GEOL 380/PGEOG 705.69
Advanced Oceanography with MatLab. The Physics of the Oceans
Summer Session II, 5 weeks: 7/13/2020 - 8/13/2020
Professor Haydee Salmun

Lecture hours/location: Fully online/synchronous, using a combination of activities: lectures, seminar-style discussions and quantitative work (labs) using the Matlab software.

Professor Salmun Contact Information

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Office Hours: ***please kindly make an appointment***

(*) Note: the best way to contact me is via email – (1) You must include the course name or number in your subject line (2) You must include your entire name in your email (3) I try to answer all emails within 24 hours. Allow for a 48 hour delay on the weekends.

Note for Graduate Students:
Although the course description and topics described below are the same for graduates and undergraduates, the expectations of your work and general performance are not. You will be invited to use this course as an opportunity to develop some of your own research tools, skills and interests and to combine these in a major project/presentation at the end of the session.

Course Prerequisite: This is a quantitative science course and we expect students to have a basic foundation in physical sciences and mathematics. We will require a strong commitment to learning the quantitative skills offered.

Course Description:
The oceans play a significant role in how the climate system responds to anthropogenic perturbations. To understand past, present and future climate, therefore, we need to know and understand our oceans. Oceanography is a multidisciplinary science. It offers a wonderful opportunity to review and to apply many of the concepts taught in the major traditional disciplines such as physics, chemistry, biology and mathematics. This course will offer an in-depth 'tour' to the fascinating and complex subject of Oceanography and an introduction to quantitative methods in oceanography using Matlab. This is a science-base course and it will require that students learn to understand, and be willing to work with, physical and quantitative concepts. It requires that students be prepared to learn the basics of scripting/programming syntax and logic, which in turn is one of the great skills to be acquired in this course.

The two main objectives of this course are (1) to further students' understanding of the ocean in the context of the earth system, and (2) to expand students' skills in quantitative analysis using Matlab, a high-level language and interactive environment for numerical computation, visualization and programming. Labs are meant to provide students with a number of identifiable skills that can be applied in other courses as well as in work environments. Consequently, class time will be spent on theoretical material (typically the first part) and on work with Matlab.

Topics to be covered include atmosphere-ocean interactions; wind-driven ocean currents and their role in the global distribution of energy; other major ocean current systems such as equatorial current systems and the circulation at high latitudes; the role of waves (large scale) in the ocean and atmosphere-ocean interactions; the South Atlantic circulation and the Overturning Meridional Circulation; Temperature, Salinity, Pressure & Density in the Ocean.

Expected learning outcomes

1. *Theory*

At the end of the semester, students would be expected to have a basic understanding of

- the world's oceans as a major component of earth-system science
- the ocean strong influence on climate including Earth's surface temperature, by influencing the amount of CO_2 in the atmosphere, the transport of heat from the tropics to polar regions, the operation of the hydrological cycle and the Earth's carbon cycle
- how to explore the way the oceans 'work' by studying processes that involve other components of the Earth system, particularly the atmosphere
- how these processes function together to determine and regulate Earth's climate, the circulation of the atmosphere and ocean and the recycling of elements

2. *Skills*

At the end of the semester, students would be expected to have acquired basic quantitative skills that will allow them to

- use basic mathematical calculations to quantify physical processes under study
- understand the importance of data visualization and explain graphs and charts in detail
- use basic Matlab to perform calculations and generate charts
- gain a basic appreciation of modeling environmental problems in a marine context through the use of the Matlab software
- gain an appreciation of computer models and data analysis

Computer Labs

Class time will be devoted to lab work in 1090B Hunter North. Labs will consist of exercises designed to introduce students to some of the concepts and skills necessary to study problems in a marine environment in a quantitative fashion. These include basic mathematical concepts, as well as using computer simulations, or models. Windows operating system, MS WORD and MS EXCEL, is expected. A greater emphasis will be placed on analysis of data and results.

Group work – is allowed and encouraged for all labs. We ask that reports from group work make explicit (1) which students are working together; and (2) hand in only one lab per group, with all students' names on the lab and their contribution to the report.

Recommended Text Book:

Introduction to Physical Oceanography by Robert H. Stewart (Department of Oceanography, Texas A & M University) Copyright 2008, September 2008 Edition.

This textbook can be downloaded FOR FREE from https://oaktrust.library.tamu.edu/handle/1969.1/160216, and going to "View/Open stewart_texbook_physicaloceanography.pdf"

A detailed schedule will be available on Blackboard at the start of Summer Session II