

# ECE 5250: Biomedical Instrumentation

## Class Meetings

---

**Class Schedule:** TR, 9:35am-10:50am

**Place:** Lectures: In person Vasey Hall, Labs: In person CEER 212, Online: Zoom

## Instructor

---

Name: Meltem Izzetoglu, PhD

Office Location: Tolentine 429A

Phone number: 610-519-4982

Email: meltem.izzetoglu@villanova.edu

## Office Hours

---

Instructor: F, 10:00am-12:00noon online or by appointment for further online or in person meeting.

## Course Description and Objectives

---

**Description:** This course will introduce various systems of human physiology from an engineering perspective and concepts in principles, design and application of medical instrumentation as a survey of biomedical engineering.

**Course Objectives:**

1. Students will learn common biomedical signals and systems, their physiological origin, characteristics, modeling, and processing.
2. Students will study various types of biosensors, transducers, bioelectrodes and amplifiers designed to acquire biomedical signals.
3. Students will gain hands-on experience with biomedical signal acquisition and processing.

Student Outcomes						
1	2	3	4	5	6	7
X		X		X	X	

## Course Materials

---

**Course Reference Texts (Recommended but not required):**

- Webster, John G., Medical Instrumentation: Application and Design, John Wiley and Sons Inc., 2009.
- Becchetti, C. Medical instrument design and development: from requirements to market placement. John Wiley & Sons, 2014.

- Prutchi D., Norris M. Design and development of medical electronic instrumentation : a practical perspective of the design, construction, and test of medical devices. Wiley-Interscience, 2005
- Normann R. A., Principles of Bioinstrumentation. John Wiley & Sons, 1988.
- Bronzino, J. D. Biomedical engineering handbook. CRC press, 1999.

## List of Covered Topics and Schedule

---

### Tentative Lecture and Exam Schedules:

Week	Lecture Content
1-2	Basic concepts of medical instrumentation – Medical sensors and system design principles, 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	Respiratory system (air flow and lung volume measurements), Lab 6, Quiz 6
13-14	Biomedical Optics, Lab 7
15	Final Exam

## Grading Policy

---

Your final grade will be determined from the following:

- Homework Assignments and Laboratory Experiments (40%)
- Quizzes (30%)
- Final Exam (25%)
- Professionalism (5%)

**Homework and Laboratory Experiments:** Homework assignments and lab reports will be due back on the following week after they are assigned. Late penalty will be applied on each of the late days following the due date where 10 points/day will be taken out of the overall grade received.

**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.

**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.

The scale used to assign letter grades is:

Numerical Grade	Letter Grade	Numerical Grade	Letter Grade
A	94 to 100	C	73 to 76
A-	90 to 93	C-	70 to 72
B+	87 to 89	D+	67 to 69
B	83 to 86	D	63 to 66
B-	80 to 82	D-	60 to 62
C+	77 to 79	F	Less than 60

## Inclusive Classroom

---

We consider this classroom to be a place where you will be treated with respect; and, 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 for every other member of the class.

## Attendance

---

Attendance is mandatory for the online lectures and in class lab sessions in general. Exceptions can be made due to COVID related issues as explained below.

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.

The University's list of excused absences for all students includes the following:

- participation in NCAA athletic competitions
- participation in special academic events (e.g., conferences, field trips, project competitions)
- participation in official university business (e.g., student representatives attending meetings related to university governance)
- attendance at significant events involving the immediate family (e.g., funerals, weddings)
- religious holidays - see the University's policy on Religious Holidays
- college-approved participation in placement activities (e.g., job interviews, graduate school interviews, attending job fairs)
- legally required absence (jury duty, court appearance, short-term military service)
- documented serious illness, such as COVID, or disability

## Academic Integrity

---

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.

Students are encouraged to read the [University's academic integrity policy](#).

The College of Engineering has adopted the following exam guidelines:

- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must write and sign the following statement, "*I have neither given nor received any unauthorized assistance in the completion of this exam.*" If taking an exam remotely, students still need to copy and sign this statement (even if signed for electronically).
- 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.

## Adherence to the Student Code of Conduct and the CARITAS Commitment

---

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.

Students, faculty, and staff are expected to comply with the [CARITAS Commitment](#). Students must wear masks, practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

## Online Expectations

---

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

## Students with Disabilities

---

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability please contact me after class or during office hours to make arrangements.

If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at [learning.support.services@villanova.edu](mailto:learning.support.services@villanova.edu) as soon as possible. Registration is needed to receive accommodations.

The Office of Disability Services 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 disabilities 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 @ 610-519-3209 or visit the office on the second floor of the Connelly Center.

## Electronics Policy

---

Online portions of this class may be recorded so that students that are absent may view the content later.

The use of electronic devices, such as phones, tablets, etc., during class is prohibited.

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.

## 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, PowerPoints, 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 material. 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 permission of the copyright owner.

Follow these links for more information about [intellectual property](#), [copyright](#), and [computer acceptable use](#).

## Professorial Duties

---

Please 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...