

## **BE 4303: Engineering Properties of Biological Materials Fall 2008 Syllabus**

**Meeting Schedule:** Lecture: 12:30-1:30 pm Monday/Wednesday, 213 Tureaud Hall  
Lab: M (Session I) or Th (Session II) 1:30-4:30, 140 Ag Metal Bldg.

**Text Book:** Sahin S. and Sumnu, S.G. Physical Properties of Foods. Springer, New York, NY, 2006.

**Pre-requisite:** MATH 2065

**Instructor:** Dorin Boldor, PhD  
Phone: 225 578 7762  
Office Hours: M: 8:30 – 9:30 pm  
E-mail: [dboldor@agcenter.lsu.edu](mailto:dboldor@agcenter.lsu.edu)  
175 EB Doran Bldg.  
T: 1:30 – 2:30 pm (or by appointment)

**Teaching Assistant:**  
Beatrice Terigar  
E-mail: [bterig1@lsu.edu](mailto:bterig1@lsu.edu)  
101 EB Doran Bldg.  
Office Hours M, W: 10:30-12:00

### **Course Objectives:**

The course covers the principles of physical properties of biological materials and their relationships with the design of engineering processes dealing with these biological materials. The major physical properties (geometrical, thermal, electromagnetic, ultrasonic, moisture-related properties, surface properties, rheological/deformation) will be presented and discussed. The specific objectives of the course are to:

1. Identify, define, and explain the different physical properties of biological materials
2. Apply knowledge of mathematics, science, and engineering to determine important properties from various physical measurements (ABET Objective a. )
3. Learn to design and conduct experiments for measuring different properties of biological materials, as well as to analyze and interpret data (ABET Objective b. )
4. Identify the relevant physical properties and use them to design a system, component, or engineering process to meet desired needs (ABET Objective c. )
5. Identify, formulate and solve biological engineering problems based on the physical and engineering properties of related material (ABET Objective e. )
6. Learn techniques, skill , and modern engineering tools necessary for the engineering practice (ABET Objective k. )

### **Web Page**

A course web page will be made available through LSU's Moodle to enhance the course contents. Students are requested to visit this web site on a regular basis. The course web site contains the course syllabus, additional lecture notes and materials, and review materials. Class notes will be posted on-line before each lecture. **Beware that Moodle is offered for the first time.**

### **Course Policies**

- Each student will undertake two individual projects as follows:
  - A critical review (3 page double spaced) of a peer-reviewed paper dealing with one engineering property of biological materials (selection by 09/22, due before the midterm).
  - Semester Design Project: An Autodesk Inventor (or Autocad) design of a piece of equipment or method (set of equipments) and the unit operation flowchart used in measuring an engineering

property of biological/agricultural/food materials. The topic must be approved by the instructor by October 15.

- Homework is due at the beginning of class on the due date. Homework assignments turned in late will not be accepted and will be assigned a grade of zero.
- **Exams** will be divided into open book and closed book sections. As you are currently learning to think on your own feet, the exam problems will not necessary be carbon copies of homework and example problems.
- **Examinations and labs** missed due to an unexcused absence cannot be made up and a grade zero will be given for each one missed.
- Any student requiring **special arrangements** for taking exams, taking-notes and other special arrangements please see or contact the instructor within the first two weeks of class.
- Please refer to the Center for Academic Success for additional academic help related to time management and learning styles (<http://appl003.lsu.edu/slas/cas.nsf/index>). It helps identifying your strengths and weaknesses in learning.

*I am available for questions outside of class.* Please stop by my office if you need my help, even if outside office hours. If I am busy and do not have time to meet with you, I will tell you and we can schedule a meeting at another time. If you have trouble finding me, or our schedules do not coincide, you can make an appointment by either Email ([dboldor@agcenter.lsu.edu](mailto:dboldor@agcenter.lsu.edu)) or Phone. If we make an appointment and you cannot attend, please call and cancel as soon as you can.

#### **Academic Integrity and Academic Misconduct**

Students are expected to comply with the Code of Student Conduct at all times throughout this course. For your information, the Code of Student Conduct can be found at

[http://appl003.lsu.edu/slas/dos.nsf/\\$Content/Code+of+Conduct?OpenDocument](http://appl003.lsu.edu/slas/dos.nsf/$Content/Code+of+Conduct?OpenDocument)

**Grading policy:** Grades will be determined based on the following break down:

Exam 1	5 % (A1)
Mid-Term	20 % (A2)
Final exam	30 % (A3)
Homework	15 % (A4)
Lab Reports	15 % (A5)
Individual Paper review	5 % (A6)
Design Project Report and presentation	10 % (A7)

To calculate your grade:  $Grade = A1*0.05 + A2*0.20 + A3*0.30 + A4*0.15 + A5*0.15 + A6*0.05 + A7*0.10$

#### **Grade Assignments:**

A:	> 90	B:	80-89.9	F:	< 60
C:	70-79.9	D:	60-69.9		

#### **Topics:**

1. Mathematical review (1 lecture): mathematical formulas and equations useful in this course
2. Geometrical properties (3 lectures): Size, shape, size distribution, volume, density, porosity.
3. Thermal properties (4 lectures): Fourier's law, thermal conductivity, thermal diffusivity, specific heat, enthalpy and latent heat
4. Radiation/Electromagnetic properties (5 lectures): Interaction of electromagnetic waves with materials, color properties, dielectric properties, emissivity, radiation, applications
5. Ultrasonic properties (1 lecture): Ultrasounds interaction with biological materials, sonograms

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6. Rheological/deformation properties (5 lectures): Deformation of material, viscoelastic behavior, mechanical models, flow of material, viscosity
7. Water-related properties (3 lectures): Moisture content, colligative properties, water activity, moisture isotherms, psychrometrics.
8. Surface properties (2 lectures): Surface tension, Laplace equation, colloidal systems

### LECTURE SCHEDULE (tentative):

Week of		Topic
August	25	Introduction (1 lecture), Mathematical background (1 lecture) <b>Lab 1 - Safety Monday only</b>
September	1	<b>LABOR DAY - NO LAB THIS WEEK, no class on Monday</b>
	3	Exam 1 (Mathematical background and pre-requisites)
	8	Geometrical properties (2 lectures) <b>Lab 2 - Geometrical properties</b>
	15	Geometrical properties (1 lecture); Thermal properties (1 lectures) <b>Lab 3 - Thermal properties 1</b>
	22	Thermal properties (2 lectures) <b>Lab 4 - Thermal properties 2</b>
	29	Thermal properties (1 lectures), Radiation properties (1 lecture) <b>Lab 5 - Radiation properties</b>
October	6	Radiation properties (1 lectures), Review for Mid-Term Exam Critical paper review due October 8 <sup>th</sup>
	9-10	<b>NO LAB - FALL HOLIDAY</b>
	13	MID-TERM EXAM, Electromagnetic properties (1 lecture) Design Topic to be approved by October 15 <sup>th</sup> . <b>Lab 6 - Electromagnetic properties 1</b>
	20	Electromagnetic properties (2 lectures) <b>Lab 7 - Electromagnetic properties 2</b>
	27	Ultrasonic properties (1 lecture), Rheological properties (1 lecture) <b>Lab 8 - Rheological properties 1</b>
November	3	Rheological properties (2 lectures) <b>Lab 9 - Rheological properties 2</b>
	10	Rheological properties (2 lectures) <b>Lab 10 - Rheological properties 3</b>
	17	Water properties (2 lectures) <b>Lab 11 - Dehydration and psychrometrics</b>
	23	Psychrometrics (1 lecture), Surface properties (1 lecture)
	26-27	<b>THANKSGIVING - NO LAB</b>
December	1	Surface properties (1 lecture), Review for Final <b>Lab 12 - problem review session</b>
	10	<b>5:30 - 7:30 PM FINAL (ON WEDNESDAY)</b>