

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

ABE3652C Sections 0137/2632

**Class Periods:** TR | Period 7 | 1:55 P.M. - 2:45 P.M. & R | Periods 8-9 | 3:00 P.M.- 4:55 P.M.

**Location:** ROG 129

**Academic Term:** Spring 2020

### **Instructor:**

Dr. William Pelletier

wpelletier@ufl.edu

(352) 294-6701

Office Hours: R 3:00 P.M. – 4:00 P.M. & and by appointment

Office Location: 101 Frazier Rogers Hall

### **Teaching Assistants:**

TBD

Office Hours: TBD

Office Location: 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. 2007.

Food Physics: Physical Properties – Measurement and Application, Springer Berlin Heidelberg New York, 550 p.

## Course Schedule (subject to change)

<b>Week 1</b>	<b>6-Jan</b>	<b>10-Jan</b>	<b>T</b> <b>LAB</b> <b>R</b>	<b>Course Introduction</b> 0 - Team Formation / Oven Drying Biological Structure and Composition
<b>Week 2</b>	<b>13-Jan</b>	<b>17-Jan</b>	<b>T</b> <b>LAB</b> <b>R</b>	Biological Structure and Composition 1 - Moisture Content and Water Activity Physical Characteristics (Shape & Size)
<b>Week 3</b>	<b>20-Jan</b>	<b>24-Jan</b>	<b>T</b> <b>LAB</b> <b>R</b>	Physical Characteristics (Shape & Size) 2 - Physical Characteristics - Part 1 Volume, Density, Porosity, Permeability and Surface Area
<b>Week 4</b>	<b>27-Jan</b>	<b>31-Jan</b>	<b>T</b> <b>LAB</b> <b>R</b>	Volume, Density, Porosity, Permeability and Surface Area 3 - Physical Characteristics - Part 2 Specific Surface Area, Particle Size Distribution
<b>Week 5</b>	<b>3-Feb</b>	<b>7-Feb</b>	<b>T</b> <b>LAB</b> <b>R</b>	Specific Surface Area, Particle Size Distribution 4 - Physical Characteristics - Part 3 Bulk, Shear, Young's Modulus
<b>Week 6</b>	<b>10-Feb</b>	<b>14-Feb</b>	<b>T</b> <b>LAB</b> <b>R</b>	Review Review <b>Exam 1*</b>
<b>Week 7</b>	<b>17-Feb</b>	<b>21-Feb</b>	<b>T</b> <b>LAB</b> <b>R</b>	Bulk, Shear, Young's Modulus 5 - Rheology of Solid - Part 1 Analysis of Force/Deformation Data
<b>Week 8</b>	<b>24-Feb</b>	<b>28-Feb</b>	<b>T</b> <b>LAB</b> <b>R</b>	Analysis of Force/Deformation Data 6 - Rheology of Solid - Part 2 Creep (Strain Retardation) and Stress Relaxation
<b>Week 9</b>	<b>2-Mar</b>	<b>6-Mar</b>	<b>T</b> <b>LAB</b> <b>R</b>	<b>Spring Break</b> <b>Spring Break</b> <b>Spring Break</b>
<b>Week 10</b>	<b>9-Mar</b>	<b>13-Mar</b>	<b>T</b> <b>LAB</b> <b>R</b>	Creep (Strain Retardation) and Stress Relaxation 7 - Rheology of Solid - Part 3 Rheology of Liquids (Flow Behavior)
<b>Week 11</b>	<b>16-Mar</b>	<b>20-Mar</b>	<b>T</b> <b>LAB</b> <b>R</b>	Rheology of Liquids (Flow Behavior) 8 - Rheology of Liquids Mechanical Impacts and Aerodynamic Properties
<b>Week 12</b>	<b>23-Mar</b>	<b>27-Mar</b>	<b>T</b> <b>LAB</b> <b>R</b>	Review Review <b>Exam 2*</b>
<b>Week 13</b>	<b>30-Mar</b>	<b>3-Apr</b>	<b>T</b> <b>LAB</b> <b>R</b>	Mechanical Impacts and Aerodynamic Properties 9 - Terminal Velocity Particle Mechanics of Granular Materials
<b>Week 14</b>	<b>6-Apr</b>	<b>10-Apr</b>	<b>T</b> <b>LAB</b> <b>R</b>	Particle Mechanics of Granular Materials 10 - Particle Mechanics - Part 1 Flow and Storage of Granular Materials
<b>Week 15</b>	<b>13-Apr</b>	<b>17-Apr</b>	<b>T</b> <b>LAB</b> <b>R</b>	Flow and Storage of Granular Materials 11 - Particle Mechanics - Part 2 <b>Review</b>
<b>Week 16</b>	<b>20-Apr</b>	<b>24-Apr</b>	<b>T</b> <b>LAB</b> <b>R</b>	<b>Exam 3</b> <b>No Class</b>

\* Because of conflicts with the different course sections, all exams will be held during the evenings.

## 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 is used and monitor attendance which accounts for 10% of your final grade. Students will be warned if they are late at 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) and should be printed. 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 before class begins. Reports submitted late, before 4:00 PM on the day they were due, will be marked down by 10% of their total. Reports submitted late before 4:00 PM on the following day will be marked down by 50% of their total. Reports won't be accepted after 4:00 PM on the following day. Electronic submissions (wpelletier@ufl.edu) are accepted. No make-up exams or quizzes will be given except for valid medical reasons or unless prior arrangements have been made.
- Cell phones must be silenced prior to the start of class and exams.
- No food will be permitted.
- 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	45%
Attendance	10%
Exam 1 (02/13/2020)	15%
Exam 2 (03/26/2020)	15%
Exam 3 (04/21/2020)	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 [disability.ufl.edu/students/get-started](http://disability.ufl.edu/students/get-started) (352-392-8565). 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/>.

## 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 Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. 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
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@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:** <http://www.counseling.ufl.edu/cwc>, 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 Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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