OCE/MPO 603: Introduction to Physical Oceanography

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Course Overview

Application of the laws of physics to the study of the properties and circulation of the world?s oceans: Geographical description of the oceans; physical properties of sea water; derivation of the equations of motion for steady ocean circulation on a rotating planet; Ekman layer, Stommel and Munk boundary layers, and the Sverdrup Balance; abyssal circulation; thermohaline circulation; instrumentation and observation.

Prerequisites: Mathematics and physics required for admission to the graduate curriculum at RSMAS, or consent of the instructor. You should know Newton's 3 Laws, linear and angular momentum conservation, derivatives and partial derivatives, integrals, scalars and vectors, gradient, divergence, and curl.

The course website is on my webpage **http://www.rsmas.miami.edu/people/faculty-index/?p=lisa-beal**. You will find the syllabus as well as links to lectures and notes.

Course requirements: Two graded exams, midterm (25%) and final (50%); One written report/project (25%). Study questions are provided weekly and solutions led and discussed by YOU during class.

Recommended Books

Robert Stewart (RS): *Introduction to Physical Oceanography* - on eReserve at RSMAS library.
John Knauss (JK): *Introduction to Physical Oceanography* - on eReserve at RSMAS library.

Other Books and Further Reading

Pond and Pickard (PP): *Introductory Dynamical Oceanography* - on reserve at RSMAS library
Open University (OU): *Ocean Circulation* - on reserve
Talley et al: *Descriptive Physical Oceanography: An Introduction*
Adrian Gill: *Atmosphere-Ocean Dynamics*

Course Outline

(1) Introduction - course overview (JK1,RS1-2)
(2) Geography of the world's oceans and major current systems (RS3)
(3) Physical properites of seawater I - T, S, density, and potential temperature (RS6,JK2,PP2)
(4) Physical properties of sea water II - static stability and sound waves (JK2,PP5)
(5) Property distributions - water masses and tracers (JK8,RS6)
(6) Forcing of the Ocean - tides, winds, and heating (RS4-5,JK3,OU1-2)
(7) Mass, energy, and salt conservation; continuity equation (PP4,JK4,0U6,PP10)
(8) Basin budgets and two-layer exchange flows (JK11)
(9) Equations of Motion on a rotating planet - Coriolis force and inertial oscillations (JK5,PP6,OU3)
(10) Scaling - relative importance of the terms in the equations of motion (PP7)
(11) Ekman layers and Ekman spiral (PP9,JK5-6,OU3,RS9)
(12) Geostrophy - thermal wind and dynamic height method (RS10,PP8,JK6,OU3)
(13) Potential vorticity equation - concept of curl/spin/vorticity (PP9,JK5,RS12)
(14) The Sverdrup balance and gyre circulation (RS11,PP9,JK6)
(15) Western intensification (RS11,PP9,OU4)
(16) The Agulhas Current - a case study of a Western Boundary Current
(17) Upwelling - equatorial, coastal, and Antarctic (OU5,JK7,RS14)
(18) Wind-generated waves (PP12,JK9)
(19) Planetary waves and eddies (PP12, JK10,OU5)
(20) Water mass formation and mixing (RS13,PP10)
(21) Abyssal circulation (RS13,PP10,OU6)
(22) Thermohaline Circulation and heat transport (RS13,OU6)
(23) Interannual variability (El Nino) and Climate change (OU5,RS14)
(24) Instrumentation and Experimentation