

## **Biomedical Engineering 355: Biomedical Instrumentation (3 Credits)**

**Spring 2022**

**Time: MWF 10:00am-10:50am; Location: 25 University Ave 127**

*Instructor: Dr. Jesse Placone*

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Office hours: T - 1:00 - 3:00pm; W - 1:00 - 3:00pm; Th - 2:00 - 3:00pm; office hours also available by appointment

### *Course Description:*

BME355 is a required course in the BME major. This course is to study the fundamentals of instrumentation in biomedical fields. Topics include: various types of medical instruments; basic analog and digital electronics; data acquisition signal processing; and applications of instrumentation in diagnoses, medical imaging, and laboratory. Regulation and medical safety will be discussed.

### *Recommended Materials:*

1. Suggested textbook: "Biomedical Instrumentation Systems." Chatterjee S. and Miller A.
2. Computer capable of running Matlab (Matlab is available for free from the University for students)

### *Prerequisites:*

BME355 requires prerequisites of BIO 265, PHY 180, and MAT 315.

### *Course Student Learning Outcomes:*

Biomedical Engineering 355 is a core course in the BME program. Throughout the semester you will develop an understanding of the fundamentals of biomedical instrumentation. Through a series of lectures, example problems, and homework problems, you will be able to 1) identify and formulate engineering problems, 2) devise solution strategies using math, science, and engineering knowledge, and 3) execute the solution strategy and evaluate their answers. In addition, you will be able to 4) sketch a design/prototype of a component, simple system, or process, and perform engineering analysis of the design.

### *Program Learning Objectives/ABET Student Outcomes:*

- Student Outcome #1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (**Problem sets and Exams**)
- Student Outcome #2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (**Problem Sets**)

### *Meeting and Assessing Student Learning Outcomes:*

- Student learning outcomes will be achieved by interactive lectures and students working on the assigned problems outside of class time. The primary form of assessment of the student learning outcomes will be exams and problem sets.

### *Course Web Page:*

This course has a D2L website associated with it. Syllabus and related material will be on D2L. Announcements will be posted to D2L.

### *Evaluation and Grading:*

Preparation: 15%

Problem Sets: 15%

Midterm exams (2 x 20% each): 40%

Final Exam: 30%

### *Attendance Policy:*

Attendance is an important part of the class. Attendance will be taken at the start of each class period. Excused absences are limited to those due to participation in University- sanctioned events (see policy in the WCU undergraduate catalog) or those accompanied by written confirmation from a doctor, the Dean of Students, etc. If you are sick, you must obtain a doctor's note. Finally, whether your absence is excused or unexcused (or if you are late to class), you will be responsible for any material covered and any announcements that were made in class that day.

### *Reading:*

Students are expected to keep up with the assigned reading. Assigned reading will be posted to D2L.

### *Preparation:*

Preparation will be assessed by periodic quizzes based upon the assigned problem sets, assigned reading, and lectures. Keeping up with the assigned reading, problem sets, and lectures will be instrumental in doing well on these. In addition, I may call on students to walk through example problems as part of this assessment.

### *Problem Sets:*

Problem sets will be assigned in class. Points will be deducted from assignments handed in late, and no credit will be given once solutions have been posted. Please do not dismiss the importance of homework assignments simply because they comprise only 15% of your total grade - doing homework problems is one of the primary ways to learn the material, and is critical for doing well on tests. When working on the problem sets, your focus should be on learning the material. No homework assignments will be accepted over email. All assignments must be submitted via D2L.

### *Exam policy:*

There will be two tests over the course of the semester. An unexcused absence on the day of a test will result of a grade of zero for that test. In the case of a University sanctioned event, please schedule a makeup exam with me in advance. If you should miss an examination due to a certifiable emergency or illness, please notify me as soon as possible providing appropriate documentation and either a makeup exam will be arranged or your score on the final exam will replace the missed exam. **All unexcused absences will result in a grade of zero.** You are encouraged to bring a calculator to the exams, but the calculator cannot be a part of a cell phone, iPod, etc. (i.e., it must be ONLY a calculator).

### *Final Exam Policy:*

This course follows the WCU Final Exam Policy. The final exam is cumulative and mandatory.

### *Letter grade scale:*

Grade	Quality Points	Percentage Equivalents	Interpretation
A	4.00	93-100	Excellent
A-	3.67	90-92	Excellent
B+	3.33	87-89	Superior
B	3.00	83-86	Superior
B-	2.67	80-82	Superior
C+	2.33	77-79	Average
C	2.00	73-76	Average
C-	1.67	70-72	Average
D+	1.33	67-69	Below Average
D	1.00	63-66	Below Average
D-	0.67	60-62	Below Average
F	0	< 60%	Failure

Refer to the Undergraduate Catalog for description of NG (No Grade), W, Z, and other grades.

*BME 355 Spring 2022, Tentative Course Schedule*

The following schedule is subject to change at the discretion of the instructor. Every effort will be made to announce changes in advance, but students are responsible for changes.

Week	Topic
1	Introduction to Biomedical Instrumentation
2	Basic Analog Electronics
3	Basic Analog and Digital Electronics
4	Basic Digital Electronics
5	<b>Exam 1</b>
6	Signals and Systems
7	Signals and Systems
8	<b>Spring Break</b>
9	System Response
10	Applications of Medical Instrumentation
11	<b>Exam 2</b>
12	Medical Imaging
13	Applications of laboratory instrumentation
14	Applications of laboratory instrumentation
15	Applications of laboratory instrumentation
16	<b>Cumulative Final Exam TBD</b>

*Bibliography: Additional resources that may be of interest:*

1. Belmont, Barry. <https://github.com/barrybelmont/biomed-211-w19/blob/master/biomed-211-w19.pdf>
2. Strogatz SH. "Nonlinear Dynamics and Chaos with applications to Physics, Biology, chemistry, and Engineering." First or second edition
3. Woods RL and Lawrence KL. "Modeling and Simulation of Dynamic Systems" Any edition

## *Statements Common to All WCU Undergraduate Syllabi:*

### ACADEMIC & PERSONAL INTEGRITY

It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram's Eye View, and the University website at [www.wcupa.edu](http://www.wcupa.edu).

### STUDENTS WITH DISABILITIES

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is [ossd@wcupa.edu](mailto:ossd@wcupa.edu), and their website is at <https://www.wcupa.edu/universityCollege/ossd/>. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

### EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

### REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. **Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy.** Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at:

<https://www.wcupa.edu/admin/diversityEquityInclusion/sexualMisconduct/default.aspx>

### INCLUSIVE LEARNING ENVIRONMENT AND ANTI-RACIST STATEMENT

Diversity, equity, and inclusion are central to West Chester University's mission as reflected in our [Mission Statement](#), [Values Statement](#), [Vision Statement](#) and [Strategic Plan: Pathways to Student Success](#). We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful

behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.

Resources for education and action are available through WCU's [Office for Diversity, Equity, and Inclusion](#) (ODEI), DEI committees within departments or colleges, the student [ombudsperson](#), and centers on campus committed to doing this work (e.g., [Dowdy Multicultural Center](#), [Center for Women and Gender Equity](#), and the [Center for Trans and Queer Advocacy](#)).

Guidance on how to report incidents of discrimination and harassment is available at the University's [Office of Diversity, Equity and Inclusion](#).

## EMERGENCY PREPAREDNESS

All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit [www.wcupa.edu/wcualert](http://www.wcupa.edu/wcualert). To report an emergency, call the Department of Public Safety at 610-436-3311.

## ELECTRONIC MAIL POLICY

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

## BASIC NEEDS STATEMENT

WCU is committed to ensuring that all students are able to reach their full academic potential. We know that basic needs are essential for effective learning, and we are working to address economic insecurity among our students in a number of ways. In particular, the WCU Resource Pantry is open to all students who lack access to food and supplies. Resources are also available for students facing housing insecurity. Please contact the Office of Service-Learning & Volunteer Programs for more information. As these factors directly affect academics, students who are comfortable doing so should contact faculty for further support.