Course Outline

MSCI3001 / MSCI5004

Physical Oceanography / Oceanographic Processes

Biological and Earth Sciences

Faculty of Science

Session T2, 2019

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor/ Lecturer	Alex Sen Gupta	a.sengupta@unsw.edu.au	Any time by appointment	93858951
Teaching Assistant	Veronique Lago	v.lago@unsw.edu.au	Any time by appointment	

2. Course information

Units of credit: 6

Pre-requisite(s): Any 6 Units of Credit of Level I Mathematics

Teaching times and locations: ?

http://www.timetable.unsw.edu.au

2.1 Summary & Aim

Ocean motion and the movement of heat, nutrients and other properties have direct impacts on climate and weather, coastal infrastructure and marine species. In this course, we dive into how the ocean works. From the East Australian Current to the global conveyor belt, and from eddies to beach waves. We will cover the dynamics and properties of ocean water and the way those are measured, and apply it to problems like El Nino, coral bleaching, the great garbage patches and Global Warming.

The main aim of the course is to give the students an understanding of some of the important and often counterintuitive processes that occur in the ocean, and how the physical system interacts with and controls marine biology and the climate system. While the course does not require advanced mathematics, the course does require some basic mathematics

2.3 Course learning outcomes (CLO)

What you will learn:

- How to analyse real oceanographic data with state of the art analysis tools
- How we observe an often hostile and remote ocean and how we model the ocean
- The forces that drive ocean motion
- The different types of ocean circulation and why they are important
- How the physical environment controls marine biology
- How the ocean affects with the rest of the climate system and how it is affected by Global Warming
- How to solve quantitative problems related to the ocean

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The course will include:

- Face-to-face lectures (recordings may be available): covering ocean basics, observation & modelling, ocean physics, waves and climate
- Basic maths tutorials (2 x 2hrs): optional additional tutorials for those that want to brush up on their basic maths skills
- Tutorials (4 x 2hrs): numerical problem solving (includes a revision tutorial)

- MATLAB labs (5 x 2hr): computer labs where you will analyse real oceanographic data using the MATLAB analysis tool (2 introductory labs + 3 labs with a short, assessed reports)
- Class discussion: one double tutorial period devoted to class discussion of a contentious topic
- Spherical cow (3 x 1hr): learn the critical art of guestimation in science
- Student workshop: end of semester student presentations based on chosen research projects

This is a challenging course and it is expected (though not compulsory) that you attend lectures, tutorials, labs and the end of semester workshop. You are encouraged to collaborate in tutorials, labs and assignments, but the final work you hand in must be your own.

4. Course schedule and structure

WK	Lecture (1hr)	Tute (2hr)*	Lab (2hr)	Lecture (2hr)	OUT	IN	Other
	Tues 9-10am K-G27-G04 - PioneerTh	Tues 12-2 K-F23-102 - Mat 102	Wed 12-2pm K-E26-G006 - TchLab 5	Wed 4-6pm K-G27-G04 - PioneerTh			
1 (3 June)	Why Oceanography?	Basic maths 1 (1hr) + Spherical Cow (1hr)	MATLAB 1 Coding basic (optional)	Logistics + basic properties of the ocean	RP		
2 (10 June)	Archimedes + stratification	Basic maths 2 + (1hr) Spherical Cow (1hr)	MATLAB 2 Intro to data handling (optional)	Stratification, turbulence. Mixing & transport			
3 (17 June)	Forces, Hydrostatic balance, Pressure	Transport, Richardson no., gradients	MATLAB 3 El Nino/La Nina (not assessed)	Barotropic vs baroclinic, Coriolis, scaling, geostrophy & thermal wind	A1		
4 (24 June)	Ekman transport & spirals	Gesostrophy, Ekman & Thermal Wind	MATLAB 4 Ocean surface heights (assessed)	Ekman pumping, storm surges, large scale circulation & plastics	M4	RPo	
5 (1 July) FIELDWORK							
6 (8 July)	Recap	Ekman pumping (1hr) +Spherical Cow (1hr)	MATLAB 5 Drifting Floats (assessed)	Vorticity, western boundary currents and Sverdrup transport	A2, M5	M4	
7 (15 July)	Thermohaline circulation	Vorticity (1hr)	MATLAB 6 Ocean productivity (assessed)	Waves & Tides	M6	A1	
8 (22 July)	Planetary waves +eddies	Waves (1hr) Class Discussion (1hr)	MATLAB7 HELP (1hr)	ENSO & climate change		M5	
9 (29 July)	Guest talks	Waves & tides		Observing the ocean		A2	
10 (5 Aug)	Modelling the ocean	Additional exam Questions (1 hr optional)		Revision		RP/RPT, M6	Student Workshop (5hr)

Assessed Work (see table):

- *Assignment 1 (A1): Transport, ocean properties, geostrophy [worksheet ~3 problems]*
- *Assignment 2 (A2): Vorticity, Ekman, Kelvin waves) [worksheet ~4 problems]*
- *MATLAB4 (M4): Sea surface height & geostrophy [max 200 words + 2-3 figures]*
- *MATLAB5 (M5): Floats [max 200 words + 2-3 figures]*
- *MATLAB6 (M6): Biological productivity & ENSO [max 200 + 2-3 figures]*
- *Research Project (RP) [max 1500 words maximum + figures, figure captions and references]*
- *Research Project outline (RPo) [3-4 bullet points + 3-4 journal articles, outlining plan of final report]*
- *Research project talk (RPT) [5 min]*

5. Assessment

5.1 Assessment tasks

Assessment task	Length	MSCI3001 Mark/100	MSCI 5004 Mark/100	Due date (normally Friday of that week)
Research Project outline	*½ page*	*0*	*0*	*Wk4*
Assignment 1 (A1): Transport, ocean properties, geostrophy	*worksheet -3 problems*	*11*	*12*	*Wk7*
Assignment 2 (A2): Vorticity, Ekman, Kelvin waves	*worksheet -4 problems*	*15*	*16*	*Wk9*
MATLAB4 (M4): Sea surface height & geostrophy	*Max 200 words + 2-3 figures*	*5*	*6*	*Wk6*
MATLAB5 (M5): Floats	*Max 200 words + 2-3 figures*	*5*	*6*	*Wk8*
MATLAB6 (M6): Biological productivity & ENSO	*Max 200 words + 2-3 figures*	*6*	*6*	*Wk10*
Research Project (literature review)	*Maximum 1400 words (excluding references) + figures*	*13*	*14*	*Wk10*
Research project (presentation)	*5 min*	*5*	*5*	*Wk9 or 10*
Exam		*40*	*35*	

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

Matlab assessments 1,2 & 3

Marking criteria:

- Code (working order, no bugs, properly commented, no superfluous code): 30%

- Figures (well presented, properly labelled): 35%

- Report (refers to all figures, insightful description of the oceanography): 35%

Research Project

Marking criteria:

Scientific writing (20%)

Presentation (10%)

Scientific content (50%)

Referencing (10%)

Assignments 1 & 2

Breakdown of marks shown in the handout. Marks will be deducted for lack of working. Marks will be awarded for incorrect answer as long as working is valid.

5.3 Submission of assessment tasks

Assignments should be submitted through MOODLE where possible. If this is not possible you may submit by email to a.sengupta@unsw.edu.au (an email confirmation will be provided).

Late submissions will incur a 10% decrease in the overall mark per day. Assignments handed in more than 7 days late will not be marked. Extensions will normally only be considered if arranged prior to the due date.

To pass this course, satisfactory performance across ALL components of the course is required.

5.4. Feedback on assessment

Grades and comments will normally be provided via MOODLE. Model answers will be provided for assignments and first two MATLAB labs.

6. Academic integrity, referencing and plagiarism

Indicate the preferred referencing style with links to resources on how to use it.

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

Outline Lecture Notes

Lecture notes will be made available online. These lecture notes are intended to give a brief outline of the course to be used as an aid to learning. They are not intended to be a replacement for attendance at lectures, problem classes or tutorials.

Web page

Course notes, slides, assessments, tutorial and lab information will be made available on Moodle

Check this site regularly for any course updates.

Textbooks

There are no prescribed textbooks for this course, however the following are suggested for further reading.

- *Ocean Circulation (Open University) (UNSW Open Reserve WP/1458)*
- *Introductory oceanography, H.V. Thurman (PQ551.46/121A, PQ551.46/121)*
- *An introduction to the world's oceans, A.C. Duxbury and A. Duxbury (P551.46/96)*
- *Descriptive physical oceanography, G.L. Pickard and W.J. Emery (P551.46/10C, P551.46/10D)*
- *Introductory dynamical oceanography, Pond and G.L. Pickard (P551.47/16E)*
- *Regional oceanography: an introduction, M. Tomczak and J.S. Godfrey (P551.46/142)*
- *Waves, tides, and shallow-water processes (Open University) (P551.47/35A, P551.47/35B)*
- *Introduction to Physical Oceanography, J.A. Knauss (Prentice Hall)*

8. Administrative matters

- *School office: https://www.bees.unsw.edu.au/biosciences-student-office*
- *See course site on moodle for all administrative matters*

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Disability Support Services: https://student.unsw.edu.au/disability-services
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html