# Course Outline

# MSCI3001 / MSCI5004

# Physical Oceanography / Oceanographic Processes

## Biological and Earth Sciences

## Faculty of Science

## Session T2, 2021

**Due to the pandemic, large parts of this course will be delivered online in 2020.**

| 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 |
| Tutorial/Lab support | Rishav Goyal | rishav.goyal@unsw.edu.au | | |
| Guest lecture | Andrea Taschetto | a.taschetto@unsw.edu.au | | |
| Guest lcture | Moninya Roughan | mroughan@unsw.edu.au | | |

# 2. Course information

Units of credit: 6

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

Teaching times and locations: See below

*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

**PERSONAL REQUEST:** *IF YOU ARE COMFORTABLE TO DO SO, IT REALLY HELPS ME AND THE DYNAMIC OF OUR ZOOM MEETINGS IF YOU KEEP YOUR VIDEO ON. LECTURING TO A BLANK SCREEN IS REALLY AWFUL AND MAKES FOR MORE BORING LECTURES!*

The course will include:

- ZOOM: real-time lectures (these will also be recorded): covering ocean basics, observation & modelling, ocean physics, waves and climate
- In person/ZOOM:
    - 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)
    - spherical cow tutorials (3 x 1hr): learn the critical art of guestimation in science
- ZOOM: 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)
- Student workshop: end of semester student presentations based on chosen research projects. The format for this is to be confirmed

**For 2021 all lectures and labs will be run via ZOOM (or equivalent). Tutorials will have concurrent in-person and ZOOM options. Lectures and some parts of the tutorials and labs will be recorded and made available via Moodle. I will be available, together with some helpers, to facilitate labs, tutorials, discussion and workshop.**

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.

PLEASE NOTE LECTURES AND TAUGHT COMPONENTS OF TUTORIALS AND LABS WILL BE RECORDED VIA ZOOM AND MADE AVAILABLE TO ALL STUDENTS VIA MOODLE. IF YOU DO NOT WISH TO BE RECORDED YOU CAN KEEP YOUR VIDEO AND AUDIO TURNED OFF. IF YOU STILL HAVE CONCERNS YOU ARE NOT REQUIRED TO ATTEND ONLINE LECTURES, TUTORIAL OR LABS AND MAY VIEW THE RECORDINGS ONCE THEY ARE RELEASED ON MOODLE

# 4. Course schedule and structure (NB **red font** indicates optional sessions where Ill provide additional help or Spherical Cow short course)

| WK | Lecture (2hr) | Lab (2hr) | Tute (2hr)* | Lecture (1hr) | OUT | IN | Other |
|---|---|---|---|---|---|---|---|
| | **Tue 10:00 - 12:00** **virtual** | **Tue 12:00 - 14:00** **virtual** | **Wed 12:00 - 14:00** **K-F23-104 - Mat 104 & virtual** | **Fri 14:00 - 15:00** **virtual** | | | |
| | (Weeks:1-5,7-10) | (Weeks:1-5,7-10) | (Weeks:1-5,7-10) | (Weeks:1-5,7-10) | | | |
| 1 (1 June) | Logistics<br>Why Oceanography?<br>Basic properties | MATLAB 1<br>Coding basic<br>(optional) | Basic maths 1<br>(1hr)<br>+ Spherical Cow<br>(1hr) | Continued from Tuesday | RP | | |
| 2 (8 June) | Archimedes + stratification and turbulence. Mixing & transport | MATLAB 2<br>Intro to data handling<br>(optional) | Basic maths 2 +<br>(1hr)<br>Spherical Cow<br>(1hr) | Continued from Tuesday | | | |
| 3 (15 June) | Forces, Hydrostatic balance, Pressure. Barotropic vs baroclinic, Coriolis, scaling, geostrophy & thermal wind | MATLAB 3<br>El Nino/La Nina<br>(not assessed) | Transport, Richardson no., gradients | Continued from Tuesday | A1 | | |
| 4 (22 June) | Ekman transport & spirals. Ekman pumping, storm surges, large scale circulation & plastics | MATLAB 4<br>Ocean surface heights (assessed) | Gesostrophy, Ekman & Thermal Wind | Continued from Tuesday | M4 | RPo | |
| 5 (29 June) | Recap. Vorticity, western boundary currents and Sverdrup transport | MATLAB 5<br>Drifting Floats<br>(assessed) | Ekman pumping<br>(1hr)<br>+Spherical Cow<br>(1hr) | Continued from Tuesday | A2,<br>M5 | M4 | |
| 6 (Break) | | | | | | | |
| 7 (13 July) | Thermohaline circulation. Waves & Tides | MATLAB 6<br>Ocean productivity (assessed) | Vorticity (1hr) | Continued from Tuesday | M6 | A1 | |
| 8 (20 July) | Planetary waves +eddies. ENSO & climate change | MATLAB7<br>HELP (1hr)<br>(optional) | Waves (1hr)<br>Class Discussion (1hr) | Continued from Tuesday | | M5 | Andrea Guest lecture |
| 9 (27 July) | Observing the ocean | | Waves & tides | Guest Talks | | A2 | Moninya Guest lecture |
| 10 (3 Aug) | Modelling the ocean | | Additional exam practice<br>(1 hr optional) | Revision | | RP/RPT,<br>M6 | Student Workshop (multiple groups ~2hr/group) |

*Assessed Work (see table):*

- *Assignment 1 (A1): Transport, ocean properties, geostrophy*
- *Assignment 2 (A2): Vorticity, Ekman, Kelvin waves)*
- *MATLAB4 (M4): Sea surface height & geostrophy*
- *MATLAB5 (M5): Floats*
- *MATLAB6 (M6): Biological productivity & ENSO*
- *Research Project (RP)*
- *Research Project outline (RPo)*
- *Research project talk (RPT)*

# 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* | *3-4 bullet points outlining plan of final report [max 200 words] + 3-4 journal references,* | *0* | *0* | *Wk4* |
| *Assignment 1 (A1): Transport, ocean properties, geostrophy* | *worksheet -3 problems* | *12* | *13* | *Wk7* |
| *Assignment 2 (A2): Vorticity, Ekman, Kelvin waves* | *worksheet -4 problems* | *16* | *17* | *Wk9* |
| *MATLAB4 (M4): Sea surface height & geostrophy* | *Max 200 words + 2-3 figures* | *7* | *8* | *Wk6* |
| *MATLAB5 (M5): Floats* | *Max 200 words + 2-3 figures* | *7* | *8* | *Wk8* |
| *MATLAB6 (M6): Biological productivity & ENSO* | *Max 200 words + 2-3 figures* | *8* | *8* | *Wk10* |
| **Research Project (literature review)* | *Maximum 1200-1500 words (excluding references) + figures/captions* | *15* | *16* | *Wk10** |
| *Research project (presentation)* | *5 min. Presentations will be made via zoom in groups as part of a group of 8-10 students* | *5* | *5* | *Wk9 or 10* |
| *Exam* | | *30* | *25* | |
| | *TOTAL* | *100* | *100* | |

*To better manage your load you may want to complete your research project report earlier in the term (e.g. over week 6 break)

**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**

For each assessed MATLAB you will hand in a single 'live script' that contains your code figure and brief report (at the end of the script)

Marking criteria:

- Code (working order, no errors, properly commented, no superfluous code): 30%
- Figures (well presented, properly labelled): 30%
- Report (refers to all figures, insightful description of the oceanography): 40%

**Research Project**

*Marking criteria:*

- *Clear scientific writing for a non-specialist scientifically literate audience (20%)*
- *Presentation (good structure, relevant figures, logical order, 10%)*
- *Scientific content (50%)*
- *Referencing (10%) [All information derived from journals/books should be properly references (scan some academic journals if you are usure what is required; preferred style: nature referencing: https://paperpile.com/s/nature-citation-style/]*

**Research Presentation**

*Students will present a 5-minute talk (online) followed by 2-3 minutes of Q&A. NB we will randomly split the class into approximately four groups of 10 students (depending on class size) plus an invigilator. You will only be presenting to your group. You will be required to provide feedback to your group (what you liked about the presentation/what could be improved)*

*Marking criteria:*

- *Scientific content (40%)*
- *Presentation clarity (30%)*
- *Presentation visuals (30%)*

**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. If you have any technical problems email a.sengupta@unsw.edu.au

Handwritten work should be scanned/photo'd and submitted as a pdf.
**PLEASE always include your name in the filename e.g *AlexSENGUPTA_Ass1.pdf***

Unless prior approval is given, 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

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)*

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

• *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