BE 4303: Engineering Properties of Biological Materials
Fall 2010 Syllabus
Louisiana State University

Meeting Schedule: Lecture: 12:40-1:30 pm Monday/Wednesday, 215 Tureaud Hall
Lab: M (Session I) or Th (Session II) 1:40-4:30, 140 Ag Metal Bldg.

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

Pre-requisite: MATH 2065

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

Teaching Assistant: TBA — 101 EB Doran Bldg.
E-mail: — Office Hours: TBA

THIS COURSE INCLUDES A SERVICE-LEARNING COMPONENT (see Service-Learning Design Project Activities)

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 and engineering properties (geometrical, thermal, electromagnetic, ultrasonic, moisture-related 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.)
7. Learn to function in multidisciplinary teams addressing contemporary issues in engineering-related properties of biological materials, with an understanding of the professional and ethical responsibility when communicating and collaborating with outside community partners (ABET Objectives d., f., g., j.)
8. Reflect on the learning experience provided in the service-learning component of the course, and understand the need for life-long learning and the impact engineering practice and solutions have on the society (ABET Objectives h., i.)

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.

Service-Learning Design Project Activities, Expectations, Policies, and Evaluation

THIS COURSE INCLUDES A SERVICE-LEARNING COMPONENT: Service-Learning is an experience in which students participate in a service activity that meets community needs and reflect on the service activity to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility. The rationale behind this S-L design project is to relate the course content to the way elementary school students understand these engineering and scientific concepts. By having to teaching to elementary school students, you will have to break it down and reduce it to the appropriate level of comprehension. Through this exercise you will be able to enhance your own understanding of the course materials.

- Semester Design Project: Students will be divided into random groups of four according to laboratory sections, and each group will design, develop, and present a teaching module to be used in K-12 science education (target grades 4^{th} and 5^{th}) related to engineering properties of biological materials (i.e. thermal, electromagnetic, ultrasonic, rhelogical etc.). The modules will include lecture materials, problems/solved problems, and a laboratory exercise. The topic must be approved by September 1^{st}, 2010. You are expected to complete all design assignments (with the exception of the final presentations) by November 16^{th}.
- Each group will be provided with the course materials (lecture notes, presentations, problems, and lab handouts) covering their respective topics immediately after the projects are assigned.
- Our community partner is the LSU Laboratory School. (contact: Natalie Jadid, Danielle Blackwood)
- Each group is expected to visit our community partner at least five times during the semester (official laboratory times are set aside for these tasks. You might have to set aside additional times for visits). You should be adequately prepared for each visit with questions, materials, and other items as needed, and the meeting times will be arranged directly with the teacher. The following order of visits is recommended, but it can be adjusted:
  1. Initial visit to introduce yourself to the teacher who will be working with you
  2. Second visit to observe their teaching methods, observe their class environment, and interaction between students and teachers
  3. Third visit to discuss the materials prepared with the teacher, account for their observations, and revise the materials accordingly.
  4. Fourth visit with the teacher to discuss the revised materials and settle on a suitable date in which the materials will be presented to the 4^{th} and 5^{th} grades.
  5. A set of visits to perform the teaching duties as discussed with the teachers. These may include teaching the lectures, assisting with the hands-on activities, and assisting groups of students with their problem solving skills. Each group will have to perform the teaching activities four times with the four different classes at the same grade level.
  6. Other visits as needed.
- Some of the laboratory time will be dedicated to work on the project
- Grading of the service-learning project will be based on combining your presentations (25%), reports (including reflective components – your own learning outcomes) (25%) with my evaluation (25%) and with those within each group (25%)
- The individual reflective components will include a preliminary two page report after the third visit and a three page final report. Additional instructions will be posted on Moodle.
- Grading rubrics for group evaluations will be provided (examples include participation, professionalism, punctuality, etc.)

Course Policies

- 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. You will be graded not only on the results, but also on style (you do get style points for well organized homework). Same is true for laboratory reports.
- **Exams** will be closed book, but divided into two sections: theory and problems. Each student will be allowed a single page, handwritten with equations. As you are currently learning to think on your own feet, the exam problems will not necessarily be carbon copies of homework and example problems. NO CELLPHONES, IPODS, IPADS, LAPTOPS, or any other electronic devices are allowed at any time. All calculators will be handed to the instructor or proctor until the theory portion of the exam is turned in, at which time the calculator can be retrieved and used for the problems section.
- **Examinations** and **labs** missed due to an unexcused absence cannot be made up and a grade of zero will be given for each one missed.
- Any student requiring **special arrangements** for taking exams, taking-notes and other special needs 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) 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

Grading policy: Grades will be determined based on the following breakdown:

Exam 1	5 % (A1)
Mid-Term	20 % (A2)
Final exam	30 % (A3)
Homework (both content and presentation – writing skills)	10 % (A4)
Lab Reports (both content and presentation – writing skills)	10 % (A5)
S-L Design Project Performance, Report and Presentation (writing, speaking, communication)	25% (A6)

To calculate your grade: Grade = A1*0.05 + A2*0.15 + A3*0.30 + A4*0.10 + A5*0.10 + A6*0.25

Grade Assignments:

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

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
6. Rheological/deformation properties (6 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.

LECTURE SCHEDULE (tentative):

Week of		Topic
August	23	Introduction (1 lecture), Project Introduction (1 lecture)
		Lab 1 - Safety and Mathematical background
August	30	Exam 1 (Mathematical background and pre-requisites), Geometrical properties (1 lecture)
		Lab 2 - Project introduction, meetings with community partner
September	***6***	***LABOR DAY - NO LAB THIS WEEK, no class on Monday (work on design)***
		Geometrical properties (1 lecture)
	13	Geometrical properties (1 lecture), Thermal properties (1 lecture)
		Lab 3 – Geometrical properties
	20	Thermal properties (2 lectures)
		Lab 4 – Project preparation
	27	Thermal properties (1 lecture), Radiation properties (1 lecture)
		S-L Preliminary reports due
October	4	Radiation properties (1 lecture), Review for Mid-Term Exam
		Lab 5 - Thermal properties and Radiation properties
	11	MID-TERM EXAM, Electromagnetic properties (1 lecture)
		Lab 6 – Project Preparation
	18	Electromagnetic properties (2 lectures)
	21-22	***NO LAB - FALL HOLIDAY (work on projects)***
	25	Ultrasonic properties (1 lecture), Rheological properties (1 lecture)
		Lab 7 – Electromagnetic properties, ultrasonic properties
	2	Rheological properties (2 lectures)
November		***Lab 8 – Project preparation***
	9	Rheological properties (2 lectures)
		Lab 9 - Rheological properties
		S-L Design reports due
	16	Rheological properties (1 lecture) Water properties (1 lectures),
		Lab 10 - Dehydration and psychrometrics
	22	Psychrometrics (1 lecture)
	24-26	***THANKSGIVING – NO CLASS ON WEDNESDAY (lab work on projects)***
	29	Problem session, Review for Final
		Lab 11 –Design Presentations
December	***9***	***12:30 – 2:30 PM FINAL (ON Thursday)***