

**Biophysical Mechanics: BIOL 4305**  
**Fall 2019 Syllabus**

**Lecture**

**Meeting Times:** 9:00 am-9:50 am MWF **Location:** WSB 321

**Instructor:** Anirban Bhattacharjee

**Office:** WSB317 — **Email:** axb14ku@sulross.edu — **Office Hours:** MWF 10-11 AM W  
**3:30- 5 PM**

**Course Description:**

Biophysics is a course designed to introduce the essentials of Biophysics to undergraduate students. In this class we will explore certain principles of BioPhysics and how these principles apply on both macro and micro level. We are going to divide the class into two sections. First will be going over basic concepts and then exploring how they influence Human Biology. I am going to follow the textbook 'Introduction to Biological Physics for the Health and Life Sciences by Kirsten Franklin, Paul Muir, Terry Scott, Lara Wilcocks, Paul Yates' and provide you with my own notes.

**Resources:****Required:**

Introduction to Biological Physics for the Health and Life Sciences by Kirsten Franklin, Paul Muir, Terry Scott

Loose-leaf paper – for in-class assignments

A simple scientific calculator

**Course Objectives:**

The goals for this class are as follows:

- Appreciate the BioPhysics process, how it works, the notion that principle of physical laws are universal, the elements of scientific theories, what they do and do not tell us.

### Instructional Philosophy of the Course:

The overarching goals of this course are for you to understand the nature of Biology through the eyes of Physics; to understand the big ideas in Biophysics; and to develop a lifelong interest in Physics and current events surrounding Biology. To meet these three goals, the course instructors have carefully designed a sequence of learning tasks and assessment procedures as outlined below.

*-Active engagement with nearly daily group activities.* It is a demonstrated fact that you can only learn a limited amount of information from lecture alone, no matter how clear or entertaining. Therefore, this course is composed of a series of mini-lectures. In order to nurture a collaborative and productive environment, I will insist that **all cell phones, PDAs, blackberrys, etc.** be **turned off** during the class. Communication with the outside world during class will be considered disruptive and disrespectful to the rest of the students (and could also be considered cheating – see **Academic Honesty**). Anyone caught using any of these devices during class will be asked to **leave**.

*-Attendance at all classes is expected and very strongly encouraged.* Because this course is built around daily activities to accompany the lecture, your attendance and full participation at each class period will be an essential component of your success in the course. Periodically we will administer unscheduled questionnaires in class that will be collected during class and used to establish a participation grade. These questionnaires will not be given a letter or numeric grade, rather you will be given credit for what you complete on an all or nothing basis. I will be keeping attendance throughout the course, not necessarily for grading purposes (though good attendance can help you in borderline grade cases) but mostly because it is helpful for me when evaluating myself to know what attendance was like.

*-Carefully studying the text is REQUIRED.* The course mini-lectures are designed to focus on the really difficult aspects of astronomy or to provide structure for your out-of-class study. You are accountable for all material, concepts, and interrelationships presented in the mini-lectures and the text. Therefore, it is imperative to your success in this course that you complete the assigned readings prior to coming to class. Reading assignments should be completed **BEFORE** the date listed. Otherwise, the mini-lectures and tutorials will be less useful in helping you develop a deep understanding of the course topics. It is important to remember that the exams or questionnaires will cover material from the text readings that may or may not be discussed in class.

### Assessment and Grading:

In order to promote an active and collaborative learning environment, there will be no curve to assess grades. Each student will only be competing against themselves, and will be responsible for gaining the declarative knowledge and conceptual understanding for performance. This is a three credit class with three credits in the primary lecture section (§1).

The portion of the grade in the lecture section will come from two sources sources: (1) Final Exam, (2) Homeworks, and (3) Presentation . One final Exam will account for 20% of the final grade.

The exams will test your understanding of key concepts in Biophysics that has been covered over the entire semester. Homework will be 70% of the final grade. Remaining 10 % of the grade will come from a

The final grade will be computed using the scores in the following manner:

		Grading Scheme	
		Total Points	Grade
Total points = 0.10 × (Presentation points)		90–100	A
0.70 × (HW total points)	(1)	80–89.999...	B
+0.20 × (Final Exam points)		70–79.999...	C
		60.–69.999...	D
		<59.9999	F

From the total points, letter grades will be assigned according to the table on the right. There will be no plus or minus grades assigned.

Students with disabilities: If you require any special accommodations to participate in the class or complete assignments, please contact the instructor as soon as possible.

### Academic Honesty:

Academic Dishonesty is defined as:

”The University expects all students to engage in all academic pursuits in a manner that is beyond reproach and to maintain complete honesty and integrity in the academic experiences both in and out of their classroom. The University may initiate disciplinary proceedings against a student accused of any form of academic dishonesty, including but not limited to, cheating on an examination or other academic work, plagiarism, collusion, and the abuse of resource materials. 1. Cheating includes:

- a. Copying from another students test paper, laboratory report, other report, or computer files, data listings, and/or programs, or allowing another student to copy from same.
- b. Using, during a test, materials not authorized by the person giving the test.

- c. Collaborating, without authorization, with another person during an examination or in preparing academic work.
- d. Knowingly, and without authorization, using, buying, selling, stealing, transporting, soliciting, copying, or possessing, in whole or in part, the contents of an unadministered test.
- e. Substituting for another student; permitting any other person, or otherwise assisting any other person to substitute for oneself or for another student in the taking of an examination or test or the preparation of academic work to be submitted for academic credit.
- f. Bribing another person to obtain an unadministered test or information about an unadministered test.
- g. Purchasing, or otherwise acquiring and submitting as ones own work any research paper or other writing assignment prepared by an individual or firm. This section does not apply to the typing of the rough and/or final versions of an assignment by a professional typist.
- h. "Plagiarism" means the appropriation and the unacknowledged incorporation of anothers work or idea in ones own written work offered for credit.
- i. "Collusion" means the unauthorized collaboration with another person in preparing written work offered for credit.
- j. "Abuse of resource materials" means the mutilation, destruction, concealment, theft or alteration of materials provided to assist students in the mastery of course materials.
- k. "Academic work" means the preparation of an essay, dissertation, thesis, report,problem, assignment, or other project that the student submits as a course requirement or for a grade.
- l. "Falsification of Data" means the representation, claim, or use of research, data, statistics, records, files, results, or information that is falsified, fabricated, fraudulently altered, or otherwise misappropriated or misrepresented.

Procedures for discipline due to academic dishonesty shall be the same as in other disciplinary actions, except that all academic dishonesty cases shall be first considered and reviewed by the faculty member. If, after reviewing the case, the faculty member believes that disciplinary action is necessary, he/she may recommend a penalty but must notify the student of his/her right to appeal to the academic department chair and, eventually, to the dean before imposition of the penalty. If the student does not accept the decision of the academic department chair or dean, the student may then follow the normal disciplinary procedures. No disciplinary action shall become effective against the student until the student has received substantive and procedural due process except as provided under Interim Disciplinary Action.

In addition, during the course of the semester, each student will be asked to carry out exercises in collaboration with other students. To nurture such an environment, we will consider any disruptive or disrespectful acts (such talking on a cell phone, or texting during class) to be a form of

cheating. We consider academic dishonesty to be a serious offense and the maximum punishments allowed will be pursued in all scenarios. This includes completing any quizzes, or scantron forms with the help of another student or for scantron forms completed by another student who is not you. If similar work is submitted, all parties involved will receive a zero for their assignment. Make your work your own, be original.

### **ADA Statement**

SRSU is committed to equal access in compliance with the Americans with Disabilities act of 1973. It is the student's responsibility to initiate a request for accessibility services. Student seeking accessibility services must contact ADA coordinator in Counseling and Accessibility Services, Ferguson Hall 112 (432) 837-8203.

## Tentative Schedule of Topics, Assignments, and Exams

Topic/Assignments	
Week 1 – Introductions	
8/28	Introductions,
8/30	Discussion of Syllabus, Day-to-day class structure
9/1	Introduction and Math Review
Week 2 – Introduction	
9/6	Introduction to Biophysics and Physics Review
9/8	Introduction to Biophysics
Week 3 – Building Blocks and Structure.	
9/11	Building Blocks and Structure
9/13	Building Blocks and Structure
9/15	Building Blocks and Structure
Week 4 – Living State Interactions .	
9/18	Forces and Molecular Bonds
9/20	Electric and Thermal Interactions
9/22	Domains of Physics in Biology
Week 5 – Heat Transfer in Biomaterials	
9/25	3.1 Heat Transfer Mechanisms
9/27	Heat Equation
9/29	Joule Heating of Tissue
Week 6 – Living State Thermodynamics	
10/2	First Law of Thermodynamics and Conservation of Energy
10/4	Entropy and the Second Law of Thermodynamics
10/6	Protein Folding and Unfolding
Week 7 – Diffusion and Transport	
10/9	Fick's Laws of Diffusion
10/11	Navier-Stokes Equation
10/13	Active and Passive Membrane Transport
Week 8 – Fluids	
10/16	Bernoulli's Equation
10/18	Venturi Effect
10/20	Capillary Action

Topic/Assignments	
Week 9 – Bioenergetics and Molecular Motors	
10/23	ATP synthesis in Mitochondria Photosynthesis in Chloroplasts
10/25	Light Absorption in Biomolecules
10/27	8.6 Vibrational Spectra of Biomolecules
Week 10 – Passive Electrical Properties of Living Cells	
10/30	Intrinsic Membrane Potentials Induced Membrane Potentials
11/1	Bioimpedance
11/3	Nonlinear Effects
Week 11 – Nerve Conduction	
11/6	Neurotransmitters and Synapses
11/8	Active Transport and the Hodgkin Huxley Equations
11/10	Action Potentials in Earthworm Nerve Fibers
Week 12 –Mechanical Properties of Biomaterials	
11/13	Elastic Moduli
11/15	Electric Stresses in Biological Membranes
11/17	Mechanical Effects of Microgravity during Space Flight height
Week 13 – Biomagnetism	
11/20	Biomagnetic Sources
Nerve Impulses	
Week 14 –Biomagnetism	
11/27	Magnetotactic Bacteria
11/29	SQUID magnetometry
12/1	Magnetocardiography
Week 15 – Life and the Universe	
12/4	Astrobiology and Extremophiles
12/6	Search for Life in and Outside the Solar System
Week 16 –Exam	