

THIS DOCUMENT UPDATED 08.23.2016

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GEO130 Oceanography

Fall Semester 2016 (S1-2016)

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Class meets: 11:15 – 12:50 Tue, Thu

Office Hours by appointment

FINAL EXAM - Because of the odd time this class meets the final exam is given during the last scheduled day of class **Thursday December 1st @ 11:15 AM**

Things You Need to Know:

1. Class attendance is required.
2. If you miss a test there IS NO MAKE UP WITHOUT A VALID EXCUSE. That means you get a "Zero".
3. There is NO EXTRA CREDIT WORK. You have a number of opportunities to demonstrate what you have learned, 2 tests (100 pts. Each), 1 final exam (150 points) and 6 labs (20 points each) Total 470 points.
4. All work must be done on time.
5. You must do your own work.
6. In group learning situations (lab exercises) you must pull your own weight.
7. You must cite sources of specific information. We will follow the University's policy on plagiarism to the letter.
5. If you cheat you will be penalized as specified in the University's policy on cheating.
6. Disability policy: Students with documented disabilities will be accommodated in full compliance with Section 504 of the Rehabilitation Act of 1973, the Mount St. Joseph University provides academic adjustments and auxiliary aids for students with physical or mental impairments that substantially limit or restrict one or more of such major life activities as walking, seeing, hearing, or learning. Students with disabilities should the Director of Academic Support, to present documentation and develop individualized accommodation plans.

Updated versions of this document and other information are available at:

www.shorstmeyer.com/msj/geo130/info.html

TEXTBOOK

There is no textbook for this course.

Readings will be assigned as the semester progresses and listed on the class readings page.

WEB RESOURCES

An online textbook, Our Ocean Planet

<http://oceanworld.tamu.edu/resources/oceanography-book/contents2.htm>

Ocean Motion

<http://oceanmotion.org/>

NASA Science

<http://nasascience.nasa.gov/earth-science/oceanography/>

National Oceanographic Data Center

<http://www.nodc.noaa.gov/>

National Center for Environmental Prediction Marine Modeling and Analysis Branch

<http://polar.ncep.noaa.gov/>

HYCOM Hybrid Coordinate Ocean Model

<https://hycom.org/ocean-prediction>

Ocean Data and Maps from the National Centers for Environmental Prediction

<http://www.cpc.ncep.noaa.gov/products/GODAS/climatology.shtml>

SST Anomaly Maps

<http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/>

COURSE DESCRIPTION

From space the single most striking feature of the planet Earth is the vastness of the blue oceans, in fact Earth should probably be called "Oceania". Extraterrestrial observers would surely characterize our home as a water planet. The immense body of salt water is really a chemical soup and the home of countless numbers of plant and animal species, some undoubtedly yet to be discovered.

The oceans are vast reservoirs of heat and carbon dioxide and other gases and thus exert long and short term controls on climate. The oceans are a great food resource for the swelling numbers of people on Earth and at the same time a repository for the waste products generated by those societies. Unfortunately the oceans are abused and mismanaged to the point that it is questionable we can count on them as a resource in the future. Earth's oceans afford a means of transportation, opportunities for adventure, recreation and exploration. Earth's oceans are still largely unknown. The cold, dark, murky depths of Earth's oceans present an environment with extreme water pressure, cold temperatures and absolute darkness. It is an environment more difficult to survive than the surface of the moon.

GEO130 is the study of the physical characteristics of Earth's remarkable oceans, how the physical characteristics determine the distribution of life and moderate Earth's climates, and, how rapid changes are taking place leading to an uncertain future

Goals of GEO 130

1. **Increase each student's ability to think critically about political and social issues involving Earth's ocean.** A scientist is an open minded yet skeptical individual who uses various approaches of investigation (termed the scientific method) to observe, organize the observations into data, make hypotheses, draw conclusions and test those hypotheses. We will emulate these approaches in GEO130.
2. **Clarify the physical role of Earth's oceans** in the distribution of climates, climate change and global warming, the distribution of life and in the physical and social history of our planet.
3. **Examine the biological environments** of Earth's oceans.
4. **Examine changes occurring to Earth's ocean** in the short and long term, small and large spatial scales and both physical and biological. Important in this is the ability to distinguish the large-scale average state (temporal and spatial) from a specific state at a place and time and decide if the specific state is an indicator of a long-term trend.

Course Content

1. **Class lectures.**
2. **Demonstrations**
3. **7 lab Exercises**
4. **10 Films – You will be TESTED on these**

Grading and Assignments	% OF FINAL GRADE
2 tests – 100 points each (200)	41%
A semi-comprehensive final 150 points	30%
7 lab exercises – 20 points each (140)	29%
Total 490 points	

Test Dates:

Thu Sep 22

Thu Oct 27

Final Exam Thu Dec 1, 11:15AM

Test format: You **will not** see multiple choice questions. You will see short answer questions, diagrams and graphs, maps and definitions. As far as is possible I will minimize rote memory questions and emphasize concepts. Remember – give me a fish and I eat for a day, teach me to fish and I eat for a lifetime. A fish is like a tidbit of information. The process of fishing allows the gathering of an unlimited number of tidbit, then using the scientific method forming a hypothesis about the as long as the fish population has not be decimated by over fishing.

ALL information presented in class, including news worthy events, the films, laboratory background information and exercises is fair game for test questions. Tests are given on Thursdays. The Tuesday preceding a test is a review session.

Test grading philosophy: No one can write a perfect test and there are many reasons test scores vary so final grades will be relative to class performance.

Test dates are fixed and will not vary (blizzards, earthquakes, tornadoes etc. being examples of exceptional circumstances for which allowances will be made). If we fall behind the schedule as specified below the content of a scheduled test will vary but the test date is fixed.

Laboratory exercises: Lab exercise submissions will be accepted in electronic form via email only.

Lab exercises are designed to increase student's ability to think critically by expanding on lecture topics and incorporating the Mount St. Joseph University baccalaureate learning outcomes and performance indicators (LOPIs).

1. **Problem Definition:** Elucidate the scientific conceptual basis of the current topic as a chain of cause and effect from the smallest applicable scale to the global scale.
2. **Quantitative Literacy:** Using real-world data, creating maps, cross sections, time sections and graphs that describe the temporal and spatial variation ocean variables (water temperature, salinity, dissolved gas concentration, chlorophyll concentration).
3. **Scientific Literacy:** Demonstrate competence using the scientific method by using the raw data, maps, graphs, cross sections and time sections created in #2 to state a testable hypothesis.
4. **Information Literacy:** Support your hypothesis by comparing the evidence you used to develop it to readily available scientific evidence on the same topic. Cite your sources.
5. **Synthesize** the evidence into several concise, general statements that summarize the solution to the problem. Highlight the features, physical geography and biology of Earth's oceans (it should really be singular because there is only one ocean, after all they are connected.)
6. **Integrative Learning – Connections across Disciplines:** Summarize ongoing changes in the Ocean-Atmosphere-Earth system, how those changes may modify interactions with society in the future and what society can and should do in the face of a changing global environment.

GENERAL INFORMATION YOU MUST KNOW: *If it is presented in class you are responsible for it and you may see it on a test.* As much as possible GEO130 will be concept oriented and I will minimize rote memorization. However every subject has general information that must be committed to memory

To successfully complete GEO130 you must be able to locate and identify on a map:

1. Any location by latitude and longitude in both decimal degrees and degrees, minutes, seconds.
2. All Earth's ocean basins and continents
3. Major seas and other water bodies of Earth (Red Sea, Mediterranean Sea, Gulf of Mexico, Caribbean Sea, South China Sea and others).
4. Major surface features of the oceans (major currents, gyres, upwelling locations and major areas of seasonal change of salinity, dissolved gas and primary productivity).
5. Major wind systems of Earth's atmosphere.
6. The general vertical distribution of ocean physical properties (temperature, salinity, dissolved gases).
7. The major features of the sea floor, primarily by feature type but there will be some specific features.

GEO130 Fall 2015 Flexible Schedule of Topics

Dates	Topic
Aug 23/25	Requisite red tape and introductory remarks Ways of viewing the world Scientific Method, What is Science, Birth of the Universe Introducing Earth, Earth's History and the formation of the oceans History of Oceanography Begin Plate Tectonics Film: <i>How the Earth Was Made</i>
Aug 30/Sep1	Plate Tectonics – A Scientific Revolution Ocean Basins, The Sea Floor, Sediments Lab #1 The sea floor Film: <i>Japan's Killer Quake</i>
Sep 6/8	Finish Lab #1, Plate Tectonics, Ocean Basins and Sediments Start Water Characteristics, Kinetic Theory
Sep 13/15	Water, Kinetic Theory, evaporation and condensation, dissolved gasses, The QLL and other reasons water is cool - <i>see class website</i> Lab #2 Geography of Ocean Basins, Continents and Surface Currents Film: <i>Violent Hawaii</i>
Sep 20	Wrap up unfinished business Review for Test #1 Film: <i>The Blue Planet: Ocean World - 2nd Half Tuesday</i>
Sep 22	Test #1
Sep 27/29	Atmospheric and Oceanic Circulation Lab #3: Geography of Salinity, Dissolved Oxygen (and other gases) and nutrients
Oct 4/6	Eastern and Western Boundary Currents Heat Flux and Upwelling Lab #4: The Thermocline Film: <i>The Blue Planet: Seasonal Seas</i>
Oct 11/14	Heat Flux, Upwelling, Primary Productivity Lab #5: Eastern vs. Western Boundary Currents
Oct 18/20	Life in the Ocean Primary Productivity Lab #6: Seasonal Variation of Primary Productivity Thursday; Film - <i>The Blue Planet: Coral Seas</i>

Oct 25	Finish Primary Productivity Wrap up unfinished business Review for Test #2 Test #2 Thursday Film - <i>The Blue Planet: The Deep</i> – Last Half Tuesday
Oct 27	Test #2
Nov 1/3	Start: The Ocean, Weather and Climate Climate vs. Weather – Guiding Principles Broad Climate Patterns and El Niño/La Niña/ENSO Seasonal Variations and The Asian Monsoon Smaller Patterns – Nor'easters Tropical Cyclones
Nov 8/10	The Ocean and Climate, Climate Change, Global Warming and The Role of Human Activities Film - <i>The Blue Planet: Frozen Seas</i>
Nov 15/17	The Ocean and Climate: The Deep Past and the Distant Future Lab #7 Changing Climate Film – <i>Earth: The Biography – Ice</i>
Nov 22	Climate Change and Ocean Change Finish Climate Change
Nov 24	Thanksgiving Day
Nov 29	Wrap up and Review
Dec 1	Thursday Dec 1 Final Exam