### **School of Information and Physical Sciences**

PHYS2112: Classical Physics 2 Callaghan Semester 2 - 2023 THE UNIVERSITY OF NEWCASTLE AUSTRALIA

www.newcastle.edu.au CRICOS Provider 00109J

# **OVERVIEW**

#### **Course Description**

Waves and oscillating systems are fundamental to an understanding of the physical world. Through these concepts we can understand diverse phenomena, from pendulums, musical instruments, and mechanical structures, through tides, plasma waves in space, to the nature of light. Technological applications of these ideas are at the heart of all optical and electrical devices.

At its core Classical Physics 2 studies the motion of particles, fields and energy using the concepts of Wave Mechanics. This course requires an intermediate level of calculus for treatment of waves and oscillators, electromagnetism and optics.

Blended problem-based conceptual learning (lectorials) will be used to gain an understanding of key developments, ideas and theories covered in Classical Physics 2. Blended problem-based, hands-on learning (laboratory workshops) will be used to gain an understanding of key experiments, models and analysis covered in Classical Physics 2.

At the end of this course students will have a deeper understanding of concepts in mechanics, optics and electromagnetism, and be able to solve time-dependent problems in these areas.

Requisites Students must have successfully completed PHYS1210 and PHYS1220, and at least one of MATH1120, MATH1210 or MATH1220 to enrol in this course. If students have completed PHYS2260 they cannot enrol in this course.

Assumed Knowledge MATH2310 Contact Hours Callaghan Laboratory Face to Face On Campus

3 hour(s) per Week for 11 Weeks starting Week 2

#### Lectorial

Face to Face On Campus 2 hour(s) per Week for Full Term starting Week 1

**Tutorial** Face to Face On Campus 1 hour(s) per Week for 12 Weeks starting Week 1

#### Unit Weighting Workload

10 Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.



# CONTACTS

Course Coordinator	<b>Callaghan</b> Dr Joshua Williams Joshua.S.Williams@newcastle.edu.au Consultation: Details available on Canvas
Teaching Staff	A/Prof David Pontin david.pontin@newcastle.edu.au
	Dr Lachlan Rogers lachlan.rogers@newcastle.edu.au
School Office	School of Information and Physical Sciences SR233, Social Sciences Building Callaghan CESE-SIPS-Admin@newcastle.edu.au +61 2 4921 5513 9am-5pm (Mon-Fri)

# **SYLLABUS**

### **Course Content**

### Waves and Oscillations

- Fundamental waves concepts and methods of analysis
- Behaviour of damped, forced and coupled oscillators

#### Electromagnetism

- Vector calculus treatment of Maxwell's equations
- Time-dependent electric and magnetic fields
- Electromagnetic wave equation

#### Optics

- Ideas of wave optics, interference, diffraction, optical devices, and optical Fourier transforms

Course Learning<br/>OutcomesOn successful completion of this course, students will be able to:<br/>1. Describe how the concepts of waves and oscillations are used to develop models of<br/>electromagnetism and optical devices.2. Solve qualitative and quantitative wave, electromagnetism, and optics problems, using<br/>appropriate mathematical and computing techniques.3. Perform experiments to investigate the properties of wave system in mechanics,<br/>electromagnetism, and optics making correct and appropriate use of a range of scientific<br/>equipment, keeping an accurate record of experimental work and analysing results and<br/>reaching non-trivial conclusions from them.

4. Communicate the results of both theoretical and experimental work in mechanics, optics, and electromagnetism in various forms including written reports, oral presentations and poster presentations.

5. Contribute to team and group work for scientific investigations and for the process of learning.

#### Course Materials Lecture Materials:

Lecture notes, video materials, and details of advised textbooks for additional reading will be provided through Canvas





# SCHEDULE

Week	Week Begins	Торіс	Learning Activity	Assessment Due		
1	17 Jul	Oscillators and waves 1 (Simple, damped and driven oscillators)	Lectorial, online lab safety induction	Weekly quiz		
2	24 Jul	Oscillators and waves 2 (Coupled oscillators, wave equation)	Lectorial, laboratory	Weekly quiz		
3	31 Jul	Oscillators and waves 3 (Superposition, Fourier analysis)	Lectorial, laboratory	Weekly quiz		
4	7 Aug	Electromagnetism 1 (Electrostatics)	Lectorial, laboratory	Weekly quiz; Lab report (Double Pendulum); Lab workbook (Op Amp); Homework assignment (Oscillators & Waves)		
5	14 Aug	Electromagnetism 2 (Currents, conductance)	Lectorial, laboratory	Weekly quiz		
6	21 Aug	Electromagnetism 3 (Magnetostatics)	Lectorial, laboratory	Weekly quiz		
7	28 Aug	Electromagnetism 4 (Time- dependent EM fields)	Lectorial, laboratory	Weekly quiz		
8	4 Sep	Electromagnetism 5 (EM waves)	Lectorial, laboratory	Weekly quiz		
9	11 Sep	Optics 1 (Light and its interactions)	Lectorial, laboratory	Weekly quiz; Lab report (EM waves); Homework assignment (EM)		
10	18 Sep	Optics 2 (Wave nature of light)	Lectorial, laboratory	Weekly quiz		
		Mid Ter	m Break			
Mid Term Break						
11	9 Oct	Optics 3 (Wave nature of light, cont.)	Lectorial, laboratory	Weekly quiz; Lab report (Optics)		
12	16 Oct	Optics 4 (Diffraction)	Lectorial, laboratory	Weekly quiz; Group project poster submission		
13	23 Oct	-	Group project poster presentation	Written report on group project; Homework assignment (Optics)		
		Examinat	ion Period			
Examination Period						



# ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Weekly Quizzes	Weekly, prior to the lectorial class (Sundays by 11:59pm)	Individual	10%	1, 2
2	3 Homework Assignments	Three times during the semester: Monday at 11:59pm in weeks 4, 9 and 13	Individual	15%	1, 2
3	3-5 Tutorial/Laboratory Exercises	For laboratory workbooks 1 day after the lab session, for laboratory reports 1 week after the lab session.	Individual	30%	3, 4, 5
4	Formal Examination	During examination period	Individual	30%	1, 2
5	Group Project	Submissions during weeks 12 and 13. Details to be advised on Canvas.	Group	15%	4, 5

# Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

### Assessment 1 - Weekly Quizzes

Assessment Type	Quiz
Purpose	Test knowledge and understanding of principles of the course and associated problem solving skills (learning outcomes 1 and 2)
Description	Weekly quiz based on the week's material
Weighting	10%
Length	1-10 multiple-choice questions
Due Date	Weekly, prior to the lectorial class (Sundays by 11:59pm)
Submission Method	Online
Assessment Criteria	Demonstrate a level of conceptual understanding on course content and quantitative problem-solving abilities
Return Method	Online
Feedback Provided	Online - Grades communicated through Canvas

### **Assessment 2 - 3 Homework Assignments**

Assessment Type	Written Assignment
Purpose	Test knowledge and understanding of principles of the course and associated problem solving skills (learning outcomes 1 and 2)
Description	Take-home tests (or assignments), three during the course.
Weighting	15%
Due Date	Three times during the semester: Monday at 11:59pm in weeks 4, 9 and 13
Submission Method	Online Online via Canvas
Assessment Criteria	Demonstrate a level of conceptual understanding on course content and quantitative problem-solving abilities
Return Method	Online
Feedback Provided	Online - Provided within 2 weeks of submission deadline



## Assessment 3 - 3-5 Tutorial/Laboratory Exercises

Assessment Type Purpose Description	Tutorial / Laboratory Exercises Perform experiments, communicate results, work in a team (learning outcomes 3, 4 and 5) Written lab reports based on laboratory exercises. For experimental labs, each student will be required to submit either their laboratory workbook or a written lab report (experiments run over 1, 2 or 3 weeks during the semester).
Weighting	30%
Due Date	For laboratory workbooks 1 day after the lab session, for laboratory reports 1 week after the lab session.
Submission Method	Online
	Lab workbooks to be shown to demonstrator in person. Written reports to be submitted online via Canvas.
Assessment Criteria	Clearly document experimental/investigative method; demonstrate a level of conceptual understanding of experiment or topic, communicate that understanding in a clear, concise, and informative way.
Return Method	Online
Feedback Provided	Online - Within two weeks of submission deadline.

### Assessment 4 - Formal Examination

Assessment Type	Formal Examination	
Purpose	Test knowledge and understanding of principles of the course and associated problem solving	
	skills (learning outcomes 1 and 2)	
Description	Formal written examination, long-answer problems	
Weighting	30%	
Length	2 hours	
Due Date	During examination period	
Submission Method	Formal Exam	
Assessment Criteria	Demonstrate a level of conceptual understanding on course content and quantitative problem-solving abilities	
Return Method	Not Returned	
Feedback Provided	No Feedback	
Additional Information	Students are permitted a non-programmable scientific calculator. However, instruction booklets or cards for the calculator are not permitted in the exam as students are expected to familiarize themselves with the calculator's operations beforehand. A double-sided A4 memory aide is also permitted.	

## **Assessment 5 - Group Project**

Assessment Type	Project
Purpose	Develop literature review skills, communicate results (written and oral), work in a team (learning outcomes 3, 4 and 5)
Description	In small groups students will select a topic relevant to the course material, and research the literature on that topic. Assessed by a written report and presentation.
Weighting	15%
Due Date	Submissions during weeks 12 and 13. Details to be advised on Canvas.
Submission Method	Online
Assessment Criteria	Clearly document investigative method; demonstrate a level of conceptual understanding of experiment or topic, communicate that understanding in a clear, concise, and informative way.
Return Method	Online
Feedback Provided	Online - Within 2 weeks of submission.



# **ADDITIONAL INFORMATION**

### **Grading Scheme**

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-	This course i	s graded as fo	llows:
	Range of Marks	Grade	Description
	85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
	75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
	65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
	50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
	0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.
	*Skills are th	ose identified f	or the purposes of assessment task(s).
Communication Methods	Communicat - Canva or anr - Email - Face	ion methods u as Course Site nouncements c : Students will to Face: Comn	sed in this course include: e: Students will receive communications via the posting of content on the Canvas course site. receive communications via their student email account. nunication will be provided via face to face meetings or supervision.
Course Evaluation	Each year fea in the Univ improvement	edback is soug ersity for the t.	ht from students and other stakeholders about the courses offered purposes of identifying areas of excellence and potential
Oral Interviews (Vivas)	As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the <u>Oral Examination (viva) Procedure</u> . In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the <u>Student Conduct Rule</u> .		
Academic Misconduct	All students standards re Academic Int all locatio https://policie	are required to inforce the im tegrity policies ns. For t es.newcastle.e	o meet the academic integrity standards of the University. These portance of integrity and honesty in an academic environment. apply to all students of the University in all modes of study and in the Student Academic Integrity Policy, refer to <u>du.au/document/view-current.php?id=35</u> .



Adverse Circumstances	<ul> <li>allowable adverse circumstances that may affect their performance in assessment item(s).</li> <li>Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:</li> <li>the assessment item is a major assessment item; or</li> <li>the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system.</li> </ul>		
	<ul> <li>3. you are requesting a change of placement; or</li> <li>4. the course has a compulsory attendance requirement.</li> <li>Before applying you must refer to the Adverse Circumstance Affecting Assessment Items</li> <li>Procedure available at: https://policies.newcastle.edu.au/document/view-current.php?id=236</li> </ul>		
Important Policy Information	The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures that support a safe and respectful environment at the University.		

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original. © 2023 The University of Newcastle, Australia