



Physics of Life

EFB 200 PHYSICS OF LIFE ONLINE. 3 CREDITS. FALL 2017

Introduction to the Course

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About this course: This course will introduce you to the basic principles of physics, with the aim of helping you better to understand the physics behind the unique phenomenon of life.

This course will fulfill the one-semester physics requirements in most curricula in EFB and in many curricula at ESF. It will *not* fulfill the physics requirements for the physical science disciplines, like chemistry or engineering, or any other course of study, like pre-med or pre-vet, that requires two semesters of physics with laboratory.

No matter what your discipline, this course is intended to complement, not replace, the more traditional physics courses that are on offer at Syracuse University. If you are in a curriculum that requires a more traditional physics course, you might find this course enjoyable for seeing how biologists think about physics. If you are a biologist, once you see the power that an understanding of physics puts in your hands, you might be inspired to learn more!

General structure of the course: Physics of Life has been in the past a lecture-only course. Beginning with this semester, we are beginning to shift toward Physics of Life as an online course. More information on how the course will be run can be found in the document *About Physics of Life 2017*. This document was posted on the announcements and sent out to you as an e-mail message prior to the start of the semester. Please consult this document carefully.

The course is divided into four modules, each of which addresses a fundamental aspect of life from a physical perspective. These modules are:

1. *Thermodynamics.* Life, by its very nature, is a thermodynamic phenomenon. Living systems expend energy to create the highly ordered flows of matter that constitute the organism. To understand life in all its dimensions, including its origin and evolution, this means understanding how the concepts of work and power, energy and entropy apply.
2. *Biomechanics.* Organisms live in a world permeated by forces, whether these be imposed, like gravity, or are self-generated, such as through muscles or locomotion. Organisms must therefore be built from materials that can effectively channel, store and exploit these forces. To understand how organisms are built and how they move

about means understanding concepts of stress and strain, inertia and resistance, and the physics of simple machines.

3. *Fluids*. Most organisms live in fluid environments (air or water). Fluids have both inertia and the unique property of viscosity, and understanding how organisms live in fluid environments means understanding subtle interactions between inertia, viscosity and body size. These interactions means that the fluid world looks very different depending upon the fluid you inhabit, how big you are and how fast you move.
4. *Wave phenomena*. Organisms live in an unsteady world where matter and energy are driven by unpredictable and oscillating forces. These can be electromagnetic, including light, radiant heat, ionizing radiation and the earth's magnetic field. Organisms also generate electricity and use it for everything from nerve communication to defense against enemies. Finally,. it includes mechanical forces, such as the elastic waves that underscore sound, both audible and inaudible, and both natural and generated by living things. Many of the clever things organisms do depends upon being able to exploit this transient-state energy.

Course materials: This is a unique course for which there is no suitable textbook that covers all the topics I wish and in the way that I wish. Therefore, rather than make you shell out precious cash for 3-4 textbooks, we're not going to have any textbooks at all. In lieu of textbooks, there will be what I impart in lectures, supplemented by various types of material, such as video lectures, audio recordings, online resources and so forth. These materials will be available in a variety of forms—even on your smart phone if you want to take a break from incessantly texting your friends and learn some physics! Seriously, these are course materials which you are expected to know, because I will be asking you about them on the exams (see below).

My object in this course is to get you so intrigued by the physics of life that you will want to learn more. Therefore, I have provided in a separate document a list of several books I think are worth getting to know. If you decide to buy them, they can be had for a pittance on Amazon or eBay, certainly a fraction of the cost of 3-4 textbooks at the campus bookstores.

Preparation for this course: There are no prerequisites for this course: I'm a professor and therefore a pedantic blowhard, which means I'll lecture to anybody, on anything. I do expect, however, that you will have done more than sleep through high school, and picked up whatever lessons in chemistry, physics, mathematics and biology that might still be taught there.

On-line facilities: Blackboard is headquarters for this course. News, announcements, links to written, audio and video materials and other fun stuff will be posted there. Check the announcements on Blackboard frequently. I will post reminders about exams and so forth there, and I generally will *not* send e-mail reminders on these matters, so check the announcements frequently.

Evaluation: There will be four examinations through the course, each corresponding to one of the four modules. Examinations are not cumulative. Each examination will be worth 25% of your total score, for a cumulative total of 100%. Examinations will include a variety of questions, including multiple choice, fill-in, short answer, and questions that

involve interpreting or reproducing a diagram. Dates for the exams are available on the course calendar.

Examinations will be administered on-line and will be delivered through Blackboard. Examinations are **closed book individual efforts**. The usual proctored environment will be our regular classroom at a normal day and time of the class, and you will be expected to take the examination there and on the specified date. If there is an absolutely unavoidable conflict, arrangements can be made for an alternate proctored venue, but arrangements must be made by you and approved by me well in advance of the exam. *Ex post facto* arrangements for alternate venues will not be accepted.

There is no service-learning component to this course. There is no option for extra credit either. Your grade depends solely upon your performance on the exams.

At the end of the semester, you will be assigned a grade of A, B, C, D or F. Please be advised that I do not assign (+) or (-) modifiers to my grades.

Academic integrity: You are not allowed to consult notes or other materials or aids when taking examinations, nor are you allowed to share your answers with your fellow students. The ESF Code of Student Conduct and ESF's policies on Academic Integrity apply strictly to examinations.

Tips for doing well: Study the material, get into a study group, talk about it with your friends or with me, recopy your notes, write out questions to ask your friends or me, use flash cards. Students who do those things generally will do better on the examinations than those who do not. And as an extra bonus, you will have learned some physics, therefore getting what you are paying tuition for.

Anything discussed in lecture or in any of the media products related to the class are fair game for the examinations. This saves you the embarrassment of asking the silly question whether a particular item will be on the exam, because the answer will always be "maybe yes, maybe no".

Course mascot: Bender from *Futurama* is the official course mascot, just because I like his ne'er do well airs and cavalier attitude toward authority. Also because he's a robot. He serves in this capacity with the generous permission of Comedy Central (pending).

Legalese and small print I have to mention: Please take note of these policies, which I have to spell out and of which you have to make yourself aware.

- *Again about the grades, just so it's clear:* At the end of the semester, you will be assigned a grade of A, B, C, D or F. I do not assign (+) or (-) modifiers to my grades.
- *Taking the course again:* Probably not a good idea. In fact, probably a waste of everyone's time and money. Far better to do the hard work to get it right the first time.
- *Special accommodations:* For examinations, we will routinely offer a quiet room on campus where the examination can be taken, if that is the student's wish. For students with the need for extra time for examinations, ample time is already built into the time window for both the on-line examinations. We strive to have notes and audio recordings of the lectures available on-line. Requests for special accommodations beyond these needs must be made through the Office of Student Life.
- *Attendance:* I don't take it. You will not be rewarded for good attendance: showing up is not an achievement. Nor will you be penalized for not coming to lecture: it might be foolish not to come to lecture, but it's your money, and I get paid either way.
- *Extra credit:* Don't ask, there won't be any.

- *Service learning:* Ditto. You're here to learn physics. Planting trees in parks is not physics.
- *Online academic integrity:* Collusion and consulting outside materials during exams is a serious violation of ESF's Code of Student Conduct and ESF's policies on Academic Integrity and is **strictly forbidden**. These policies may be found at <http://www.esf.edu/students/handbook/>. All students are expected to be familiar with these policies and to adhere to them. If you're not familiar with them, take a second look. ESF also adheres to the honor system for sustaining ESF's climate of academic integrity. This means that students bear the same responsibility for sustaining a climate of academic integrity as do faculty. If you witness your fellow students engaged in behavior that violates academic integrity, you are obliged to help stop it or to bring it to my attention. This is as true in the age of the Cloud as it was for the age of paper. Sharing information or consulting notes on line during exams is as much cheating as looking at the book, or passing notes to classmates, or looking over another student's shoulders, and is every bit as serious a violation of academic integrity. If we discover that you have violated these policies, you will, at minimum, be assigned a grade of zero for the exam where you have been caught cheating. I may also assign you a failing grade for the course. What to do about cheating in my class is my decision. If you don't like it, tell it to the judge.
- *Missed examinations:* Don't miss them. There will be no make-up exams. If you miss an examination, a score of zero will be entered for the missed exam. Again, this can be waived if the circumstances are truly exceptional (see below). The dates for the examinations are posted well in advance, and it is your responsibility to plan your semester accordingly.
- *Excused absences:* Exceptions for missed examinations can be made, but the circumstances must be exceptional. "Exceptional circumstances" are those beyond your control that involve you being physically unable to take the exam. Inconvenience is not an exceptional circumstance. Because examinations are on-line, absence from campus is not an exceptional circumstance. You have to convince the Office of Student Life, not me, that your circumstances are indeed exceptional. If you manage to do this, your final score will be pro-rated from the other examinations and the zero score on the missed exam will not count against you.
- *Technical issues during exams:*
 1. *Blackboard glitches:* Blackboard will sometimes close you out of an exam before you have finished. If that arises during an exam, *notify us immediately* of the problem, so corrective action can be taken immediately. That way, you can complete the examination in a timely way.
 2. *Power issues:* Examinations will be given in a room with limited access to power points. We will not supply extension cords. If your laptop battery is dead, access to a plug cannot be guaranteed. If you don't want to be in a world of hurt, be sure your laptop battery is fully charged so you can keep your laptop running during the exam. If your laptop battery dies and you can't finish the exam, we will be very sorry about that, but you really need to buy another battery.
 3. *Browser issues:* **Mozilla Firefox is the preferred browser for taking the on-line examinations.** Other browsers, particularly Internet Explorer and Chrome, have caused problems in the past with some features of Blackboard's examination software. There is a practice exam available throughout the semester that will let you ensure your browser works with all question types. Use it before you have issues in an exam. You don't want to be installing a new browser during an exam period.
 4. *Notes on smart phone Blackboard apps:* There are various apps available for iPhone and Android phones. These give you access to the course materials, but examinations will not work on smart phones. Exams can work on tablets like the iPad that can run a full-service browser.
 5. *Take the practice quiz:* There is a practice quiz available in the "Tests" content area that runs sample questions for all question formats that run through Blackboard. To ensure browser capability, take the practice quiz.
- 6. *Network issues:* The network in Marshall Hall has adequate bandwidth, but it is limited. That means you must *turn off* all other network devices except the one you are using for the exam. Your access to the network is also blocked if the network determines your device is running bit-streaming operations. Turn those off. Also, check prior to the exam that your device will have access to the network. You don't want to be running to the Help Desk during the examination period. You are responsible for

dealing with these matters. We will be very sympathetic to your plight, but you need to deal with them prior to entering the room.

- *Feedback on examinations:* Your exams will not be returned to you. We make every effort to ensure that your answers to examination questions are graded fairly and objectively. This includes accounting both for substance and for the technical glitches that commonly arise in Blackboard. This takes us a few days, and you will commonly see your initial score rise as we catch those problems. Please be patient while we do so.
Feedback on particular questions is provided in the form of short videos that are available for a limited time following the exam. If you have questions about the grading of a particular question beyond this, we are happy to meet with you individually to resolve your concerns.
- *Scope of examinations:* Each module has one exam. Scope of exams is not cumulative: Each exam covers one module. Any of the course materials for a module may appear in an exam. This means there is no need ever to ask whether some topic will be on the exam.
- *Recording my lectures:* I will be posting audio recordings of lectures. I'm not always reliable in this, so you are welcome to record lectures yourself, but just please ask my permission to do so. Please remember that my lectures, whether I post them or you record them, are copyrighted, and you may not distribute them or sell them (as if!).
- *Posted notes:* We will post notes taken during the lecture to accompany the audiotaped lectures.
- *Distribution of media:* All media, including supplemental essays, videos, audio recordings, or any other products developed by me for this course are my intellectual property and are under appropriate copyright protection. You may not distribute them or copy them for your own use.
- Students needing accommodation for examinations may obtain them through the Syracuse University Office of Disability Services.