The Hong Kong University of Science and Technology
Department of Ocean Science

Descriptive Physical Oceanography

OCES 2003

3 credits

Pre-requisites: (PHYS 1101 OR PHYS 1111 OR PHYS 1112 OR PHYS 1312) AND (MATH 1012 OR MATH 1013 OR MATH 1020 OR MATH 1023). Can be done as co-prerequisites.

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Consultation Hours: after lecture, Rm 5485 (Lift 25/26)

Course Description

The ocean is dynamic and how it transports and stores tracers in marine environments highlights the crucial role of physics to other areas of marine sciences. This descriptive physical oceanography course introduces concepts, terminology, and topics in physical oceanography relevant to anyone involved in ocean/marine sciences, be it in an ecology/biology/chemistry or in an engineering/physics/mathematics capacity, and is compulsory for all OST majors. While the course will touch on some specialized geographical characteristics of the physical phenomena, the primary focus of the course will be on dynamical processes from a descriptive point of view, as the dynamics part is more widely applicable. The course material will be primarily visual and qualitative. Wherever turning slightly quantitative, the course material will involve interpretable calculation symbols serving to build up conceptual understanding.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Describe the large-scale distributions of ocean's physical properties (e.g., temperature, salinity, and currents).

2. Describe various oceanic physical processes spanning different spatial and temporal scales, and their interactions and impacts on the ocean state.

3. Explain the basic principles of ocean physics (e.g., equation of state of seawater, consequence of stratification, effects of Earth's rotation, transport by mean and fluctuating ocean currents).

4. Identify ocean processes from observations (e.g., meridional heat transport by geostrophic and overturning circulations).

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Mid-term exam	40%	*
Final exam	45%	*
Class attendance	15%	continuous

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Midterm and Final	ILO1, ILO2, ILO3, ILO4	Formal closed-book exams with questions designed to link concepts covered in class in a comprehensive fashion.
Class attendance	ILO1, ILO2, ILO3, ILO4	Class attendance to discuss and find scientific links among concepts.

Grading Rubrics

The midterm and finals work similarly, and will be marked out of 40 and 45, respectively. In either case, approximately 80% of the questions focus on the basics, and the rest resolves around extensions from what is covered in class but based on the same fundamental concepts. Both exams are composed of multiple choice questions plus essay type questions.

For class attendance, 23 lectures are scheduled. Discounting the add/drop period, attendance will be recorded in at least 15 out of the remaining 19 classes, with one credit subtraction upon one record of absence. The total attendance credits for will be calculated at the end of the class.

Final Grade Descriptors:

Below are sample grade boundaries subject to minor adjustments (except the F grade boundary which is non- negotiable).

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance (>85% in the course)	Shows mastery of knowledge and understanding of the main subject matter, can problem-solve.
B	Good Performance (70 – 85% in the course)	Shows good knowledge and understanding of the main subject matter, competence in problem-solving.
C	Satisfactory Performance (50 – 70% in the course)	Shows adequate knowledge and understanding of the main subject matter, some issues with problem-solving.
F	Fail (<50% in the course)	Shows poor knowledge and understanding of the main subject matter, struggles with problem-solving.

Course AI Policy

The midterm and final are both assessments that are closed book with no access to any external material, including AI.

Communication and Feedback

We follow a 48-hour email return policy i.e., please allow at least 48 hours before your email is addressed.

Resubmission Policy

Given the arrangements of closed book exams with consistent timing, no resubmission issue will be involved under normal circumstances.

Required Texts and Materials

The instructor's slides are designed to cover essentially everything needed for this course. Students are encouraged to take additional in-class notes, particularly during chalkboard tutorial sessions.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

[Optional] Additional Resources

- Lynn D. Talley, George L. Pickard, William I. Emery, and James H. Swift, *Descriptive Physical Oceanography*, Academic Press, 2nd Ed., 2011.
- Kris Karnauskas, *Physical Oceanography and Climate*, Cambridge University Press, 2020.
- John A. Knauss and Newell Garfield, *Introduction to Physical Oceanography*, Waveland Press, 3rd Ed., 2016.
- Robert H. Stewart, *Introduction to Physical Oceanography*, 2008, freely accessible via https://hdl.handle.net/1969.1/160216.
- John Marshall and R. Allen Plumb, *Atmosphere, Ocean and Climate Dynamics*, Academic Press, 2007.
- Gerold Siedler (Ed.), Stephen M. Griffies (Ed.), John Gould (Ed.), and John A. Church (Ed.), *Ocean Circulation and Climate*, Academic Press, 2nd Ed., 2013