# Biomedical Engineering 315: Biomedical Engineering Laboratory I

# Fall 2022

# Lecture: Friday 12:00-12:50pm SECC 107

# Lab: Friday 2:00-4:50pm SECC 171

## Instructors:

Dr. Jesse K. Placone

Office: SECC 352

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Office hours: Tuesday 11am-1pm; Wednesday 12-1pm; Thursday 12-2pm; or by appointment

Dr. Nicole Ramo

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Office Hours: Tuesday 2 – 4pm; Wednesday 11am – 12pm; Thursday 1 – 3pm; or by appointment

## Course Description:

This course introduces biomedical engineering laboratory techniques and tools, as well as provides hands-on laboratory experiences. Students will perform a series of laboratory experiments, and a project will be conducted at the end of the semester.

## Required Materials:

* A laboratory notebook (digital or physical)
* A computer with internet connectivity
* A computer that is able to run ImageJ or FIJI (more information will be posted to D2L)
* A computer with Microsoft Office Suite ([free from the University](https://www.wcupa.edu/infoServices/office365/))

## Prerequisites:

BME110 and BIO265 are required to enroll in the class unless specific permission is given by the instructor.

## Course Student Learning Outcomes:

BME 315 is the first of a series of two biomedical engineering laboratory courses. Lab modules will introduce a range of Biomedical Engineering laboratory techniques. These modules are designed to support the achievement of the following course student learning outcomes:

* The student will be able to effectively communicate scientific knowledge.
* The student will be able to conduct common biomedical engineering experiments and analyze/interpret data.
* The student will be able to plan and execute an experimental plan to test a hypothesis.

These will be assessed through lab module write-ups, pre-lab quizzes, and assignments related to the final project.

## Program Goals/ABET Student Outcomes:

* Student Outcome #3: an ability to communicate effectively with a range of audiences. (Final Project Report & Presentation)
* Student Outcome #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. (Peer Evaluations)
* Student Outcome #6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Lab Write-ups, Final Project Report & Presentation)
* Student Outcome #7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (Lab Write-ups, Pre-lab Quizzes, Final Project Report & Presentation)

## Meeting and Assessing Student Learning Outcomes:

Student learning outcomes will be achieved through interactive laboratory modules and laboratory lectures, and students working on laboratory write-ups, and as teams on a final project. The primary form of assessment in this course will be the laboratory module write-ups and the final project reports and presentations.

## Course Web Page:

The syllabus and related material will be on D2L.

## Evaluation and Grading:

Peer Evaluation / Engagement: 5%

Prelab Quizzes: 10%

Lab Write-ups: 60%

Final Project (Report & Presentation): 25%

## Experiments:

Experiments will be carried out every week with the associated write-up due the following week. The one exception is Lab 7. This lab will be split over several weeks with a final write-up due a week after the completion of the final module. The lab modules are listed in the tentative course schedule.

## Attendance Policy:

Attendance is an important part of the class – the equipment for that lab module has been prepared on that day for you. 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.

## Preparation:

Journal articles, relevant protocols, and procedures will be assigned before each lab. For your safety and the safety of others, it is expected that these materials are read **before carrying out any laboratory experiments**. If anything is unclear, please bring it up with the instructor preferably during the lecture so that it may be clarified for the entire class.

## Prelab Quizzes:

To incentivize you to keep up with the assigned preparation work, lab quizzes on the upcoming experiments will be administered randomly throughout the semester. The goal is for you to have a basic understanding of the lab and the protocols that need to be followed. It is not expected for you to have memorized the lab manuals, but it is expected that you are familiar with the basics.

## Lab Write-up Policy:

Lab write-ups will be evaluated on an individual basis; assignments related to the final project will be evaluated on a group basis. In this course, you will develop the ability to effectively communicate scientific knowledge. We will utilize peer reviews in addition to critiques from your instructor to improve submitted documents. **All sources used should be properly cited and should be from respected sources (e.g., Journal Articles, Textbooks, and Reviews).** It is suggested that you use reference manager software such as EndNote Web which is provided through the [University Library Services](https://library.wcupa.edu/endnote) to help you find, manage, and incorporate your references into your submitted documents.

## Late/Missing Work:

You are expected to turn in every assignment by the deadline. The final project report and presentation is a group assignment. It is the responsibility of the team to effectively work together to submit the assignment on time. Please communicate with the instructor ahead of time if there are any unforeseen circumstances. For the first late assignment, a warning will be given. For each subsequent late assignment, there will be a deduction of 5% for each day that the assignment is late.

## Letter grade scale:

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

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

## Bibliography (additional resources that may be of interest):

1. Engler AJ, Sen S, Sweeney HL, Discher DE. Matrix elasticity directs stem cell lineage specification. Cell. 2006 Aug 25;126(4):677-89. doi: 10.1016/j.cell.2006.06.044. PMID: 16923388.
2. <https://learn.lambdau.net/>
3. Engineering Mechanics: Statics and Dynamics, 14th Edition, by R.C. Hibbeler
4. Biomaterials: The Intersection of Biology and Materials Science, 1st Edition, by Temenoff and Mikos
5. Biomaterials Science. An introduction to materials in medicine. 3rd Edition. Editors: B. Ratner, A. Hoffman, F. Schoen, J. Lemon.
6. Surface Modification of Polymeric Biomaterials. Editors: B. Ratner and D. Castner.

*BME 315 Fall 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.

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| --- | --- | --- | --- | --- |
| **Week** | **Date** | **Deliverables** | **Lecture Topics** | **Lab Module** |
| 1 | September 2nd |  | Course Introduction;General Laboratory Safety | Lab 1. Human Elbow Joint Equilibrium |
| 2 | September 9th  | Lab 1 Report | Statistical Analysis of Experimental Data | Lab 2. Ground Reaction Forces during Countermovement Jump |
| 3 | September 16th  | Lab 2 Report | WCU Library resources for research (guest lecture) | Lab 3. Tensile Mechanical Properties |
| 4 | September 23rd  | Lab 3 Report | Critical Assessment of Journal Articles | Lab 4. Compression Mechanical Properties |
| 5 | September 30th  | Lab 4 Report | Class Critique of Assigned Article | Lab 5. Bending Mechanical Properties |
| 6 | October 7th  | Lab 5 Report | Biomaterials and Stem Cells | Lab 6. Biomaterial Synthesis |
| 7 | October 14th  | Lab 6 Report | Final Project Discussion; Writing an Effective Scientific Abstract | Aseptic Technique (videos) |
| 8 | October 19th & 21st  | Abstract Draft | Peer Evaluation of Abstracts | Lab 7a. Cell Culture |
| 9 | October 24th, 26th & 28th  |  | Writing a Scientific Technical Document | Lab 7b. Cell Staining and Imaging |
| 10 | November 4th  | Technical Document Draft | Peer Evaluations of Technical Document | Lab 7c. In-Cell Western |
| 11 | November 11th  | Lab 7 Report; Technical Document | Final Project | Final Project |
| 12 | November 18th  |  | Final Project | Final Project |
| 13 | November 25th  | **Thanksgiving Break (no lab)** |
| 14 | December 2nd  |  | Scientific Presentations | Final Project |
| 15 | December 9th  | Final Report and Presentation | Final Presentations |
| 16 | December 16th  | **No Lab** |

**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, the [University website](http://www.wcupa.edu), and [Undergraduate Student Academic Integrity Policy](https://catalog.wcupa.edu/undergraduate/academic-policies-procedures/academic-integrity/)

*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 your instructor as soon as possible so that they 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 their website](https://www.wcupa.edu/universityCollege/ossd/) or visit them in-person 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. 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.

*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](https://protect-us.mimecast.com/s/Kh8QCrk6x5SDqM24CQRU_b?domain=wcupa.edu),[Values Statement](https://protect-us.mimecast.com/s/XD1FCv2kB5Ty91Arswntb5?domain=wcupa.edu),[Vision Statement](https://protect-us.mimecast.com/s/XD1FCv2kB5Ty91Arswntb5?domain=wcupa.edu) and[Strategic Plan: Pathways to Student Success](https://protect-us.mimecast.com/s/ovVXCwplD5TRj6yghld0bL?domain=wcupa.edu). 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](https://www.wcupa.edu/_admin/diversityEquityInclusion/changeBeginsHere.aspx) (ODEI), DEI committees within departments or colleges, the student [ombudsperson](https://www.wcupa.edu/_services/STU/studentOmbuds/), and centers on campus committed to doing this work (e.g., [Dowdy Multicultural Center](https://www.wcupa.edu/_services/multicultural/), [Center for Women and Gender Equity](https://www.wcupa.edu/_services/stu.wce/), and the [Center for Trans and Queer Advocacy](https://www.wcupa.edu/_services/transAndQueer/)).

Guidance on how to report incidents of discrimination and harassment is available at the University’s [Office of Diversity, Equity, and Inclusion](https://www.wcupa.edu/_admin/diversityEquityInclusion/).

*Emergency Preparedness*

All students are encouraged to sign up for the University’s free [WCU ALERT service](http://www.wcupa.edu/wcualert), which delivers official WCU emergency text messages directly to your cell phone. 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.

*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 found on the [Sexual Misconduct page of the Office for Diversity, Equity, and Inclusion](https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx).