

## **Physical and Rheological Properties of Biological Materials**

ABE3652C (10131)

**Class Periods:** TR | Period 7 | 1:55 P.M. - 2:45 P.M.

**Laboratory Section:** T | Periods 8-9 | 3:00 P.M. - 4:55 P.M.

**Location:** Lectures ROG 129 | Laboratory ROG 160

**Academic Term:** Spring 2024

### **Instructor:**

Dr. William Pelletier

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(352) 294-6701

Office Hours: Online TBD

Office Location: 101 Frazier Rogers Hall

### **Teaching Assistants:**

TBD

### **Course Description**

Theory and use of physical and rheological properties of biological materials in agricultural engineering applications.  
3 Credits

### **Course Pre-Requisites**

CHM 2045 and MAC 2313 and PHY 2048.

### **Course Objectives**

- Provide students with fundamental knowledge of physical and rheological properties needed for the engineering design of processing, storage and handling systems for food and biological materials.
- Provide students with an opportunity to master communicative and technical writing skills by submitting weekly technical reports complete with summary, objectives, methodology, and presentation of results, following rules of convention for data presentation.
- Provide students with team building and teamwork experiences through self-directed team formation and organization, with grades based on team output and teammate evaluation.
- Train students in the use of modern computational and experimental testing equipment.

Upon successful completion of this course, the student should be capable of analyzing and measuring various rheological and physiological properties agricultural and biological material. This course will help students develop their ability to: 3. communicate effectively with a range of audiences; 5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives; 6. develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions

The course will consist of two (2) lectures and one (1) laboratory per week, laboratory reports and examinations.

### **Materials and Supply Fees**

N/A

### Professional Component (ABET):

This course contributes four (3) credit hours toward meeting the minimum 48 credit hours of Engineering Topics in the basic-level curriculum for the Bachelor of Science Degree in Biological Engineering.

### Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	
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	
3. An ability to communicate effectively with a range of audiences	High
4. 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, economic, environmental, and societal contexts	
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	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

### Optional Textbook

Figura, L. O. and Teixeira, A. A. 2023.

Food Physics: Physical Properties – Measurement and Applications 2<sup>nd</sup> Edition  
Springer Berlin Heidelberg New York, 637 p.

## Course Schedule (subject to change)

Week 1	8-Jan	12-Jan	T	<b>Course Introduction</b>
			LAB	0 - Team Formation / Oven Drying
			R	1 - Moisture Content and Water Activity
Week 2	15-Jan	19-Jan	T	1 - Moisture Content and Water Activity
			LAB	1 - Moisture Content and Water Activity
			R	Physical Characteristics (Shape & Size)
Week 3	22-Jan	26-Jan	T	Physical Characteristics (Shape & Size)
			LAB	2 - Physical Characteristics - Part 1
			R	Volume, Density, Porosity, Permeability and Surface Area
Week 4	29-Jan	2-Feb	T	Volume, Density, Porosity, Permeability and Surface Area
			LAB	3 - Physical Characteristics - Part 2
			R	Specific Surface Area, Particle Size Distribution
Week 5	5-Feb	9-Feb	T	Specific Surface Area, Particle Size Distribution
			LAB	4 - Physical Characteristics - Part 3
			R	Review
Week 6	12-Feb	16-Feb	T	<b>Exam 1*</b>
			LAB	-
			R	Modulus of Elasticity (Bulk, Shear, Young's)
Week 7	19-Feb	23-Feb	T	Modulus of Elasticity (Bulk, Shear, Young's)
			LAB	5 - Rheology of Solid - Part 1
			R	Analysis of Force/Deformation Data
Week 8	26-Feb	1-Mar	T	Analysis of Force/Deformation Data
			LAB	6 - Rheology of Solid - Part 2
			R	Creep (Strain Retardation) and Stress Relaxation
Week 9	4-Mar	8-Mar	T	Creep (Strain Retardation) and Stress Relaxation
			LAB	7 - Rheology of Solid - Part 3
			R	Rheology of Liquids (Flow Behavior)
Week 10	11-Mar	15-Mar	T	
			LAB	<b>Spring Break</b>
			R	
Week 11	18-Mar	22-Mar	T	Rheology of Liquids (Flow Behavior)
			LAB	8 - Rheology of Liquids
			R	Review
Week 12	25-Mar	29-Mar	T	<b>Exam 2*</b>
			LAB	-
			R	Mechanical Impact and Aerodynamic Properties
Week 13	1-Apr	5-Apr	T	Mechanical Impact and Aerodynamic Properties
			LAB	9 - Terminal Velocity
			R	Particle Mechanics of Granular Materials
Week 14	8-Apr	12-Apr	T	Particle Mechanics of Granular Materials
			LAB	10 - Particle Mechanics - Part 1
			R	Flow and storage of Granular Materials
Week 15	15-Apr	19-Apr	T	Flow and storage of Granular Materials
			LAB	11 - Particle Mechanics - Part 2
			R	<b>Review</b>
Week 16	22-Apr	26-Apr	T	<b>Exam 3*</b>
			LAB	-
			R	<b>No Class</b>

## Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance (on time) at lectures and laboratory sessions is expected from all students at all times. A sign-in sheet will be used to monitor attendance which accounts for 10% of your final grade. Students will be warned if they are late on several occasions. Following a second warning, late attendances will be counted as missed lectures.
- Laboratory reports are due one week after the laboratory is completed (unless it is mentioned otherwise). Reports will be marked down for a sloppy presentation and, if excessive, they may be returned un-graded. Reports, including all calculations, must be typed and must be submitted through Canvas. A report submitted late (5 h or less) on the day they were due, will be marked down by 10% of its total. Starting at that 5-h deadline, students will have 24 h to submit the report with a 50% penalty. Reports won't be accepted after that 24-h period. No make-up exams or quizzes will be given except for valid medical reasons or unless prior arrangements have been made.
- For all online submissions (Canvas), it is the student's responsibility to ensure that the correct file is uploaded on Canvas. A wrong submission will be penalized. If technical difficulties with Canvas were to occur, students can always email the file to [wpelletier@ufl.edu](mailto:wpelletier@ufl.edu).
- Cell phones must be silenced prior to the start of class.
- No food will be permitted.
- Closed-toe shoes are required for laboratory sessions.
- Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

## Evaluation of Grades

Assignment	Percentage of Final Grade
Laboratory Reports & Quizzes	45%
Attendance	10%
Exam 1 (expected date: 02/13/2023 at 1:55 P.M.)	15%
Exam 2 (expected date: 03/26/2023 at 1:55 P.M.)	15%
Exam 3 (expected date: 04/23/2023 at 1:55 P.M.)	15%
TOTAL	100%

## Grading Policy

Percent	Grade	Grade Points
[90 - 100%]	A	4.00
[87 - 90%[	A-	3.67
[84 - 87%[	B+	3.33
[80 - 84%[	B	3.00
[77 - 80%[	B-	2.67
[74 - 77%[	C+	2.33
[70 - 74%[	C	2.00
[67 - 70%[	C-	1.67
[64 - 67%[	D+	1.33
[60 - 64%[	D	1.00
[57 - 60%[	D-	0.67
[0 - 57%[	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

## **Course Evaluation**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

## **In-Class Recording**

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

## **University Honesty Policy**

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## **Commitment to a Safe and Inclusive Learning Environment**

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, (352) 392-0904, [student-support-hr@eng.ufl.edu](mailto:student-support-hr@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

## Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

## Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

## Campus Resources:

### Health and Wellness

#### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connection Center:** Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

**Library Support:** <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center:** Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio:** 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.