis.

Whenever possible, students should inform the instructor if they plan to be late or absent from class. In all cases, documentation is required to petition for *excused* absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. The excused absence form is posted on this page: <https://villanova.sharepoint.com/teams/COECurrentUndergrads/SitePages/Catalog.aspx> under the heading “Engineering Academic Policies and Forms”.

Excused absences do not count towards a failure in the course for first year students. Absence from class does not release the student from assigned work. Students who miss an in-class obligation such as an exam, a presentation, etc., due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing a class. The University’s list of excused absences for all students includes the following:

1. Participation in NCAA athletic competitions
2. Participation in special academic events such as: conferences, field trips, project competitions, etc., and in official university business such as student representatives attending meetings related to university governance
3. Attendance at significant events of the immediate family such as: funerals, weddings, etc.
4. Religious holidays - see the University’s policy on Religious Holidays
5. College-approved participation in placement activities such as: job interviews, graduate school interviews, job fairs

6. Legally required absence such as: jury duty, court appearance, short-term military service
7. Documented serious illness or disability

Personal Days

Personal Days are NOT allotted for laboratory sessions and courses that meet once a week. For all other courses that meet at least twice a week, students are entitled to excused absences for any reason that may contribute to their personal wellness. The following rules apply.

Students must advise the instructor by email *before* class of their intent to utilize a Personal Day as the reason for their absence. A Personal Day will not be approved retroactively. Students may, but are not required, to provide additional information regarding their absence. A Personal Day does not grant an automatic extension for items due. Students remain responsible for all assignments, exams, presentations, etc. due on that date. The instructor may apply her/his discretion on a case-by-case basis to determine whether an extension on a deliverable item is appropriate.

For classes that meet thrice a week (50 mins \times 3), TWO personal days are allowed in the semester. These personal days may not be used ...

1. on consecutive class days
2. in the same week
3. immediately preceding or following a University holiday or break period, and
4. on days when exams, presentations or other major assignments are scheduled.

For classes that meet twice a week (75 mins \times 2), ONE personal day is allowed in the semester. This personal day may not be used ...

1. immediately preceding or following a University holiday or break period, and
2. on days when exams, presentations or other major assignments are scheduled.

12 Examination Policy

The College of Engineering has adopted the following general examination guidelines:

1. Students must arrive before the start of the examination. Under exceptional circumstances a student may need to arrive late, but he/she can enter the examination room no later than 5 minutes after the start of the exam.
2. All cell phones and smart devices must be turned off and stored away until the student exits the exam room, unless explicitly permitted by the instructor.
3. The official [Villanova class attendance policy](#) must be followed when requesting excuses for absences or lateness to an examination.
4. Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this examination."
5. In the case of virtual exams, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will announce ahead of time to students if they plan to use any form of video proctoring during an assessment and whether a recording will take place.

13 Academic Integrity Policy

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. The University's academic integrity policy can be found on the following web page:

<https://live-villanova-catalog.cleancatalog.io/academic-integrity-0>.

14 Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to university regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

15 Inclusive Classroom

This classroom is a place where you will be treated with respect; we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment to allow all among us to learn and flourish.

16 Students with Disabilities

It is the policy of the university to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability (non-physical) please register with the office of [Learning Support Services \(LSS\)](#) by emailing Learning.support.services@villanova.edu or by phoning 610-519-5176 as soon as possible. Registration is *required* in order to receive accommodations. In addition, please contact the instructor during office hours in order to make the appropriate arrangements.

The [Office of Disability Services \(ODS\)](#) collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities at 610-519-3209 or visit the office on the second floor of the Connelly Center.

17 Tutoring Services

Villanova's tutoring services include [The Writing Center](#), [The Learner's Studio](#), and [The Center for Speaking and Presentation](#). These services are offered free of charge to students. Drop in as-

needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length.

Register for an account and book sessions in advance at villanova.mywconline.com. If you don't see your class listed, request a tutor for a missing subject at: tutorrequest.villanova.edu For more information, contact Juliana Struder at juliana.studer@villanova.edu or at 610-519-5862.

18 Online Expectations

Some or all sessions of this class may be recorded for educational purposes and for later playback. In order to foster a professional environment, please wear appropriate clothes, refrain from eating, mute your microphone when you are not talking so as to eliminate background noise, and select an appropriate setting free of distractions. You may turn off your webcam for privacy reasons unless explicitly instructed not to do so by the instructor (such as during the conduct of online examinations).

19 Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, calculators, etc., during class is generally allowed, unless their use causes a disturbance to others. During examinations, the use of any electronic device is prohibited, unless it is expressly authorized by the instructor.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

20 Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the university which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, slides, etc., provided by a course instructor. Course materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in "Blackboard" are copyrighted materials. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g. uploading to websites, sale, exchange, etc.) without the permission of the copyright owner.

Follow these links for more information on [Intellectual Property](#), [Copyright](#), and [Computer Acceptable Use](#).

21 Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few commitments.