**ABE 201: Thermodynamics in Biological Systems I**

**Fall 2016**

**Lectures:** M, W, F from 1:30pm - 2:20pm

Lyles-Porter Hall 1160

**Recitation:** M from 2:30-3:20pm

Discovery Learning Research Center (DLR) room 131

**Lab:** M from 3:30-5:20pm

Discovery Learning Research Center (DLR) room 131

**Instructor:** Dr. Nathan S. Mosier

**Office Hours:** by appointment

POTR 220

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**Graduate TA:** Yuan Lyu

**Office Hours:** Wednesdays and Thursdays 2:30-3:20pm, TBD

lv10@purdue.edu

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| **Undergrad**  **Teaching**  **Assistants** | Sarah Reeves  Lydia Furrow  Ashton Tipton | sreaves@purdue.edu  lfurrow@purdue.edu  tiptonw@purdue.edu |

**Description**

Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production.

**Textbook and/or other required material**

Thermodynamics in Biological Systems I Course Handouts (Available through Blackboard)

### **Felder, Richard M. and Rousseau, Ronald W. *Elementary Principles of Chemical Processes*. John Wiley & Sons ISBN 0-471-53478-1**

StrengthsFinder 2.0 by Tom Rath ISBN: 978-1-59562-015-6

**Lecture Learning Objectives:**

Successful completion of this thermodynamics in biological systems course will enable students to:

1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems (PO 2, 4, 5) (a, c, b)

2. Develop mass and energy balances for systems with and without biochemical reactions for in vivo and in vitro biological systems (PO 2, 4, 5, 6) (a, c, b, k)

3. Characterize the properties of solids, liquids, and gases common to biological systems (PO 1, 2) (l, a)

4. Estimate gas/vapor properties using gas laws (PO 1, 2, 4) (l, a, c)

5. Understanding the relationships between psychrometric properties such as temperature, and humidity (PO 1, 2, 4) (l, a, c,)

6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems (PO 1,2, 3) (l, a, e)

7. Use models to predict the physical behavior of materials at equilibrium in multicomponent, multiphase systems (PO 1,2, 4, 6) (l, a, c, k)

8. identify new products/processes in biological engineering (PO 8) (j)

9. Develop engineering analysis and designs for bioprocesses or bioproducts using material and energy balances and constraints and present findings in oral and written form (PO 4, 5, 6, 7, 9) (c, b, k, h, g)

**Reading Assignments:** Reading assignments (textbook and class notes) and videos for core concepts are provided on Blackboard. You are expected to watch the video and complete the quiz for each module before the class period where discussion of the topic begins. The videos posted on Blackboard as well as the relevant sections of the textbook will prepare you for the quiz and the class discussion/work.

**Blackboard and Email:** All assignments will be posted on Blackboard! It is **your**responsibility to regularly check the ABE 20100 Blackboard website. The instructor will also announce assignments and other important information (course news, special events, internship opportunities, etc.). In addition, the syllabus, reading and homework assignments, review materials, Excel, Matlab, Mathcad, and other course files are available on **Blackboard**. The website will be updated regularly throughout the semester

**Homework:** The homework is **DUE** on the date listed at the **BEGINNING** of class. Late homework will be accepted until that assignment is graded and returned. Late assignments will receive a maximum grade of 50%.

Use engineering paper, one side each page; begin each problem on a new page; place final answer(s) in a box.

Homework solutions will NOT be posted. It is your responsibility to make sure you find out how to solve the problems before, or after, they are due.

**Lab Projects:** The lab is being taught through the use of projects to integrate hands on practical skills with your engineering principles. Therefore, the projects make up the majority of the lab grade. Smaller assignments that build toward your final project reports will be given on a weekly basis and will be turned in as a team. Projects will be graded based on team performance, but you will have the opportunity to evaluate your team after each assignment. Individual grades will be adjusted based on team evaluations. Your teammates can become a blessing or a curse. It is our hope that through this course you can learn team development strategies to make your team the best it can be. The instructor, TAs, and peer mentors are available to help your team be successful. Don't be afraid to ask for help!

**Class Attendance:** You are expected to attend all class lectures. You will be held responsible for all information from the reading assignments, lectures, e-mail, etc., regardless of attendance. If you have some extenuating circumstance, see the instructor as soon as possible prior to the absence.

**Exams:** There will be 3 midterm exams during the semester, plus a comprehensive final exam. *All tests will be open-book, open-notes.* You will have one week after your graded exams have been returned to contest any points lost due to instructor error or other valid reasons.

**Missed Tests:** If you miss a test or final exam without either a certified medical excuse or prior instructor approval, you will receive a zero on that test or final exam. Tests missed with approval will be dealt with on a case-by-case basis.

**Grading Policy:** Grades will be assigned based on the total number of points you earn over the course of the semester.

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| --- | --- |
| Exam 1 | 100 pts |
| Exam 2 | 100 pts |
| Exam 3 | 100 pts |
| Final Exam | 200 pts |
| Quizes | 160 pts |
| Homeworks | 320 pts (approximate, subject to change) |
| Lab Project 1 | 150 pts |
| Lab Project 2 | 250 pts |
| Other Lab Assignments | 50 pts (approximate, subject to change) |
| **Total** | **1430 pts** |

The total homework and lab assignment points are subject to the number of assignments given and point totals possible, which may change as the semester progresses. You can find out how many points you have earned out of the total possible as the semester progresses by checking your gradebook on Blackboard.

The course grading scale (approximate):

% of Total Possible Points

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

This course is not graded on a curve. So, theoretically everyone could get an A (or an F). Your performance only depends on you (and your team). Therefore it is in your best interest to help your classmates in every **academically ethical** way possible.

Grade will be posted on Blackboard as soon as assignments are graded. Your current points total is also available. If you notice any discrepancy between your Blackboard grade and the grade written on your returned assignment, please let me know right away.

**In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Here are ways to get information about changes in this course:**

Course web page : <https://mycourses.purdue.edu/>

Instructor's email mosiern@purdue.edu

Instructor's phone 765-494-7022

**Academic Honesty:** My definition of working together includes showing each other how to solve a problem, and checking each other's work for mistakes. However, all work that you submit under your name should be the result of your efforts. If you copy someone else's work and put your name on it, you are being dishonest. Anything that appears with your name on it must reflect your own work. I expect honesty from all my students. Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor’s discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

Students who witness academic dishonesty report them to the instructor or to the

Office of the Dean of Students (<http://purdue.edu/odos>) by phone (765-494-

8778) or email (integrity@purdue.edu).

**Instructor's Commitment:** You can expect your instructor to be courteous, respectful, and punctual; be prepared for class; answer questions clearly and in a positive fashion; be available for office hours or notify you in advance if unable to keep them; provide notice and a suitable substitute lecturer when traveling for the University; and grade uniformly and consistently according to the guidelines described.

You are encouraged to contact me in person, via phone, text or email for help of any kind during the semester.