

Time & Place: Tuesday & Thursday, 10:40am – 12:30pm

Room: STAT 0333

Instructor: Xiang-qiang (Rosie) Chu, Assistant Professor, Department of Physics and Astronomy

Office hours: stop-by my office (Room 212 Physics Building) or make an appointment (recommend)

Telephone: 313-577-8962

E-mail: chux@wayne.edu

Textbook: Philip Nelson: Biological Physics (Updated First Edition), ISBN 0-7167-9897-2

Key Goal for Biological physics: Biological physics deals with fundamental physical principles at the center of life's processes. In this course, we will concentrate on the physics of molecular dynamics through cellular processes. This course covers many concepts used in biological systems, including thermodynamics, electro-dynamics, kinetics, and statistical mechanics. Thus, in addition to learning about the physics of life, this course will also serve as an introduction to these important areas of physics. We will also learn mathematical techniques in this course, as needed. Studying from real research paper and present what students learn, we will integrate knowledge from the book and combine with real world what is happening.

Level of course:

This course is a senior level undergraduate course. As such, we will learn how to analyze complex physical situations and use modestly advanced calculus. Students need to be aware **this is not an easy course**. A high level of attention and dedication is expected from students who want to achieve a grade of A. Understanding the course material will be assisted by weekly problem solving sessions, as well as quizzes and regular homework assignments.

Assignment: total 110 points

Attendance 10 pts: will be taken every class

Homework 20 pts: will be given weekly. Students will present their homework solutions during our weekly problems solving session. Problem/solving of homework is held on (usually) Thursday.

Problem solving 15 pts: Handing in a problem for homework, but not understanding the solution, will result in a loss of points for both the problem solving session and the handed-in homework. Problem solving will be graded on an honest effort basis, not on the absolute correctness of the solution presented. It is important to demonstrate you have spent time and effort to think about the problem and *can explain* how you arrived at your solution. Therefore, do **not** copy solutions from others. Instead, if you need help, discuss problems with your fellow students or with me.

Review Exam 5 pts: is based on material from the textbook already covered in PHY 4700. These previously covered topics are needed to understand the more advanced chapters in the book.

Mid-term Exam 20 pts (2x10 pts): will be 1 hour each

Final Exam 40 pts: 2 hours

Grading: The overall course grade will be determined on the basis of the following table:

Grade	Cumulated score	Grade	Cumulated score	Grade	Cumulated score
A	91 – 100	B-	70 – 74	D+	50 – 54
A-	85 – 90	C+	65 – 69	D	45 - 49
B+	80 – 84	C	60 – 64	D-	40 - 44
B	75 - 79	C-	55 - 59	F	0 – 39

Week	Date	Day	Topics	Read (pages)
1	9/1	Th	Course remark, review problem solving	1 – 154
2	9/6	T	Review problem solving	
	9/8	Th	Review problem solving	
3 HW6	9/13	T	Review Exam (Ch.1 ~5, exclude ch2)	
	9/15	Th	Ch. 6: Entropy, Temperature, and the second law. Reading quiz	196 – 209
4	9/20	T	Ch. 6: Open system, Microscopic system, and Excursion.	210 – 245
	9/22	Th	Problem solving for ch. 6	
5 HW7	9/27	T	Ch. 7: Microscopic view of entropic forces and Osmotic pressure. Reading quiz	246 – 253
	9/29	Th	Ch. 7: Osmotic flow, a repulsive interlude, and properties of water. Problem Solving for ch 7.	254 – 293
6 HW8	10/4	T	Ch. 8: Chemical potential & chemical reactions Reading quiz	294 – 307
	10/6	Th	Ch. 8: Dissociation & self-assembly of amphiphiles	308 – 320
7	10/11	T	Ch. 8: self-assembly in cells	322 – 340
	10/13	Th	Ch. 8: Chemical potential & chemical reactions Problem Solving for ch 8.	294 – 307
8	10/18	T	Mid-exam 1 (Chapter 6, 7 & 8)	
	10/20	Th	Ch. 9: Elasticity and stiffness Reading quiz	341 – 353
9 HW9	10/25	T	Ch. 9: Cooperativity and Thermal switching	358 – 375
	10/27	Th	Ch. 9: Allostery, Problem Solving for ch 8.	376 – 401
10 HW10	11/1	T	Ch. 10: Molecular machine Reading quiz	401 – 421
	11/3	Th	Ch. 10: Mechanical principles	422 – 431
11 HW11	11/8	T	Ch. 10: Kinetics of enzymes	432 – 451
	11/10	Th	Ch. 11: Electroosmotic effects & Ion pumping Reading quiz	469 – 485
12	11/15	T	Ch. 11: Mitochondria as factories Problem Solving for ch 11	486 – 505
	11/17	Th	Summary	
13	11/22	T	Mid-exam 2 (Ch. 9, 10, & 11)	
	11/24	Th	No Class	
14 HW12	11/29	T	Ch. 12: Nerve impulses Reading quiz	506 – 531
	12/1	Th	Ch. 12: Nerve impulses	532 - 556
15	12/6	T	Review Final Exam, Problem Solving for ch 12	
	12/8	Th	Review Final Exam	

Note: presentation will be 20~30 min with 30 min discussion.