MSCI/GEOL 781 Physical Oceanography
Fall, 2011

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Office hours: Monday, Wednesday 10-11 AM or by appointment

Lectures: Monday, Wednesday 8:40-9:55 AM SUM 241

Objective: To lay the framework for an understanding of physical and dynamical processes in the oceans.

Description:
This is a graduate-level course in physical oceanography. This course is an introduction to the results and the methods of observational physical oceanography, a very rapidly developing field. Rapid development is a response to the pressing societal need to understand how the physical state of the oceans might be changing as part of a changing Earth climate -- Are the oceans warming? Is the ocean circulation slowing? Rapid development on these and other questions is made possible by new technology, e.g., satellite measurement systems and autonomous floats and gliders that enable more efficient and more comprehensive observation of the ocean. Topics are organized around concepts and processes, rather than geography, and, like modern oceanography generally, my approach will be quantitative rather than merely descriptive.

Learning Outcome
Three specific objectives are:
1) Know (be able to interpret) the large-scale distributions of the ocean's physical properties, e.g., temperature, salinity and currents, and how these are observed.
2) Understand (be able to explain) the basic principles of ocean physics, e.g., equation of state of sea water, consequences of stratification, effects of Earth's rotation, transport by mean and fluctuating ocean currents.
3) Learn how to estimate ocean processes from the observations, e.g., meridional heat transport by geostrophic and Ekman layer currents.

Other objectives includes:

- basic knowledge of physical Oceanography;
- multidisciplinary training through advanced coursework and individual research projects;
- basic theoretical knowledge and understanding of oceans using observations and Ocean General Circulation Models.
- basic theoretical knowledge and understanding of ocean dynamics and ocean processes;
- training in practical ocean observing techniques and application of advanced techniques working with current satellite data;

Text Books: (1) **Descriptive Physical Oceanography** (Sixth Edition) by Lynn D. Talley, George L. Pickard, Willian J. Emery, and James H. Swift.
(2) ***Introduction to Physical Oceanography*** by Robert Stewart. This is an online text only, which includes a printable pdf and cover.
(3) ***Introduction to Physical Oceanography*** by John Knauss. Second Edition. Prentice Hall.

Reference/suggested:

(1) Introductory Dynamical Oceanography by Pond and Pickard
(2) Ocean Circulation by Open University
(3) Waves, Tides, and Shallow Water Processes by Open University team.
(4) A*tmosphere-Ocean Dynamics* by Adrian Gill.

Required: Calculator with higher order functions (logarithm, exponential, hyperbolic functions, π)

Grading:		
	Exams (3)	150 points
	Assignments and Quizzes	100 points
	Final project	50 points

Final grades will be based on a grading scale suggested as follows: A = 93-100; B+ = 87-92; B = 83-86; C+ = 77-82; C = 73-76; D+ = 67-72; D = 60-66; and F < 60.

Class Lecture topics:

August 22:	Lecture 1	Course Overview
August 24:	Lecture 2	Physical Properties of Seawater I
August 29	Lecture 3	Physical Properties of Seawater II
August 31	Lecture 4	Typical Distributions/Ocean Structure I
September 5	Labor Day	
September 7	Lecture 5	Typical Distributions/Ocean Structure II
September 12	Lecture 6	Advection/Transports/Budgets I
September 14	Lecture 7	Advection/Transports/Budgets II
September 19	Lecture 8	Dynamics I (momentum)
September 21	Lecture 9	Dynamics II (Rotation/Geostrophy)

September 26 EXAM-1

September 28	Lecture 10	Dynamics III (Ekman)
October 3	Lecture 11	Dynamics V (Sverdrup balance & Western boundary currents)
October 5	Lecture 12	Observational methods and data analysis
October 10	Lecture 13	Pacific Ocean I
October 12	Lecture 14	Pacific Ocean II
October 17	**EXAM-2**	
October 24	Lecture 15	Waves/Tides 1
October 26	Lecture 16	Waves/Tides II
October 31	Lecture 17	Waves/Tides III
November 2	Lecture 18	Indian Ocean
November 7	Lecture 19	Southern Ocean
November 9	Lecture 20	Atlantic Ocean (surface Circulation)
November 14	Lecture 21	Atlantic Ocean (deep and Meridional Overturning Circulation)
November 16	Lecture 22	ENSO/Decadal Climate Variability (NAO/PDO)
November 21	**EXAM-3**	
November 25- 29	Thanksgiving holidays	
November 28	Lecture 23	Numerical Ocean Modeling
November 30	Last Day of Class	
December 2	**Project Due**.	