

UNIVERSITY of TORONTO at SCARBOROUGH
Department of Physical & Environmental Sciences

January 2018
Oceanography EES C19

The world's oceans constitute more than 70 % of the earth's surface environments. This course will introduce students to the dynamics of ocean environments, ranging from deep ocean basins, to marginal seas, to the coastal ocean. The physical nature of ocean systems, their origins, and their importance in the global hydro-climatic system will be examined first; we will then focus on the primary physical mechanisms that control ocean dynamics.

Students who have completed introductory calculus (MATA30/31 and MATA36/37) can expect to be well-prepared, but those without are strongly advised to consult the Math and Statistics Learning Centre (<http://www.uts.utoronto.ca/mslc/>) for additional assistance. Completion of first year physics would also be an asset.

Instructor: Prof. Mathew Wells
Email: wells@uts.utoronto.ca

Office: EV456
Office hours Friday 10-12 am - For all detailed questions please come to my office hours. I will only answer **short emails** from **official UofT accounts**, and anything that requires a detailed answer I'll ask you come to the course office hours.

The course will be organized around: (a) a 2-hour lecture each week; (b) a 1-hour tutorial/ practical class most weeks where the assignments will be discussed. I will be posting lectures on blackboard usually the day before classes.

Lectures:

Thursday 9:00-11:00 Room: HW214

Tutorials

Thursday 11:00-12:00 Room: either in HW215, in computer labs BV471 or demos in ESCB.

Course Grade:

Mid-Term Test 10 %

Assignments (4) 40 % - note that late assignments will be penalized.

Video presentation 10% and report 5 %

Final Examination 35 %

TENTATIVE COURSE OUTLINE

Week 1 – January 11th Orientation on Physical Oceanography

Physical Oceanography as a Branch of Physics
Environmental Challenges in Oceanography
Introduction to Marine Systems (Physical)
The World Ocean
Ocean Morphology
Sea Water: Physical & Chemical Properties

Lab demo in ECSB building

Week 2 – January 18th FORCES ON THE GLOBAL OCEAN 1: Thermo-Haline Circulation

Deep ocean overturning thermohaline circulation

ASSIGNMENT 1 issued: Basic properties of ocean temperature and salinity. Due week 4.

Computer lab tutorial on Java Ocean Atlas in BV471 Booked for Jan. 18th from 9:00 a.m. to 10:00 a.m. (Java Ocean atlas will be used for T/S diagrams in assignment 4 as well).

Week 3 – January 25th FORCES ON THE GLOBAL OCEAN 2: WIND

Surface Currents & Ekman Circulation
Inertial Currents and Geostrophic Currents
Oceanic Fronts
Gyres, Rings, Eddies
Atlantic Ocean
North Atlantic Gyre

Week 4 – Feb 1st FORCES ON THE GLOBAL OCEAN 3: WAVES

Wind Waves in Ocean Current Systems
Wave Generation & Propagation: Wind Waves & Swell
Wave Breaking & Decay, Wave Boundary Layers
Storm surges
Tsunamis

ASSIGNMENT 2 issued: Waves due in week 6.

Week 5 – February 8th FORCES ON THE GLOBAL OCEAN 4: OCEANIC TIDES

Equilibrium Theory of Tides
Tidal Constituents & Dynamical Theory of Tides
Amphidromic Systems, Tidal Currents

ASSIGNMENT 3 issued: Tides – due in week 7 (after reading week).

Week 6 – February 15th

In class midterm scheduled – 1:30 duration.

Reading week - February 19th – 23rd

Week 7 March 1st OCEAN CURRENT SYSTEMS I:

Pacific Ocean

El Nino Southern Oscillation (ENSO)

Indian Ocean

Tropical Monsoon

The Equatorial Current Systems

The Subtropical Gyres

The Equatorial Undercurrent

Week 8 – March 8th OCEAN WATER MASSES

Heat Budget & Conservation of Salt

Upper & Intermediate Water Masses

Deep and Bottom Water Masses

Ocean Mixing

ASSIGNMENT 4 issued: Temperature-salt diagrams – due week 10

Week 9 – March 15th MARINE-FRESHWATER INTERFACE: ESTUARIES

Morphology & Estuary Types

Estuarine Processes

Environmental Problems

Week 10 – March 22nd DISTRIBUTION OF BIOLOGY

Phytoplankton and Zooplankton, Red Tides

Oxygen and Nutrient distributions

Upwellings zones, CO₂ uptake in ocean

Week 11 March 29th

Watch a sample of 10-minute student video presentations on Ocean Currents

Week 12 April 5th

Course Review

TEXTBOOK

Two texts from the UK Open University that will be used in this course as the textbook. You can buy them from Amazon but these two books are available online through the U of Toronto library website

Ocean circulation –

<http://simplelink.library.utoronto.ca/url.cfm/51807>

Waves, tides, and shallow-water processes -

<http://simplelink.library.utoronto.ca/url.cfm/51808>

Other useful texts are "Regional Oceanography: an Introduction" by Matthias Tomczak and Stuart Godfrey. A PDF version of this book is available at

<http://gyre.umeoce.maine.edu/physicalocean/Tomczak/regoc/pdfversion.html>

A more technical book is "Introduction to Physical Oceanography" by Robert Stewart.

A PDF version of this book is available at

http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book_pdf_files.html

and the online version is available at

http://oceanworld.tamu.edu/resources/ocng_textbook/contents.html

We are also able to access the online "Encyclopedia of Ocean Sciences". The encyclopedia was published in 2001 and is the most up-to-date resource on oceanography available. Here is a link to the encyclopedia

<http://simplelink.library.utoronto.ca/url.cfm/282540>