UNIVERSITY of TORONTO at SCARBOROUGH
Department of Physical & Environmental Sciences

January 2019
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.utsc.utoronto.ca/mslc/) for additional assistance. Completion of first year physics would also be an asset.

Instructor: Prof. Mathew Wells
Email: wells@utsc.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** through the Quercus messaging system, 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 PDF files of the lectures on Quercus usually the day before classes.

Lectures:
Thursday 9:00-11:00 Room: IC 120

Tutorials
Thursday 11:00-12:00 Room: either in IC 120, 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 15%
Final Examination 35 %

TENTATIVE COURSE OUTLINE

Week 1 – January 10th 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 17th 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. 17th from 11:00 a.m. to 12:00 a.m. (Java Ocean atlas will be used for T/S diagrams in assignment 4 as well).

Week 3 – January 24 th 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 – Jan 31st 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 7th 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 14th
In class midterm scheduled – 1:30 duration.

Reading week - February 18th – 22rd

Week 7 February 28th 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 7th 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
ESC19 Oceanography Tutorial BV-471 11am-12pm

Week 9 – March 14th
MARINE-FRESHWATER INTERFACE: ESTUARIES
Morphology & Estuary Types
Estuarine Processes
Environmental Problems

Week 10 – March 21st
Presentation by TA Bryan Flood on how to make good presentations for final video presentations.

Week 11 March 29th
DISTRIBUTION OF BIOLOGY
Phytoplankton and Zooplankton, Red Tides
Oxygen and Nutrient distributions
Upwellings zones, C02 uptake in ocean

Week 12 April 4th
Course Review
Finish with watching a sample of 10-minute student video presentations on Ocean Currents

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