

**OCN 310L: Global Environmental Change Laboratory
(cross-listed as MET 310L and OEST 310L)**

Marine Science Building, Room 307/314, Tue 1:30-4:00 pm

Instructor: Richard E. Zeebe, MSB 504, We 10-11 am.

TA: Paulo Calil, MSB 411, Tel. 956-6895, Email: calil@hawaii.edu

Textbook: Consider a spherical cow: A course in environmental problem solving, John Harte, University Science Books, Sausalito, CA, 1988. ISBN: 0-935702-58-X.

Grading:

Weekly homework assignments: 30%

Homework presentation and class participation: 40%

Draft, paper and oral presentation: 30%

No midterm! No final!

Rules:

In fairness to other students, draft or paper turned in 1 and 2 days late will receive a grade corresponding to 2/3 and 1/3 of the points scored, respectively. After 2 days, zero credit will be given. Homework not turned in before class receives 0 points. These rules apply unless there is a *documented* reason such as medical emergency or funeral.

In this class you will develop and improve skills in working out strategies and ideas how to quantitatively solve problems. The topics will focus on Earth's environment. Your challenge will be to develop concepts and approaches to various problems and finally provide useful solutions to them (calculating sophisticated, highly accurate answers will not be the goal, rather useful approaches and reasonable values will be required). This is sometimes not a trivial task and you should **anticipate to spend a considerable amount of time on your homework**, but – as the famous physicist Richard Feynman has put it – you will have "the pleasure of finding things out"!

If necessary, contact Paulo regarding your homework – but only after in-depth consideration of the problem and with a preliminary idea or a precise question.

The first part of the class will be concerned with problems and exercises of the textbook. Every week homework will be assigned and turned in before class the week after. The homework will be discussed in class and every week some of you will present their solutions to the other students (**bring an extra copy of your homework to every class!**). The presentation will rotate and at the end of the semester each student will have presented approximately the same number of exercises.

The second part of the class will be concerned with developing and using numerical tools for quantitative problem solving. The scientific topic will focus on phosphorus cycling in the ocean. Each of you will develop a numerical algorithm to solve the equations of a box model of the ocean's phosphorus cycle (Toggweiler, 1999). The software used for this application will be MATLAB (**bring a diskette or memory key to every class in order to save your files!**). After development of the base model, you will choose a project which will serve as the subject of your paper and oral presentation. A typical project will require changes to the existing numerical code in order to perform a sensitivity study or tackle a related/advanced problem.

Tentative Schedule

Aug 22

Introduction
Chapter I.1–I.7
Homework (due Aug 29):
 Related exercises, to be assigned
 Read p. 21–33, Chapter II.1–II.4

Aug 29

Chapter II.1–II.4
Homework (due Sep 05):
 Related exercises, to be assigned
 Read p. 34–44, Chapter II.5–II.7

Sep 05

Chapter II.5–II.7

Homework (due Sep 12):
Related exercises, to be assigned
Read p. 45–58, Chapter II.8–II.10

Sep 12

Chapter II.8–II.10
Homework (due Sep 19):
Related exercises, to be assigned
Read p. 95–108, Chapter IIC (II.19–II.20)

Sep 19

Introduction to chemical equilibria
Chapter II.19–II.20
Homework (due Sep 26):
Related exercises, to be assigned
Read p. 111–113, 138–149, Chapter (II.22, III.4)

Sep 26

Non-steady state box models and carbonate chemistry
Chapter II.22, III.4
Homework (due Oct 03):
Related exercises, to be assigned
Read MATLAB Intro

Oct 03

Introduction to MATLAB
Homework (due Oct 10):
Solve analytically $dy/dt = \lambda y, y(0) = y_0$

Oct 10

Solve numerically $dy/dt = \lambda y, y(0) = y_0$
Develop routines for base model (PO_4 in 3-box model)
Homework:
Work on model/Read project description

Oct 17

Develop routines for base model (PO_4 in 3-box model)
Discussion/assignment of projects
Homework:
Work on model/draft paper

Oct 24

Finalize routines for base model (PO_4 in 3-box model)
Model experiments
Homework:
Work on model/draft paper

Oct 31

Model experiments
Work on draft paper
Homework:
Draft paper

Nov 07 Election Day**Nov 14**

Discussion of reviewed draft paper
Work on model/final paper in class
Homework:
Work on model/final paper
Prepare oral presentation

Nov 21**Oral presentations**

Homework (due Nov 28):
Read p. 59–73, Chapter II.11–II.13

Nov 28

Chapter II.11–II.13
Homework (due Dec 05):
Related exercises, to be assigned.

Dec 05

Homework Presentation
Chapter II.11–II.13