Biomolecular Thermodynamics and Kinetics

BME 4621 Section 18054
Class Periods: MWF, 1:55-2:45, 7th period
Location: LAR 0310
Academic Term: FALL 2025

Instructor:
Gregory A. Hudalla
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352-273-9326
Office Hours: Monday & Wednesday 12:45-1:45 PM BMS J296

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Joseph Tsenum, josephtsenum@ufl.edu

Course Description
Principles of thermodynamics and kinetics from a biomolecular perspective. The mathematics, analysis, and applications of classical thermodynamics, statistical thermodynamics, and reaction kinetics will be introduced in the context of molecular interactions, binding equilibria, metabolism, and biomolecular transport common to living systems.

Course Pre-Requisites / Co-Requisites
BME 3060, BME 4311

Course Objectives

- Develop basic knowledge of classical thermodynamics, equilibrium, and reaction kinetics.
- Develop an understanding of the application of statistical thermodynamics to biomolecule behavior and interactions.
- Develop a competence in the fundamental analytical and computational tools used to describe energy transformation within living systems.

Materials and Supply Fees
None

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	High, emphasized
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	
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 environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

Title: Biomolecular Thermodynamics: From Theory to Application
Author: Barrick, Douglas
Publication date and Edition: 2017, 1st edition; CRC Press
ISBN: 978-1-4398-0019-5

Recommended Materials

Title: *Biological Thermodynamics*
Author: Haynie, Donald T.
Publication date and edition: 2008, 2rd edition; Cambridge
ISBN number: 978-0-5217-1134-0

Title: *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology*.
Author: Dill, Ken A., and Bromberg, S.
Publication date: 2002, Routledge
ISBN: 978-0-8153-2051-7.

Title: *Biochemical Engineering Fundamentals*
Author: Bailey, James E., and Ollis, David F.
Publication date: 1986, 2rd edition, McGraw-Hill
ISBN: 978-0-0706-6601-6

Required Computer

Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Schedule

Week	Topic
	PART 1
1	Overview of energy transformation in living systems
2	First law of thermodynamics – Barrick 3
3	Second law of thermodynamics – Barrick 4
4	Gibbs Free Energy – Theory I – Barrick 5
5	Gibbs Free Energy – Theory II
6	Gibbs Free Energy – Applications I
7	Gibbs Free Energy – Applications II
	PART 2
8	Statistical Thermodynamics - Theory – Barrick 8, 9
9	Statistical Thermodynamics - Application
10	Binding Equilibria – Barrick 13, 14
11	Cooperativity/Allostery
12	Reaction kinetics - Theory
13	Reaction kinetics – Modeling I
14	Reaction kinetics – Modeling II
15	Biology, complexity, and evolution

Evaluation of Grades

Assignment	**Total Points**	**Percentage of Final Grade**
Homework Sets (6)	20 each	40%
Exams (3)	60 each	60%
	300	100%

Assessment dates:

Problem sets (due Wednesdays by midnight via Canvas): Sept 3, Sept 17, Oct 8, Oct 29, Nov 19, Dec 3

Exams (Fridays, in class, via Canvas)**:** Sept 26, Nov 7, Dec 12

Grading Policy

Percent	**Grade**	**Grade Points**
94 - 100	A	4.00
90.0 - 93.99	A-	3.67
87 - 89.99	B+	3.33
83 - 86.99	B	3.00
80 – 82.99	B-	2.67
77 - 79.99	C+	2.33
73- 76.99	C	2.00
70 – 72.99	C-	1.67
67 - 69.99	D+	1.33
63 - 66.99	D	1.00
60 – 62.99	D-	0.67
0 - 59.99	E	0.00

Academic Policies & Resources
To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:
• Your academic advisor or Undergraduate Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu