UNSW Course Outline

ZPEM3404 Ocean Waves and Modelling - 2024

Published on the 01 Jul 2024

General Course Information

Course Code : ZPEM3404
Year : 2024
Term : Semester 2
Teaching Period : Z2
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : UC Science
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course covers ocean waves and modelling. Waves occur both on the surface of the ocean and within the ocean interior. Internal waves are important in mixing and sonar operations. After reviewing the basic principles of surface waves, this course presents the basics of internal

waves, examining the dynamics, generation, propagation, and their impact on the ocean environment. Ocean modelling is a key component both in climate studies and naval operations. Basic modelling principles will be covered for both analytical and numerical ocean models with application to examples such as small-scale coastal systems, tsunamis, and the global ocean circulation.

Course Aims

Understanding of waves, particularly internal waves, and ocean modelling.

There are two main sections in this course: waves and modelling. For the waves section the topics include: the dynamics, generation, and propagation of gravity waves, both surface and internal, and the role of internal waves in mixing, bottom currents, and acoustic propagation. The modelling section will introduce the basics of numerical modelling and cover both analytical and numerical with applications to both a small-scale coastal system and the global ocean. This course assumes knowledge of the second year course: Australian Waters and their Dynamics.

Relationship to Other Courses

This course builds on the Ocean Dynamics component of the second-year course ZPEM2401 and the Ocean Mixing component of the third-year course ZPEM3401, further exploring ocean waves, including their impact on ocean mixing.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Demonstrate a good understanding of the dynamics of surface and internal waves; their generation, propagation and dynamics, and be able to solve related conceptual and practical problems.
CLO2 : Demonstrate an understanding of the basics of ocean modelling; the differences between analytical and numerical modelling, an understanding of their limitations, and be able to solve related conceptual and practical problems.
CLO3 : Investigate ocean waves and modelling concepts in laboratory experiments or computer programs, and relate the results to the ocean

Course Learning Outcomes	Assessment Item
CLO1 : Demonstrate a good understanding of the dynamics of surface and internal waves; their generation, propagation and dynamics, and be able to solve related conceptual and practical problems.	• final three hour exam • 3 in-class tests
CLO2 : Demonstrate an understanding of the basics of ocean modelling; the differences between analytical and numerical modelling, an understanding of their limitations, and be able to solve related conceptual and practical problems.	• coursework, 6 lab reports • final three hour exam • 3 in-class tests
CLO3 : Investigate ocean waves and modelling concepts in laboratory experiments or computer programs, and relate the results to the ocean	• coursework, 6 lab reports • final three hour exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

The course is taught through classes and laboratory sessions. Classes will outline the core material and give an opportunity to explore applications of theory together with problem solving. The lab component will give hands-on exposure to key concepts. Supplementary material is presented on Moodle. You should revise regularly and keep up to date with the material. Enrolment in this course or participation in any activity that is recorded constitutes consent to be recorded during tutorial and other teaching sessions. Recordings will only be used for the

purposes of teaching this course. If you do not consent to be recorded, you must notify your course convenor immediately so other arrangements can be made.

Additional Course Information

In this course we investigate surface and internal waves and an introduction to ocean modelling. The course assumes knowledge of ocean dynamics and introductory ocean wave theory. Wave topics include the dynamics, generation and propagation of surface and internal gravity waves, and the role of internal waves in mixing, bottom currents, and acoustic propagation. The modelling section will introduce the basics of numerical modelling and cover both analytical and numerical with applications to both a small-scale coastal system and global ocean.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
final three hour exam	40%	Start Date: Not Applicable Due Date: Not Applicable
coursework, 6 lab reports Short Extension: Yes (5 days)	30%	Start Date: Not Applicable Due Date: Not Applicable
3 in-class tests Short Extension: Yes (5 days)	30%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

final three hour exam

Assessment Overview

Not specified

Course Learning Outcomes

- CLO1 : Demonstrate a good understanding of the dynamics of surface and internal waves; their generation, propagation and dynamics, and be able to solve related conceptual and practical problems.
- CLO2 : Demonstrate an understanding of the basics of ocean modelling; the differences between analytical and numerical modelling, an understanding of their limitations, and be able to solve related conceptual and practical problems.
- CLO3 : Investigate ocean waves and modelling concepts in laboratory experiments or computer programs, and relate the results to the ocean

Detailed Assessment Description

A 3-hr final comprehensive exam held during the scheduled examination period. The exam will be

on paper and only calculator is allowed.

Assessment Length

2hrs

Assignment submission Turnitin type

Not Applicable

coursework, 6 lab reports

Assessment Overview

Not specified

Course Learning Outcomes

- CLO2 : Demonstrate an understanding of the basics of ocean modelling; the differences between analytical and numerical modelling, an understanding of their limitations, and be able to solve related conceptual and practical problems.
- CLO3 : Investigate ocean waves and modelling concepts in laboratory experiments or computer programs, and relate the results to the ocean

Detailed Assessment Description

There will be 3 lab reports, each weight 10%.

Late Submission of Assessment Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.

Assessment Length

3hrs

Assessment information

Three laboratories worth 10% each. These will be held in weeks 3, 6 and 11

Assignment submission Turnitin type

Not Applicable

3 in-class tests

Assessment Overview

Not specified

Course Learning Outcomes

- CLO1 : Demonstrate a good understanding of the dynamics of surface and internal waves; their generation, propagation and dynamics, and be able to solve related conceptual and practical problems.
- CLO2 : Demonstrate an understanding of the basics of ocean modelling; the differences between analytical and numerical modelling, an understanding of their limitations, and be able to solve related conceptual and practical problems.

Detailed Assessment Description

Two class tests worth 15% each on material covered since the previous class test. These will be held in weeks 7 and 12. (30%)

Assessment Length

1hr

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Assessment Breakdown:

- Lab report: 10%+10%+10%=30%
- Midterm Test: 15%+15%=30%
- Final Exam: 40%

Labs: Three laboratories worth 10% each. These will be held in weeks 3, 6 and 11.

Exams and Tests: Class Tests: Scheduled for Week 4 and 12. This will be a 1-hour test consisting of multiple-choice and short-answer questions covering the material from the first half of the course. It will account for 30% of the overall grade.

Final Exam: This will be a 3-hour exam (on paper) held during the examination period, consisting of multiple-choice, short-answer, and long-answer questions. Calculators are permitted to bring. It will cover all course content and account for 40% of the overall grade.

General Assessment Information

Missed Assessments:

If a student misses an assessment due to valid reasons (e.g., medical or personal emergencies), they must provide appropriate documentation. Arrangements will be made for a make-up assessment or an alternative assignment, depending on the situation.

Use of AI:

Students must adhere to UNSW's policy on the use of Artificial Intelligence (AI) in academic work. Unauthorized use of AI tools for generating assessments will be considered academic misconduct. Any assistance received from AI must be properly acknowledged and used in compliance with academic integrity guidelines.

Grading Basis

Standard

Requirements to pass course

The assessment for this course has been designed so that an overall mark of **50%** or greater indicates that the student has unambiguously demonstrated satisfactory completion of each learning outcome. For this reason, and consistent with the UNSW policy of abolishing the Pass Conceded grade, students who receive less than 50% overall for the course will receive a fail grade.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Internal waves
Week 2 : 22 July - 26 July	Lecture	Internal Waves
Week 3 : 29 July - 2 August	Laboratory	Lab 1 internal Waves
	Lecture	Internal Waves
Week 4 : 5 August - 9 August	Lecture	Internal waves
Week 5 : 12 August - 16 August	Lecture	Internal tides
Week 6 : 19 August - 23 August	Lecture	Planetary waves
	Laboratory	Lab 2 shallow water wave Model
Week 7 : 9 September - 13 September	Lecture	Ocean models introduction
Week 8 : 16 September - 20 September	Lecture	How models work+Box Model
Week 9 : 23 September - 27 September	Lecture	1D grids, numerical stability Discretising tsunami model
Week 10 : 30 September - 4 October	Lecture	Model errors 2D, 3D grids models
Week 11 : 7 October - 11 October	Lecture	Basic model application
	Laboratory	
Week 12 : 14 October - 18 October	Lecture	Basic model application

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings. Students are indeed expected to attend all lectures, tutorials, laboratory sessions and assessments unless their absence has been approved by the course coordinator. Students who have missed assessments or a laboratory, or expect to miss such a requirement, must inform the course coordinator by email at the earliest practicable date:
In typical circumstances of missed assessments, a formal application for Special Consideration via the prescribed University procedure may be appropriate. Alternative assessment can then be arranged. Otherwise, in the case of absence a mark of zero will be awarded for the assessment. Further information is available under 'assessments'.

General Schedule Information

There are three classes per week and three laboratory sessions scheduled for the semester. You are expected to attend all.

Course Resources

Prescribed Resources

The lecture notes and slides will be updated weekly on Moodle.

Recommended Resources

Recommended Readings

1. Fluid Mechanics, Kundu, Cohen, and Dowling, Academic Press, 5th edition, 2012 available in the library.

2. Introduction to Physical Oceanography (particularly chapter 15): R. H. Stewart A free download from https://oaktrust.library.tamu.edu/handle/1969.1/ 160216. Ocean Models, by the Computational Science Education Project

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course. Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff

Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development. Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy https:// www.gs.unsw.edu.au/policy/documents/stu dentcodepolicy.pdf

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Zhibing Li		G19, B26	0420215236	Monday to Friday 9.30am to 6.00pm	No	Yes