GEOL4465/5465 Physical Oceanography and Limnology

Course Information

Instructor:
Arne Winguth, Ph.D., Professor

Office Number:
GS (Geosciences) 238

Office Telephone Number:
817-272-2977

Email Address:
awinguth@uta.edu

Faculty Profile:
https://mentis.uta.edu/explore/profile/arne-winguth

Office Hours:
Tuesday & Thursday 12:30 pm - 1:00 pm or after appointment

Course Information

Section Information:
GEOL 4465-001 / GEOL5465-001

Teaching Assistant:
Josh Pulcinella

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joshua.pulcinella@mavs.uta.edu

Office Hours:
Tuesday & Thursday 10:00 am - 11:00 am or after appointment

Section Information:
Lecture GEOL4465/5465-001
Lab GEOL4465/5465-011

Time and Place of Class Meetings:
Lecture: Tuesday & Thursday 11:00 am – 1:20 pm, Geosciences Room 109
Lab: Thursday, 1:00 pm – 2:20 pm, Geosciences Room 202

Additional books recommended:


Stewart, R., Introduction to Physical Oceanography, pdf provided on Blackboard.


**Description of Course Content:** This course offers an introduction to physical processes in the oceans. The oceans are an important part of the global climate system. Changes in the global climate system, such as global warming, do influence the immense amount of heat, moisture, and momentum stored in the ocean. In this course, we will introduce some elementary knowledge of the ocean, its circulation, and its impact on the global climate. Prerequisites: general physics, and calculus or cons. instr.

**Student Learning Outcomes:** After completion of this class, students will be familiar with the key terminology pertaining to the oceans and will have a well-rounded understanding of the major physical process in oceanography as well as the complex interactions among the various components of the climate system. The student will be able to:

- Identify reasons why ocean sciences are important and affect, e.g., our lives and the world economy.
- Explain the major features of the seafloor.
- Summarize the major physical and chemical properties of seawater and how each affects the ocean circulation.
- Understand the feedbacks of the ocean’s processes with processes in other components of the Earth’s climate system (atmosphere, terrestrial biosphere, cryosphere, and geosphere).
- Analyze the atmospheric circulation system.
- Understand principles of the ocean circulation (due to friction, rotation of the Earth, and pressure changes).
- Analyze the wind-driven and density-driven ocean/lake circulation.
- Quantify turbulence and its impact on the ocean/lake circulation.
- Describe the principles involved in the generation of waves and tides and evaluate their effects on coastal/lake processes and energy generation.
- Identify the consequences of a rise in sea level on the coastal zone and society, and possible mitigation and adaptation strategies.
- Identify major factors leading to climate change, and assess future climate projections.
- Discuss the societal relevance of physical oceanography and limnology for global and regional initiatives and political decisions.
This knowledge will enable the students to better understand topics of great societal importance, such as future climate change, tsunamis, large-scale propagation of pollutants, and environmental sustainability.

**Grading:** Lecture grade: 75% of total course; Lab grade: 25% of total course

| Lab grade: | 25% of total course grade |
| Lecture grade: | 75% of total course grade |
| **Lecture grade:** | |
| In class quizzes (best 3 of 4) | 10% of course (3.33% each) |
| Exams (2) | 30% of course (15% each) |
| Project (1) | 15% of course |
| Final exam | 20% of course |

**Final grade calculation:**

\[
0.25 \times \text{lab} + 0.10 \times \text{quizzes} + 0.20 \times \text{exams} + 0.15 \times \text{project} + 0.20 \times \text{final exam}
\]

Score will be translated into a grade based on class average. Maximum score in each category is 100%.

Grades will not be released over the phone or by email. Grades must be either obtained in person or from the UTA online database. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels; see also “Student Support Services,” below.

**Descriptions of major assignments and examinations:**

**Exams:**
Two exams and one final exam will be problem exercises and multiple-choice questions. Exams must be taken at the scheduled time.

**Make-up exams:**
Make-up exams can be only taken in cases of illness or family emergency. A written excuse note from doctor or official may be required in these cases. Students who do not take an exam receive zero points as a grade on that exam. Make-up exams are scheduled and set by the instructor.

**Quizzes:**
Four lecture quizzes are not announced. The three best quizzes will be counted towards the total grade. There are no make-up quizzes. Echo360 quizzes are taken on-line in class for extra credit.

**Field trip:**
Is strongly recommended (corresponding to one lab extra credit) in order to write the project paper.

**Project paper:**
A signature research assignment in the area of oceanography is designed to stimulate critical thinking skills, teamwork skills, communication skills, and empirical and quantitative skills. Physical and biogeochemical measurements (e.g. temperature, salinity, oxygen, nutrients) from the lake fieldtrip will be analyzed as part of the project. Total report length for each team will be max. 5 pages of text including references. Figures and table shall be attached to the report. The format of the text shall be in letter size, single-spaced, 12 pt times new roman font. Each team will present the project in a 10-minute presentation (including discussion). The project paper has to be written in a scientific style.

**Format of paper submission: Only pdf via submission to blackboard**
Identical copy of text for the term paper from web or other sources (plagiarized papers or web pages) will result in an F.

**Teamwork:**
Teamwork is encouraged to stimulate scientific discussion in lecture and lab. Teamwork is allowed in the lab and project with **maximum team size is three students**. In oral presentations, **each** team member needs to present the material. It is the student’s responsibility to form a team and coordinate with other team members.

**Required Readings:**
Readings listed on the syllabus should be completed before the lecture. The lectures will be designed with the assumption that you have a basic understanding of the assigned material.

**Expectations for Out-of-Class Study:**
A general rule of thumb is this: for every credit hour earned, a student should spend 3 hours per week working outside of class. Hence, a 4-credit course might have a minimum expectation of 12 hours of reading, study, etc.

**Institution Information**
UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the **Institutional Information** page (http://www.uta.edu/provost/administrative-forms/course-syllabus/index.php) which includes the following policies among others:
- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

**Additional Information**

**Attendance:**
At the University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students’ academic performance, which includes establishing course-specific policies on attendance. As the instructor of this course, I strongly recommend attendance and will count it as extra credit. However, while UT
Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients “begin attendance in a course.” UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Emergency Exit Procedures:
Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Success Programs:
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

Emergency Phone Numbers
In case of an on-campus emergency, call the UT Arlington Police Department at 817-272-3003 (non-campus phone), 2-3003 (campus phone). You may also dial 911. Non-emergency number 817-272-3381
# Course Schedule GEOL 4465/5465 Physical Oceanography & Limnology

**Spring 2019**

“As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.” – Arne M.E. Winguth 08/18/19

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Days</th>
<th>Topics</th>
<th>Reading Text¹</th>
<th>Problem Sets</th>
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<tbody>
<tr>
<td>1</td>
<td>Aug. 22, 27</td>
<td><strong>Introduction and Historical Review</strong></td>
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<td>Overview, space and time scales</td>
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<tr>
<td>2</td>
<td>Aug. 29, Sep. 3</td>
<td><strong>Ocean Dimensions, Shapes, and Bottom Materials</strong></td>
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<td></td>
<td></td>
<td>Dimensions, bathymetry, sea floor, shelf, slope, abyssal plain, trenches</td>
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<tr>
<td>3</td>
<td>Sep. 5, 10, 12</td>
<td><strong>Physical Properties of Seawater</strong></td>
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<td></td>
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<td>Pressure, temperature, salinity, density, tracers, sound, light and ice</td>
<td>3</td>
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<tr>
<td>4</td>
<td>Sep. 17, 19</td>
<td><strong>Typical Distributions of Water Characteristics</strong></td>
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<td></td>
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<td>Distribution of temperature, salinity, tracers, age</td>
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<tr>
<td>1. EXAM</td>
<td>Sept. 24</td>
<td><strong>Material Chapter 1-4</strong></td>
<td>1-4</td>
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<tr>
<td>5</td>
<td>Sep. 26</td>
<td><strong>Mass, Salt, and Heat Budgets and Wind Forcing</strong></td>
<td>5</td>
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<td></td>
<td>Oct. 1</td>
<td>Conservation of volume, mass, and heat; heat fluxes, and transport; wind stress forcing</td>
<td>#3: Ch. 4</td>
<td></td>
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<tr>
<td>6</td>
<td>Oct. 3</td>
<td><strong>Data Analysis and Observational Methods</strong></td>
<td>6</td>
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<td></td>
<td>Oct. 8</td>
<td>Sampling, error, statistics, multi-dim. sampling</td>
<td>#4: Ch. 5</td>
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<tr>
<td>7</td>
<td>Oct. 10, 15, 17, 22, 24</td>
<td><strong>Dynamical Oceanographic Processes</strong></td>
<td>7</td>
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<td>Mass balance, momentum balance, mixing (turbulence), geostrophy, vorticity, wind-driven circulation, buoyancy forcing, and abyssal circulation</td>
<td>#5: Ch. 6, #6: Ch. 7</td>
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<tr>
<td>Fieldtrip</td>
<td>Oct. 19</td>
<td><strong>Lake Fieldtrip 8:00-18:00</strong></td>
<td>Notes</td>
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<td>(Rain date Oct. 20)</td>
<td>8:30 am – 5:00 pm</td>
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<td>2. EXAM</td>
<td>Oct. 29</td>
<td><strong>Material Chapter 5-7</strong></td>
<td>7-12</td>
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<td>8</td>
<td>Oct. 31, Nov. 5, 7</td>
<td><strong>Gravity Waves , Tsunami, and Tides</strong></td>
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<td></td>
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<td>Wave characteristics, gravity waves, tsunamis, tides, estuaries</td>
<td>#7: Ch. 8</td>
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<td>9</td>
<td>Nov. 12, 14</td>
<td><strong>Limnology</strong></td>
<td>Lecture notes</td>
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<td></td>
<td></td>
<td>Theory of physical limnology</td>
<td>#8 Ch. 9</td>
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<tr>
<td>10</td>
<td>Nov. 19, 20, 21, 26</td>
<td><strong>Climate Change &amp; Variability</strong></td>
<td>Lecture Notes, IPCC²</td>
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<td>Present and future, ENSO, AMO, PDO</td>
<td>#9 Ch. 10</td>
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<tr>
<td>Paper</td>
<td>Nov. 21, Nov. 22</td>
<td>Final Project Presentation in Lab 1:00 pm</td>
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<td>Final Due Date Project Paper 11:59 pm</td>
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<td>11</td>
<td>Nov. 26, Dec. 3</td>
<td><strong>Review</strong></td>
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<tr>
<td>FINAL</td>
<td>Dec 5</td>
<td><strong>FINAL EXAM</strong></td>
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