

COURSE SYLLABUS

1 ECE 5250 - Biomedical Instrumentation

2 Meeting Information

3 credits, 3 contact hours Two 75-minute lectures

a. **Section 001:**

Lecture: MW from 04:45 pm to 06:00 pm in Drosdick Hall 208., **Drosdick Hall 208**

Lab: MW from 04:45 pm to 06:00 pm in Drosdick Hall 208., **Drosdick Hall 208**

3 Course Instructor(s), TA(s)

a. **Section 001:**

Class Instructor: [Meltem Izzetoglu](#)

Office Hours: By appointment, or by appt.

Lab Instructor: [Meltem Izzetoglu](#)

Office Hours: By appointment, or by appt.

TA: None

4 Textbook

This course does not have a prescribed textbook

a. **Other Supplemental Materials:** Class slides and handouts.

b. **Misc. Notes:**

Recommended but not required book: Webster, John G., Medical Instrumentation: Application and Design, John Wiley and Sons Inc., 2009.

5 Specific Course Information

a. **Catalog Description**

Introductory course in Biomedical Engineering emphasizing human physiology & medical measurement tools & techniques. Topics include the nervous system, the cardiovascular system & the respiratory system.

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

c. Senior elective for ECE and Biomedical Minor

6 Learning Objectives

- a. i) Students will be able to understand the physiological basis, characteristics, and modeling of common biomedical signals and systems.
- ii) Students will be able to understand the working principles of various types of biosensors and instruments designed to acquire biomedical signals.
- iii) Students will be able to apply various types of biosensors to acquire biomedical signals of different origins.
- iv) Students will be able to analyze the acquired biomedical signals to extract physiologically

relevant biomarkers.

v) Students will be able to evaluate the performance of biomedical devices and their markers under various conditions.

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

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

- 1a. an ability to identify and formulate complex engineering problems by applying principles of engineering, science, and mathematics
- 1b. an ability to solve complex engineering problems by applying principles of engineering, science, and mathematics
3. an ability to communicate effectively with a range of audiences
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 6a. an ability to develop and conduct appropriate experimentation
- 6b. an ability to analyze and interpret data, and use engineering judgment to draw conclusions

7 List of Covered Topics

1. Medical sensors and devices: system design and performance evaluation principles
2. Electrical circuitry: filters, amplifiers and signal analysis
3. Biomedical optics: plethysmography, brain imaging, hematoma detection
4. Biopotentials: origin of bioelectricity and biopotential electrodes, electrocardiogram
5. Biomechanics: blood pressure, flow and volume measurements
6. Biomedical acoustics, stethoscopes and ultrasound imaging
7. Respiratory system: air flow and lung volume measurements with spirometry

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

Week or Date	Lecture Content
1-2	Basic concepts of medical instrumentation, Biomedical Optics, Lab 1, Quiz 1
3-4	Electrical circuitry, filters, amplifiers and signal analysis, Lab 2, Quiz 2
5-7	Biopotentials (origin, electrodes, bioelectricity, cell signaling), Lab 3, Quiz 3
8-9	Biomechanics (blood pressure, flow and volume measurements), Lab 4, Quiz 4
10-11	Biomedical acoustics (heart sounds, ultrasound imaging), Lab 5, Quiz 5
12-13	Respiratory system (air flow and lung volume measurements), Lab 6, Quiz 6
14	Overview
15	Final Exam

9 Grading Policy

Final grade will be determined from the following:

- a. Homework Assignments and Laboratory Experiments (45%)
- b. Quizzes (25%)
- c. Final Exam (25%)
- d. Professionalism (5%)

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

Homework Assignments and Laboratory Experiments: Homework assignments and lab reports will be due back on the following week after they are assigned.

Penalties: Late penalty will be applied to homework assignments and lab reports on each of the late days following the due date where 5 points/day will be taken out of the overall grade received. Miscellaneous (please read this carefully!): Please note that group study for working out solutions to homework problems/laboratory experiments is acceptable, and helpful to many students. However, the homework/lab report you turn in should be written out on your own, and not copied verbatim from another student's work or from the material found Online. It should reflect your understanding of the material. Homework problems/Laboratory experiment reports which are turned in and found to be verbatim copies of each other will be given zero credit, regardless of which is the original work. All work on an exam/quiz is to be entirely on your own.

Quizzes: There will be in class quizzes (every other week) related with the covered material in class. No make-up quizzes will be given. Instead, the percentage of the grade associated with each quiz missed will be added to the final exam percentage.

Final Exam: There will be an in class, comprehensive final exam on the university assigned final exam date.

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.

Attendance is mandatory. Course materials, quizzes and labs will be provided/performed in class sessions.

Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for excused absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. Students should use the form for requesting an excused absence. Excused absences do not count toward a failure in the course for first year students. Absence from class does not release the student from work assigned. Students who miss an in-class obligation (exam, 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 class.

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 at: <https://forms.office.com/r/1RsFK4qhBk>.

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 five (5) minutes after the start of the exam.
2. Cell phones must be turned off until the student exits the examination room.
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. For online examinations, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will inform students in advance if (s)he plans to use any form of video-proctoring and whether the examination will be recorded.

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.