BE 4303: Engineering Properties of Biological Materials
Fall 2015 Syllabus, Louisiana State University

Meeting Schedule: Lecture: 9:30-10:20 am Tuesday/Thursday, 218 Tureaud Hall
Lab: M (Session I) or T (Session II) 1:30-4:20, 140 Ag Metal Bldg.
Textbook: Sahin S. and Sumnu, S.G. Physical Properties of Foods. Springer, New York, NY, 2006. (available on-line from LSU Libraries)
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: 9:30 – 10:30 am Th: 10:30 – 11:30 am (or by appointment)

Teaching Assistants:
Mohamad Barekati (mbarek@tigers.lsu.edu) 101 Ag Metals Bldg. Office Hours: TH: 10 – 12 pm

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

This is a certified Communication-Intensive (C-I) course which meets all of the requirements set forth by LSU's Communication across the Curriculum program, including:
1. Instruction and assignments emphasizing informal and formal [mode 1] and [mode 2];
2. Teaching of discipline-specific communication techniques;
3. Use of draft-feedback-revision process for learning;
4. Practice of ethical and professional work standards;
5. 40% of the course grade rooted in communication-based work; and
6. A student/faculty ratio no greater than 35:1.

Students interested in pursuing the LSU Distinguished Communicators certification may use this C-I course for credit. For more information about this student recognition program, visit www.cxc.lsu.edu.

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 (dimensional, 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. All assignments will have to be turned in or submitted via Moodle.

Course time involvements
This is a 3-credit hour course (2 x 50 minute lectures and 1 x 2 hours and 50 minutes lab). According to current federal regulations, for each credit hour earned, the students are expected to spend at least 2 hours outside the formal class meetings, performing academic work related to the course content. This work can include, but is not limited to, homework assignments, reading and writing assignments, project-related work, laboratory reporting and writing assignments, visits to community partner (see Service-Learning policies outline below), and other necessary work required to accomplish the course's learning objectives.

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 4-5 students 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 4th and 5th) related to engineering properties of biological materials (i.e. thermal, electromagnetic, rheological etc.). The modules will include lecture materials, problems/solved problems, and a laboratory exercise. The topic must be approved by September 8th, 2015. You are expected to complete all design assignments (with the exception of the final presentations) by November 24th. *In each team, a group leader will be selected* (either by self choice, voting, or by random selection). *The group leader will receive a ±25% bonus on his project grade*, depending on the group's performance (if the group performs well in all activities, the "+" is counted; if the group performs poorly in all activities, the "–" is counted).
- 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: Dawn Skiles – dskiles@lsu.edu , Dianne Moran – dmoran@lsu.edu , Danielle Blackwood – dblack@lsu.edu)
- Each group is expected to visit our community partner at least five-six 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 4th and 5th 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. The groups may be split in half to share the teaching load (i.e. half of the group teaches two of the classes, the other half the other two classes, but some people in each group should participate in both to provide continuity).
6. A close-out visit to celebrate with our pupils (we usually have an ice cream social during one of their breaks)
7. 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, reports (including individual reflective components – your own learning outcomes – 1 page per individual in the report, in addition to the group report) with my evaluation [my evaluation will include a 360-evaluation of all groups, including that of your own peers in the same group and in the class, and in concordance with input from community partner teachers]. Grade breakdown is on the next page.
- There will be three written documents due as follows:
  - An outline of the project for each group will be due by September 8th. The outline will be submitted on Moodle, and will include an evaluation from each group members about the performance of the other group members. Grading rubrics are provided on Moodle.
  - A preliminary four (4) page group report after the third visit plus an additional page per individual for self reflection. Each group will create a collaborative document (via Google Docs, Dropbox, etc.) to work on the group reports. This report will also come with an evaluation from each group member on the performance of everybody else. This report will be turned in via TurnItIn on Moodle, and the evaluation of member performance will be turned in via Moodle.
  - A six (6) page final report (plus an additional one page per individual self reflection). The final six page report will include revisions of the 4 page preliminary report, plus a two page addition with information related to delivery of the information. This report will be also turned in via TurnItIn on Moodle.
  - The outlines and preliminary reports will be made available for review by your peers on-line (without the individual self-reflections). The reviews will be anonymous.
- Grading rubrics for group evaluations will be provided (examples include participation, professionalism, punctuality, etc.)

Course Policies

- All homework assignments will be turned in electronically via Moodle in PDF Document format. *Handwritten assignments can be scanned as high-resolution images and imported as PDF*. 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.
- All class notes and traditional Power Point presentations used in class (with a few exceptions) are provided on Moodle. ***The students are expected to read them ahead of time and be prepared at the time of the class.***
- Class time will be devoted, for the most part, to discussing specific case studies. In general, the instructor will discuss a case study, followed by assignments of other case studies that student groups are expected to discuss and come up with solutions. These discussions and solutions are to be summarized and submitted in PDF format at the end of the class via a Moodle assignment.
- Lab reports are to be turned in via TurnItIn on Moodle.
- **Exams** will be closed book, but divided into two sections: theory and problems. Each student will be allowed a single page, handwritten with equations for the problems section of the exam. 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. The writing intensive assignments (project and lab reports) the assignments will be turned in electronically via TurnItIn to assist you with the submission process. 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 point breakdown:

Mid-term	225
Final	325
Homework (both content and presentation – writing skills)	100
Lab Reports (both content and presentation – writing skills)	100
Course participation	20
S-L Design Project Group Report	100
S-L Design Project Individual Self-Reflective Statement	50
S-L Design Project Presentation in Class	30
S-L Design Project Evaluation in concordance with teachers/community partner	20
S-L Design group performance evaluation, including in-group evaluation	30
Total:	1000

Note: ALL project related activities include the CxC components (writing, speaking, communication)

Grade Assignments:

97% ≤ A+ ≤ 100%	93% ≤ A < 97%	90% ≤ A- < 93%
87% ≤ B+ < 90%	83% ≤ B < 87%	80% ≤ B- < 83%
77% ≤ C+ < 80%	73% ≤ C < 77%	70% ≤ C- < 73%
67% ≤ D+ < 70%	63% ≤ D < 67%	60% ≤ D- < 63%
F: < 60%		

Topics:

1. Mathematical review (1 lecture): mathematical formulas and equations useful in this course
2. Dimensional 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 (2 lectures): Moisture content, colligative properties, water activity, moisture isotherms, psychrometrics.

LECTURE SCHEDULE (tentative):

Week of		Topic
August	24	Introduction/math & pre-requisites review (1 lecture), Project introductions (1 lecture) ***Lab 1 - Safety and project introduction***
	31	Math/pre-requisites review (1 lecture), Dimensional properties (1 lecture) ***Lab 2 - Meetings with community partner***
September	7	Dimensional properties (2 lectures) ***LABOR DAY - NO LAB THIS WEEK, (work on design project) (Project outline due)***
	14	Thermal properties (2 lectures) ***Lab 3 – Geometrical/Dimensional properties***
	21	Thermal properties (2 lectures), ***Lab 4 – Project preparation***
	28	EM – Remote Sensing (1 lecture), Electromagnetic properties (1 lecture) ***Lab 5 - Thermal Properties,*** S-L Preliminary reports due
	5	Radiation properties (2 lectures) ***Lab 7 - Project preparation***
October	12	Review for Mid-Term Exam, Midterm ***Lab 6 – Electromagnetic properties (Remote sensing)***
	19	Electromagnetic properties (1 lectures) , Ultrasonic properties (1 lecture), ***Lab 8 – Project preparation***
	26	Rheological properties (1 lectures), NO LECTURE THURSDAY (fall break) ***Lab 9 – Project Preparation***
	2	Rheological properties (2 lectures) ***Lab 10 – Electromagnetic (Absorption, Dielectric, Emissivity) properties***
November	9	Rheological properties (2 lectures) ***Lab 11 – (probable social visit to Lab School,) Design Presentations,***
	16	Water properties (1 lectures), Psychrometrics (1 lecture) ***Lab 12 - Rheological properties (Tension, compression, creep test, TPA, flow)***
	23	Water properties (1 lecture), NO CLASS ON THURSDAY (Thanksgiving Holiday) ***Lab 13 – Dehydration and psychrometrics, S-L Design reports due***
	30	Dec 1st: Review for final, Dec 3rd: TBA ***Lab 14 – S-L design reports returned for revisions***
December	***12***	***10:00 AM – 12:00 PM FINAL (ON SATURDAY, DECEMBER 12)*** Revised final design reports due.