Syllabus :: ESCI 100B Fundamentals of Environmental Processes (Spring 2019)

Instructor: Patrick Chuang

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Office hour location	TBD

Course Information:

Class Website: available on Canvas

Class Meeting Times: Mon/Wed/Fri 12.0 to 13.05 in Earth and Marine Sciences Room D250

Discussion Section: Thurs 17.30 to 19.30, Earth and Marine Sciences Room D250

Section Policy: Attendance in the section is mandatory. If you miss more than one without a valid reason, you will lose 1% off your final grade per section missed.

Supplemental material: Will be provided through the course website. I will provide the supplementary material as required. Unless otherwise noted, all handouts are to be considered part of the core material.

Missed Classes: If you miss a class, you should get the notes from a fellow student. My own notes just wouldn't make any sense to you.

Exams: Midterm exam will be scheduled at a later date. The final exam is set by UCSC policy for Mon June 10 from 16.00 to 19.00.

Course Outline

Quantitative exploration of physical and chemical processes relevant to the environment, and applications to complex environmental systems. Focus will be on calculus-based tools and developing intuition for these processes (not just rote learning of the math).

Topics to be covered include:

- Week 1: Introduction/Review/Fundamentals
- Week 2: Budgets

- Weeks 3 and 4: Heat transfer processes
- Week 5 and 6: Mass transfer processes (with analogies to heat transfer)
- Week 7 and 8: Chemical processes
- Week 9 and 10: Particle transport and mechanics

Evaluation

Students will be evaluated as follows:

- Problem sets: 40% (8 weekly problem sets, none the week of the midterm or the last week of class)
- Midterm exam: 20%
- Final exam: 30%
- Attendance and participation: 10%

Homework sets: These will be comprised mainly of quantitative problems. There will be approximately 8 problem sets during the quarter. **Homework sets will be due at 4 PM on Wednesdays**. Unless previous arrangements are made, homework sets turned in by the end of class on Friday are worth 50%; homework sets will not be accepted after that. You can hand them in to me during class or in the box outside my office. **Late homeworks must be handed to me directly**.

Homework grading: All problems will be graded on a scale of 0, 25%, 50%, 75% or 100%. This reflects the realistic certainty of grading problem sets. Note that grades are rounded to the NEAREST reasonable value, they are NOT ROUNDED DOWN. So this means that if your solution is close but not perfectly correct, you can still receive 100% for the problem. Over the course of the quarter, any small issues should be averaged out.

Exams: Exams will be made up of short answer questions (approx. 1/2 to 2/3 of points) and quantitative questions (approx. 1/3 to 1/2 of points). A list of potential short answer questions will be provided ahead of time.

Extra credit: ** There will be no extra credit offered to any individuals. No exceptions. ** I may give out extra credit work, but if I do, it will be available to all students in the class.

Help: If you need help, please

- Use textbook or other resources. The topics covered in this class are commonly taught so there are lots of texts that cover the material.
- Talk to the TA or instructor. During or after class, during discussion section, office hours, by appointment or whenever else. The worst thing is to not talk to anybody.

Grades Grading will not necessarily be "on a curve." There is no expectation of what the average grade should be, nor what the grade distribution should look like. If everyone were to demonstrate outstanding understanding of all the material, then everyone deserves a grade of A (and I would be very happy to give each one of them)! I therefore encourage you to discuss the course material with each other to get the most out of the class.

I will ***guarantee*** the following letter grades: if you get a 90% or above, you will get an A or better; 80% = B or better; 70% = C or better. The scale could slide downwards, e.g.. an A is actually 86% or better, but what I am saying is that it won't slide upwards.

Historical grades: Historically, the minimum grade for an A in my classes is somewhere between 83 to 88%; for a B is about 70 to 75%; for a C is about 45 to 50%. These are simply guidelines, however, and these are always subject to change.

Adjustment of letter grade: One can receive an upward adjustment of letter grade for a number of reasons (e.g. very strong improvement during the quarter, notable participation during class, exceptional effort). In almost all cases such an adjustment will be one letter grade fraction (e.g. B to B+), except under very exceptional cases, when two letter grade fractions will be awarded. Under no circumstances will a reduction in letter grade be given, and these adjustments are made after the normal grades are assigned and therefore affect no one else's letter grade.

Course Tenets

University is about learning skills. Learning facts to accompany these skills is also necessary, but not the most important part. To learn facts, you can go to the library and read a book. It would be easier and a lot cheaper. A university-level course is both harder and more expensive because learning skills is much more challenging. However, learning a new skill also requires significant effort from the student, and this is your responsibility in this course – to make the most of this opportunity by investing the time, energy, and most importantly, thought, necessary to master something new. Accept that feeling uncomfortable with course material is normal. This is a stage that everybody goes through to gain mastery. Nobody was born knowing what Langmuir isotherm is, I promise you (even Languir).

Learning Outcomes

- Calculus-based problem solving: what types of problems require calculus to solve? How to turn a word problem into either a differential equation or an integral equation? How to solve differential and integral equations?
- Use Microsoft Excel to perform repetitive calculations. Advanced topics include goal seeking, sorting, building histograms.
- How to prepare data for plotting, and generate a plot using a computer program (we'll use the website plot.ly).

Problem sets: Tips for success

1. Work together! Many studies show that working in small groups is one of the best ways to learn. Note the verb "working", which connotes being actively involved in the process. Sitting around

watching your friends work does NOT count as working!

Note: While working together on homeworks is strongly encouraged, **verbatim copying of one person's homework by another is NOT appropriate**. Thus, word answers should be written *in your own words* even if the conceptual idea is the same as somebody else's. We realize that for quantitative problems, working together may lead to identical solutions, but you should do your best to make sure each person is contributing and understands the solution. You might also notice that there's probably no way to enforce this. However, students who don't learn to do these problems on the homeworks (each homework is worth about 4 to 5% of your overall grade) will be at a strong disadvantage on the midterm and final exams, where some portion of the grade (roughly one-third) will be solving quantitative problems, which translates to about 20% of your overall grade. Thus, the time to learn the quantitative concepts is on the problem sets, not right before the final exam!

2. Think physically. Sometimes it's easy to get lost in the mechanics of the math, but you should always have in mind that you are solving a physical problem. This is especially important when you solve a problem – make sure that this solution makes sense to you given what you know about the world around you.

3. Being confused is normal. In fact, it's what you are paying for. Grappling with deep scientific concepts is like putting together a big puzzle. You start with a many individual pieces and it feels very daunting. Again, this is normal. To make progress, you connect a few individual pieces together to make small groups. You then notice how these small groups can connect to each other, and build bigger groups, and so on until the entire puzzle is put together. Notice that this takes time. You always know where any piece or group will end up, but again, that's normal. You have to trust that eventually it will all fit together. When it does, you feel satisfied because of the hard work you put into it. But what happens next is we immediately give you a new puzzle to work on. So you're back to feeling confused. The amount of time you had to enjoy the feeling of figuring out the last puzzle was pretty short, and the time it takes to do a puzzle from start to end is long. Therefore confusion is what you feel most of the time. And you know what? That's totally normal. It's true for everybody. So how does this count as advice? Don't freak out if you can't see the whole puzzle from the start. Put a few pieces together. If you're stuck, move on to another part. Come back to it. Acknowledge the confusion but accept that this is a normal part of the process. Have faith that if you work intelligently and diligently, you'll make progress. Talking to others helps a lot. The instructors or fellow students. Sometimes it's smarter to go to sleep, and look at it with fresh eyes in the morning. Or get some fresh air or some exercise. Your brain can only soak up ideas so fast. Sometimes it needs time to sort things out. If it wasn't hard, it wouldn't be worth learning! There's a reason there aren't classes in playing tic-tac-toe.

Problem sets: Ten Commandments

You MUST follow all of these commandments for your problem sets.

1. Thou shalt write legibly (most of you are good about this).
2. Thou shalt organize your solutions in a clear fashion. You may need to re-write your solutions so they are understandable.
3. Thou shalt try to use symbols rather than values until the last possible moment in a solution.
4. Thou shalt ALWAYS have units associated with numbers. Units are NOT OPTIONAL. Numbers without units are meaningless.
5. Thou shalt use 2 to 3 significant figures on all problems, unless otherwise stated.
6. Thou shalt show your work. Do NOT skip steps. Otherwise it makes it hard or impossible to grade.
7. Thou shalt avoid "magic math." Vanishing negative signs, derivatives and integral limits that pop out of thin air, etc., are to be avoided.
8. Thou shalt define variables. Writing a bunch of symbols without knowing their meaning isn't helpful. Use a diagram, for example, to show what the variables are.
9. Thou shalt use scientific notation for particularly small and large numbers.
10. No plot, no points. If the problem asks you to plot a solution, and you do not do so, then you will get a zero. The point of the plot is to give you a sense of the solution. Without a plot, you can't obey the final commandment (common sense).

The one commandment to rule them all: Thou shalt use common sense to evaluate/common on all answers. Is the sign appropriate? How about the order of magnitude? If not, you are expected to write a short paragraph to say why the answer seems unrealistic, and where you might have gone wrong.