Oceanography for Teachers
Geology 401, Syllabus Fall 2012

Course Information: 3 Credits; meets requirements for upper level IDLS course. Cannot receive degree credit for both Geol 401 and 211.
Meets in Memorial Hall Room 7115; Wed & Fri 9:05 to 11 am

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Office Hours: I am usually available after class or you can make an appointment.

Course Description: Discover how the disciplines of geology, chemistry, physics and biology are integrated in the study of the oceans. Through a blend of lecture, in class activities, homework, and field experiences learn about marine navigation, the tectonic evolution of the ocean basins, physiography of the sea floor, heat capacity of the oceans and influence on maritime climates, and the physical motion of the ocean through waves, tides, currents, and upwelling. Determine what physical and chemical constraints control the abundance and diversity of marine life. Learn about the relationships between sea level change and climate, and the relationships among heat, salinity, density and deep water circulation. Explore coastal geology and near shore marine ecosystems directly, and learn how sediments and microfossils are clues to the past ocean-climate system.

Course Objectives:
1. Develop an adult-level understanding of essential oceanography content that directly supports VA Science SOLs and the National Ocean Literacy Principles.
2. Develop skills in scientific investigation, reasoning, and logic (supporting SOL x.1 all grades; ES.1&2).
3. Develop teacher professional habits of: exploration of prior knowledge prior to introducing new vocabulary or concepts, reading (text, and secondary/primary literature) to support your own learning and professional development, and reflecting on new knowledge and pedagogies.
4. Apply what you have learned via assignments, exams, and course projects specifically designed for pre-service teachers.

I anticipate that pre-service teachers who actively participate and take responsibility for their learning should be prepared to teach oceanography concepts by drawing from their personal experiences studying the oceans and by using effective instructional strategies and resources.

Student Responsibilities: ***As a student in this course, it is your responsibility to:***

1. Come to class on time, every time, ready to learn. This means completing all assignments on time and bringing all required materials to each class meeting.
2. Actively participate in class activities and discussions. Remember you are responsible for your own learning in this course.
3. Actively promote an environment of learning, fairness, and respect for everyone in the classroom.
4. Be familiar with all policies and procedures for the course, particularly policies for academic honesty.
5. Do your best work. Grades in this course are earned.

Instructor Responsibilities: ***As the instructor for this course, it is my responsibility to:***

1. Ensure that the classroom learning environment is one of openness, fairness, and respect for all.
2. Judge your work as honestly and fairly as possible. I will try to grade and return work within one week of when I receive it.
3. Challenge you to do your best in this course. I will not provide easy answers, but I will support and guide your efforts during the learning process.
4. Be available for consultation (during office hours or by appointment) if you need help with class material or if you have a problem or concern.

Attendance and Professionalism: I expect you to be here for each class for the full class period. We will do a lot of hands-on (constructivist) learning in this course and you can't do that if you are note here actively participating. Therefore I expect professional behavior which includes arriving on time and not leaving early, NOT texting, giving you full attention to the lecture or investigative activity during class, and demonstrating a positive attitude [see related section on "Student Responsibilities"].

Grading:

Group In-class Activities	15%
Attendance & Professionalism	
Completion of Work	
Individual Assignments and Homework	10%
Exam 1	15%
Exam 2	15%
Exam 3	15%
Oceanography in Action Poster Project	12%
Field Trip	
Participation	3%
Field Trip Synthesis Project	15%
	100%

Your lowest grade on a single individual assignment or homework will be dropped. Grades for exams and for group in-class activities are not eligible to be dropped.

Final grades will be given as follows: A = 93-100%, A- = 90-92%, B+ = 87-89%, B = 83-86%, B- = 80-82%, C+ = 77-79%, C = 73-76%, C- = 70-72%, D+ = 67-69%, D = 63-66%, D- = 60-62%, F = 0-59%.

Group in-Class Activities: Each class period will include a mix of investigative exercises from either your book or outside sources, and lectures. BRING YOUR BOOK TO EVERY CLASS. The level at which the activities (and assignments) are pitched will range – sometimes we will directly model elementary and middle school, and high school activities; other times I will challenge you with more involved upper-level undergraduate activities (don't forget you are in a upper level college course). Most in-class activities are to be worked on collaboratively (in small groups or with a partner). Your grade for group in-class activities is based equally on (a) your attendance and professionalism (see related section above) and on (b) completion of the work.

Individual Assignments and Homework: I will also occasionally assign individual homework to reinforce the in-class group work and lecture material and to help take your learning to a higher level. Homework will generally be an opportunity to practice your application, analysis, synthesis, and evaluation skills.

Exams: There will be 3 exams. The third exam will be during finals week although the test itself is not cumulative. *Exams will include both individuals and cooperative sections;* collaboration and notes (but not books or computers) will be allows for the second part of the exam. Tentative exam dates are on the schedule. They will cover material since the previous exam, but build on the material from the beginning of the course. Make-up exams due to illness or other unavoidable events will be considered on a case by case basis. Exams are challenging. Questions will include multiple choice and problem sets and short answer formats. Participating and taking notes in class is critical. Annotate the book and/or the PowerPoint diagrams with your notes. Review your notes, handouts, readings, in-class activities and homework. Use the review guides posted on Blackboard well before the exam, form study groups, and come and ask me questions. All exams must be returned to me at the end of the class period in which they are returned to students. All exams will be retained by me.

Oceanography in Action Poster Project: The textbook contains several sections, entitled *Oceanography in Action*, which provide interesting perspectives on particular oceanographic problems, events, and case studies. You are to select your top 3 *Oceanography in Action* topics from the book; I will then assign you one of those for you to develop a classroom poster. The poster should be 3'x 5' and be made using either Power Point or Adobe illustrator. Your poster should be tailored to the grade band you plan to teach. In addition to using the book, you will need to do some outside research on that particular oceanographic problem, event, or case study, and be able to communicate effectively in a poster format about that topic to your target audience. I will print your poster and you will present it to the class. Further details about the project, including an evaluation rubric, will be handed out the 1st or 2nd week of class. Each student will get digital copies of ALL of the posters produced by the class for future classroom use.

Oceanography in Action Topic Request forms due Wed., Sept 26th.
Digital Poster Drafts due Wed., Oct 24nd.
Final Posters due electronically on Mon., Nov 12th.
Poster Presentations, Wed., Nov 14th.

Field Trip: This is a required field trip. **We will now leave JMU Saturday morning Sept 15th and return Monday evening Sept 17th.** If the weather cooperates we will have three days full of activities that include a visit to the Ocean Hall exhibit at the Smithsonian, mapping the shoreline in Assateague, VA, and going out in boats to explore the geology, biology, chemistry and physics of the estuary and coastal ocean near Wachapreague, VA. We will stay in rustic cottages at the Virginia Institute of Marine Sciences (VIMS). While on the trip you will want to document the observations and interpretations you make so that these notes (written, sketches, data tables, digital photos and/or video) can be summarized and included in your field report (see below). While this course does not have a lab fee, there will be a small field trip fee to covers the cost of the dorm and shared food expenses. If the field trip is cancelled due to poor weather I will do my best to develop an alternative field experience.

Field Trip Report: The field trip will give you firsthand knowledge of the coastal ocean environment and of the resources that a museum can offer teachers and students. The goal of the field trip is to investigate several questions on oceanographic content and pedagogy:

1. **Location: How can we determine our latitude, longitude, and water depth** while in boats near Wachapreague using modern and historical methods?
2. **Geology and the Ocean: What type of coastline is this? What type(s) of sediments are deposited in the different setting along this coast?** Compare and contrast your finding with what you would predict to find at far offshore location like: 36˚ N 60˚ W. How does wave and current energy affect the type of substrate? How does the substrate affect bottom dwelling life?
3. **Water and the Ocean-Climate System: How does the temperature, salinity, dissolved oxygen of the water change laterally and vertically (depth profile) in this near shore environment?** Is this a salt wedge estuary? Compare and contrast your T-S-DO findings with what you would predict to find at 36˚ N 60˚ W.
4. **Life in the Sea: How does the type and abundance of marine life differ from one coastal habitat to another?** How do organisms adapt to the tides? What are some strategies that marine organisms use to survive?
5. **Waves, Tides, and the Coastal Environment: What evidence is there that the coastal ocean is a dynamic setting?** How has the longshore current affected the distribution of sand along Assateague Island? What is the direction of the longshore current there? Can we identify any former inlets from old maps of the Wachapreague area that are now closed? How might storms affect the coastline? Can we identify any washover fans? Can we identify areas susceptible to inlet formation? Are the barrier islands stationary or shifting their location? Why? What is the tidal range here? What is the tidal pattern here?
6. **Pedagogy: As future teachers consider how outdoor field trips and museums support classroom learning.** What works and why?

Your field trip report aims to address these questions based on your observations from the trip and integration of your observations with the oceanographic theory you will learn in class. Support your answers with evidence (i.e., descriptions of methods used to collect data, data tables, and figures, such as photos). Reports should be 12-16 pages, with 1.5 line spacing, 1"margins, Cambria 11pt font. Further details about the field project, including an evaluation rubric, will be handed out during or soon after the field trip.

Draft Field Report due Wed., Nov 28th.
Final Field Report due during final exam week, on Wed., Dec 12th.

Recommended Reading and Course Materials:

1. Required book: Leckie & Yuretich, 2011. **Investigating the Ocean, Illustrated Concepts & Classroom Inquiry**, McGraw Hill, 304 p., ISBN:-13:978-0-07-804152-5. (~$65 at the JMU bookstore). BRING THIS TO EVERY CLASS.
2. Occasional **outside reading** handed out in class and/or posted to Blackboard.
3. **PowerPoints** from lecture are posted to Blackboard. Note that lecture PowerPoints are mainly important diagrams with minimal text (e.g., new terms and concepts). Therefore it is critical that you attend class and **TAKE NOTES on what you are listening to, seeing, and doing in class and on homework.**
4. Topical **review guides** will be posted on Blackboard after a unit is completed and based on the material we cover in class. These are good resources for studying and preparing for exams as these review guides include a listing of the support resources specific to that topic,

and questions related to what we did in class and as homework on that topic. The exams are made based on the topics and questions in the review guides. The best method is to keep up with these each week. Waiting to use the review guides until the night before the exam is a bad idea.

5. **The National Ocean Literacy Principles and Fundamental Concepts**: (http://www.coexploration.org/oceanliteracy//usa/ocean_science_literacy/scope_and_sequence/home.html)
6. **Oceanography-Related VA Standards of Learning**: Look at each grade level and the Earth Science SOL for oceanographic content (http://www.doe.virginia.gov/testing/sol/standards_docs/science/review.shtml).

General Class Schedule: This is the tentative order of topics and their related readings. Be sure to check the white board in the front of the class each day for the daily outline and for any in-class or homework assignments. In-class activities will not be posted to Blackboard, homework assignments will be posted to Blackboard. Due to variable lengths of class discussions and activities, we may spend more or less time on each topic.

* note the chapter sections (e.g., 1.1, 1.2…) listed in the right column below corresponds to readings, not to the investigations (which have a similar, and therefore confusing, numbering system). I will assign specific investigations when appropriate as in-class activities or homework. BRING YOUR BOOK TO EVERY CLASS.

Date	Topics	Readings in Leckie & Yuretich, 2011*
Unit 1: Introducing the Ocean		
Wed 8/29	Why study the ocean?	1.1, 1.2, SOL and OLP handouts.
Fri 8/31	How can we determine our position at sea?	1.3, 1.4, 1.5, 1.6
Wed 9/5	How can we obtain depth information? Who owns the ocean?	1.7,1.8, 1.9, 1.10
Fri 9/7	What are we doing on our field trip? And field trip safety.	
Unit 2: Geology and the Ocean		
Wed 9/12	How did the oceans form? How do we know when different events in Earth history occurred? How are rocks of different locations correlated?	2.1, 2.2, 2.3
Fri 9/14	How do we know what the structure of the inside of the Earth is like? Why is the ocean floor low and continents high? What are the features on the ocean floor?	2.4, 2.5, 2.6
Sat 9/15 thru Mon 9/17	**Field Trip** to Sant Ocean Hall, Smithsonian; Assateague Island, and the VA Institute of Marine Sciences Eastern Shore Lab, Wachapreague.	
Wed 9/19	How can patterns of geographic, volcanic, seismic, and age data be used to construct the theory of plate tectonics?	Handout, 2.7, 2.8
Fri 9/21	What processes and resulting features exist at divergent, convergent, and transform plate boundaries? What are mantle plumes and hot spots?	2.9, 2.10. 2.11, 2.12

Date	Topics	Readings in Leckie & Yuretich, 2011*
Wed 9/26	**Exam 1; Oceanography in Action Topic Request forms due**	
Unit 3: Water and the Ocean-Climate System		
Fri 9/28	How is water unique and what is that important? How does the hydrological move water and heat around the planet? How long does a molecule of water reside in the ocean?	3,1, 3.2, 3.3, 3.5
Wed 10/3	What makes the ocean salty? How can we determine the salinity? Is the ocean getting saltier over time? *How do you make a poster using Power Point or Illustrator?*	3.4, 3.6
Fri 10/5	How does heat and salt affect ocean water density? What causes the ocean to be various shades of blue?	3.7, 3.8, 3.9
Wed 10/9	How and why does solar heating vary across the latitudes? What is the consequence of this variation in heating? What causes the seasons?	3.10, 3.11
Fri 10/12	What causes the pattern of the major wind belts? What causes the pattern of the major surface ocean currents?	3.12, 3.13, 3.14, 3.16, 3.17
Wed 10/17	How does the deep ocean circulate? How are the surface and deep ocean currents connected? How do winds cause vertical motion in the ocean? What causes monsoons and El Niňos?	3.18, 3.19, 3.20, 3.15
Unit 4: Life in the Sea		
Fri 10/19	How are marine organism classified? What are the environmental controls on life in the ocean?	4.1, 4.2, 4.3
Wed 10/24	What does the base of the marine food chain need to make food? How are nutrients and marine carbon recycled in the ocean? **Digital Poster Drafts due**	4.4, 4.5
Fri 10/26	How and why does biological productivity vary geographically and seasonally? How does energy and matter move through marine food chains?	4.6, 4.7
Wed 10/31	**Exam 2**	
Fri 11/2	What are the different major ecosystems in the ocean?	4.8, 4.9, 4.10, 4.11, 4.12, 4.13
Wed 11/7	No class**:** Dr. St. John at meeting in NC, work finalizing your posters.	
Fri 11/9	How is fishing done today? (a.k.a. where does the McDonald's fish filet come from?)	4.14, 4.15 (and video)
Mon 11/12	**Final Posters due** (submit file via email or usb drive, not blackboard)	
Wed 11/14	**Poster Presentations**	
Unit 5: Waves, Tides, and the Coastal Environment		
Fri 11/16	Where do waves come from? How do they change as they move towards the shore? What causes tsunami waves?	5.1, 5.2, 2.13, (5.11)
Wed 11/21	No class: Thanksgiving Break	
Fri 11/23	No class: Thanksgiving Break	

Date	Topics	Readings in Leckie & Yuretich, 2011*
Wed 11/28	What causes the tides? How can waves and tides be harnessed for energy? **Draft Field Report due.**	5.3, 5.4, 5.5
Fri 11/30	How do waves, the longshore current, and storms affect beaches and barrier islands? How are estuaries an important and unique coastal environment?	5.6, 5.7, 5.8, 5.9, 5.10, 5.11
Wed 12/5	What are the types of sediments on the seafloor? What controls their distribution pattern?	2.14, 2.15
Fri 12/7	What roles does the ocean have in global warming?	5.12, 5.13, 5.14
Mon 12/10	**Exam 3**, non-cumulative, 8-10 am (this is exam week)	
Wed 12/12	**Final Field Report Due** (this is exam week)	