# MARS 8030 Physical Oceanography
## General course information & course syllabus

**Instructor:** Dr. Daniela Di Iorio
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Office Hours: open door policy or by appointment

**Lectures:** Spring 2018, 9:30 to 10:45 am
Wednesday and Friday
Marine Sciences Building, Room 239

**Primary Textbooks:**
Introduction to Physical Oceanography, 3rd edition, by John A. Knauss and Newell Garfield.
Descriptive Physical Oceanography, An Introduction, 6th edition, by L.D. Talley, G.L. Pickard, W.J. Emery and J.H. Swift with supplementary materials located at the textbook website:
http://booksite.elsevier.com/DPO/

*Textbooks available in the library:*
Introductory Dynamical Oceanography, 2nd edition, by Stephen Pond and George Pickard,
Ocean Circulation, Open University Press Team.
Waves, Tides and Shallow Water Processes, Open University Press Team.

*Textbooks available online:*
Introduction to Physical Oceanography (2008), Robert H Stewart,
https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=20
Regional Oceanography: an Introduction (2003), Matthias Tomczak and J. Stuart Godfrey
http://www.es.flinders.edu.au/~mattom/regoc/pdfversion.html

**Course Description/Objectives:** This course will introduce the fundamental laws of physics and use mathematical relations to describe ocean processes ranging from coastal to global spatial scales and from minutes to yearly time scales. We will study the physical forces on Earth that cause ocean motion and quantify those motions with mathematical calculations, understanding the limitations, and giving a physical interpretation of the solutions obtained along with a drawing of the processes involved. We will examine the ocean and atmosphere as a coupled system with the energy to drive this system coming from the Sun and the motion altered by the Earth's rotation. In general, atmospheric circulation creates the global ocean wind-driven surface currents known as thermocline circulation. Coupled atmosphere ocean processes create anomalies like El Nino. Deep ocean currents driven by density differences is known as the meridional overturning circulation that together with the surface currents regulate climate on Earth and forms the global ocean circulation. We will then discover how waves are a means of propagating energy from its generation region to another point on Earth and how the Earth/Moon/Sun system causes large bodies of water to rise and fall as tidal waves. Finally we will examine coastal and estuarine circulation and the resulting mixing that takes place as a result of many forcing mechanisms including river, tide and wind effects. At the end of the course students will present a review of a research paper of your choice to the class on any topic of physical oceanography and guide a discussion.

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**Grade Distribution:**

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| Assignments (10 total, plus in class work) | 40% |
| Midterm Exam | 25% |
| Paper Presentation | 5% |
| Final Exam (Cumulative) | 30% |

*A(90-100%,4), A-(85-90%,3.7), B+(80-85%,3.3), B(75-80%,3), B-(70-75%,2.7), C+(65-70%,2.3), C(60-65%,2.0), C-(55-60%,1.7), D(50-55%,1), F(0-50%,0)*
***no adjustments will be made to the final grade distribution.***

*Incompletes:* The grade of Incomplete (I) is given to students who, for reason of accident or illness, were unable to complete a segment of the course. In no case will an Incomplete be given as a means of avoiding a failing grade.
*WF:* The grade of Withdrawal with Failure (WF) will be given to students who fail to come to class and hand in course material when expected and who withdraw from the course prior to the Midpoint Withdrawal Deadline of Mar 19, 2018.

Assignments: You may use any word processor (LaTex, Word, OpenOffice, Pages, etc), any computational software (MATLAB, R, Excel, Numbers, Python, Java etc) and/or any drawing software to help with your assignments. Hand written, plotted and drawn is just fine provided it is neat and legible. You must show your work, draw a picture, outline any assumptions made, and discuss your result, for full credit. You may work together to solve homework problems (please acknowledge who you work with on your assignment) but what you hand in must be your own work. **You may NOT use any unauthorized material to complete the assignment (past or present students' solutions)**. Corrected class work is a major part of learning and can be resubmitted provided a clear understanding of the problem is shown and the work is submitted with greater detail. The last day of this class (Apr 25, 2018) is the due date for handing in all class work – no exceptions.

Paper presentation guidelines: Choose a physical oceanographic article from any one of the following journals: *Journal of Geophysical Research (Oceans), Journal of Physical Oceanography, Estuarine Coastal Shelf Science, Continental Shelf Research, Estuaries and Coasts, Deep-Sea Research, Journal of Atmospheric and Oceanic Technology, Atmosphere-Ocean, Journal of Marine Systems, Limnology and Oceanography* and others of your choice. An article from *Nature, Science, EOS*, research letters or equivalent will NOT be accepted nor will a paper on biological and chemical oceanography be accepted unless you can show how physical processes affect them. Part of Assignment #7 will include turning in a copy of your chosen paper with a detailed summary of how you will lead a discussion - so start scanning the journals early to find a paper that interests you.

Final Exam: Wed May 2, 2018 8:00 am, Marine Sciences Building, Room 239. Exam will be cumulative with emphasis on the second half of the course.

**Academic Honesty:** All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties of academic dishonesties are severe and ignorance is not an acceptable defense. Documents for academic honesty and standards, like "A Culture of Honesty", may be found at the web site for the University of Georgia Office of Vice President for Instruction http://www.uga.edu/honesty/ahpd/culture_honesty.htm.

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*Plagiarism* ("take ideas, writings, etc. from another and pass them off as one's own", Webster's New World Dictionary) will not be tolerated. There are several forms of plagiarism, ranging from outsourcing your work to somebody else, to slight rewording of a published text or summarizing a text without citing it. If you are in doubt consult with the instructor ***before*** you hand something in.

**eLC:** All lecture notes, assignments, reading materials and data sets will be posted on the E-Learning Commons web site https://uga.view.usg.edu (the secure website). You must have a UGA-myid account. For complete information on the use of eLC, go to the Student Support link on this homepage. Once you log into eLC you will find all the courses you are authorized to use. If you do not see XLS AS_MARS8030 - GEN PHYS OCEAN then you must make sure you are registered for the course. In the Content Browser you will see a link for the Syllabus, Assignments and Class Notes. All files will be in PDF format and you will need to have the Adobe Acrobat Reader installed on your computer. If you have problems please let me know.

**Lecture Schedule:** This outline is a general plan for the course; deviations may be necessary.

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| | F Jan 5 | Class introduction / Solar input | |
| Wk 1 | W Jan 10 | Heat Fluxes | |
| | F Jan 12 | Heat Balance / Earth's rotation | |
| Wk 2 | W Jan 17 | Coriolis Force | Assign 1 due |
| | F Jan 19 | Atmospheric processes / Global wind field | |
| Wk 3 | W Jan 24 | Ekman Transport / Sverdrup Transport | |
| | F Jan 26 | Wind driven surface currents – subtropic/subpolar region | Assign 2 due |
| Wk 4 | W Jan 31 | Wind driven surface currents – The Gulf Stream (conservation of potential vorticity) | |
| | F Feb 2 | Equatorial currents | |
| Wk 5 | W Feb 7 | GOMRI Conference attendance – no classes | |
| | F Feb 9 | El Nino | Assign 3 due |
| Wk 6 | W Feb 14 8am | Water masses | |
| | W Feb 14 | TS diagrams | |
| | F Feb 16 | Deep water formation – Greenland Sea convection | Assign 4 due |
| Wk 7 | W Feb 21 | Meridional Overturning circulation/Global ocean circulation | |
| | F Feb 23 | Midterm Exam | |
| Wk 8 | W Feb 28 | Special topic: Hydrothermal circulation | Assign 5 due |
| | F Mar 2 | Dynamical Oceanography – equations of motion | |
| Wk 9 | W Mar 7 | Dynamical oceanography – conservation of momentum | Assign 6 due |

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| | F Mar 9 | Dynamical Oceanography –<br>conservation of mass and continuity | |
| Wk 10 | W/F Mar 14/16 | Spring Break – enjoy! | |
| Wk 11 | W Mar 21 | Dynamical Oceanography –<br>potential temperature and salinity | Withdrawal deadline Mar 20 |
| | F Mar 23 | Dimensional analysis and scaling | Assign 7 due, submit paper presentation summary |
| Wk 12 | W Mar 28 | Wind generated waves | |
| | F Mar 30 | Inertial and Internal waves | |
| Wk 13 | W Apr 4 | Kelvin and Rossby waves | Assign 8 due |
| | F Apr 6 | Tides – Equilibrium model:<br>Tide producing force | |
| Wk 14 | W Apr 11 | Tides – Dynamical model | |
| | F Apr 13 | Coastal Processes | Assign 9 due |
| Wk 15 | W Apr 18 | Estuarine Dynamics | |
| | F Apr 20 | Paper presentations | |
| Wk 16 | W Apr 25 | Paper presentations | Assign 10 due.<br>Last day to submit all class material |
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| May 2 | 8:00-11:00 am | Final Exam, Rm 239 | |