The Hong Kong University of Science and Technology

UG Course Syllabus

Essential Oceanography

OCES3204

No. of Credits:3

Name: Prof. Yan Wang and Prof. Charmaine Yung

Email: yanwang@ust.hk, ccmyung@ust.hk

Class time: Monday (1:30PM - 2:50PM), Friday (9:00AM - 10:20AM)

Course Description

This course invites students to explore the ocean through an interdisciplinary lens, integrating concepts from physics and biogeochemistry. Students will investigate oceanic dynamical processes, marine ecosystems, and the chemical composition of seawater while considering the interconnectivity of these fields. The curriculum includes topics including ocean circulations and transports, biogeochemical cycles, and marine biodiversity. The course emphasizes fundamental oceanic processes while enables students to address complex oceanographic challenges. By bridging multiple disciplines, this course prepares students for careers in marine science, environmental policy, and sustainability.

Intended Learning Outcomes (ILOs)

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

1. Describe the fundamental physical, chemical, and biological processes that govern ocean systems.

2. Explain the interactions between physical and biogeochemical processes in the ocean.

3. Analyze the spatial and temporal variability of oceanographic phenomena.

4. Evaluate the impacts of physical processes on marine ecosystems.

5. Apply oceanographic principles and data to address real-world problems related to climate change, coastal management, or resource sustainability.

6. Communicate oceanographic concepts and research findings in written and oral formats.

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:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date
Mid-term exam	45%	Refer to the class schedule
Final exam	45%	Refer to the exam timetable
In-class participation	10%	N/A

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Mid-term exam	ILO1, ILO2, ILO3, ILO4, ILO5, ILO6	This exam assesses students' ability to critically evaluate oceanographic phenomena and analyze its driving force, demonstrating logical thinking and quantitative skills of analysis and evaluation.
Final exam	ILO1, ILO2, ILO3, ILO4, ILO5, ILO6	This exam assesses students' ability to explain and apply oceanographic concepts, evaluate their implications, analyze their spatial and temporal variations, and interpret oceanic and climate impacts on marine ecosystems.
In-class participation	ILO3, ILO4, ILO5, ILO6	In-class participation assess students' ability to critically evaluate oceanographic data and apply oceanographic principles to practical problems, such as global climate changes, demonstrating higher-order thinking skills of analysis and evaluation.

Grading Rubrics

[Detailed rubrics for each assignment will be provided. These rubrics clearly outline the criteria used for evaluation. Students can refer to these rubrics to understand how their work will be assessed.]

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

The midterm and final are both assessments that follow closed-book formats 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.

Tentative syllabus

Week	Date	Topic	Instructor
1	2/2	Transport principles: box models	Yan Wang
	6/2	Transport principles: advection and diffusion	Yan Wang
2	9/2	Momentum: external forcing & rotation	Yan Wang
	13/2	Momentum: Ekman transport & balanced motion	Yan Wang
3	16/2	Inferring circulations from a stratified ocean	Yan Wang
	20/2	Tropical ocean circulations	Yan Wang
4	23/2	Life in a Moving Fluid: Plankton advection vs. swimming	Charmaine Yung
	27/2	Biological response to Ekman Pumping	Charmaine Yung
5	2/3	The Microbial Loop and diffusion limits	Charmaine Yung
	6/3	The Biological Pump vs. Physical Mixing	Charmaine Yung
6	9/3	Global nutrient distribution & stoichiometry	Charmaine Yung
	13/3	Physics driving Biology: ENSO variability & ecosystem shifts	Charmaine Yung
7	16/3	Review Section	Yan Wang & Charmaine Yung
	20/3	Mid-term exam	Yan Wang & Charmaine Yung
8	23/3	Potential vorticity: gyres and boundary currents	Yan Wang
	27/3	Potential vorticity: abyssal ocean circulations	Yan Wang
9	30/3	Buoyancy-driven processes: air-sea fluxes & upper-ocean responses	Yan Wang
	3/4	Mid-term break	
	6/4	Mid-term break	
	10/4	Interior turbulent transport & mixing	Yan Wang
10	13/4	Buoyancy-driven processes: ice-covered oceans	Yan Wang
	17/4	Benthic Boundary Layers: Sediment transport & pore water	Charmaine Yung
11	20/4	Buoyancy-driven Ecosystems: Estuaries & River Plumes	Charmaine Yung
	24/4	Cryosphere-Biology Coupling: Ice edge blooms & polynyas	Charmaine Yung
12	27/4	Fisheries Oceanography: Recruitment in turbulent flows	Charmaine Yung
	1/5	Holiday	
13	4/5	Life in the Stratified Ocean: Meso- and Bathypelagic layers	Charmaine Yung
	8/5	Chemosynthesis & Geophysics: Vents and Seeps	Charmaine Yung
		Final exam	