School of Information and Physical Sciences

PHYS2112: Classical Physics 2

Callaghan
Semester 2 - 2025

COURSE OUTLINE

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.

Academic Progress Requirements

Nil

Requisites

Course Pre-Requisite:
Must have successfully completed the following course(s):
PHYS1210
PHYS1220
Must have successfully completed the following course(s):
At least one course from:
MATH1120
MATH1210
MATH1220

Course Replacement:
You cannot enrol if you have successfully completed any of the following course(s):
PHYS2260

Assumed Knowledge

MATH2310

Contact Hours

Callaghan
Laboratory
Face to Face On Campus
3 hour(s) per week(s) for 11 week(s) starting Week 2

Lectorial
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

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

Unit Weighting 10
Workload 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

Callaghan
Prof David Pontin
David.Pontin@newcastle.edu.au
(02) 4055 3261
Consultation:

Teaching Staff

Dr Xiaojing Zhou
xiaojing.zhou@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 5538
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 Outcomes

On successful completion of this course, students will be able to:

1. Describe how the concepts of waves and oscillations are used to develop models of electromagnetism and optical devices.

2. Solve qualitative and quantitative wave, electromagnetism, and optics problems, using appropriate mathematical and computing techniques.

3. Perform experiments to investigate the properties of wave system in mechanics, electromagnetism, and optics making correct and appropriate use of a range of scientific equipment, keeping an accurate record of experimental work and analysing results and 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.

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	21 Jul	Oscillators and waves 1 (Simple, damped and driven oscillators)	Lectorial, online lab safety induction	Weekly quiz
2	28 Jul	Oscillators and waves 2 (Coupled oscillators, wave equation)	Lectorial, laboratory	Weekly quiz; lab workbook on RLC circuits
3	4 Aug	Oscillators and waves 3 (Superposition, Fourier analysis)	Lectorial, laboratory	Weekly quiz; homework (oscillators and waves)
4	11 Aug	Electromagnetism 1 (Electrostatics)	Lectorial, laboratory	Weekly quiz
5	18 Aug	Electromagnetism 2 (Currents, conductance)	Lectorial, laboratory	Weekly quiz; lab report on double pendulum
Recess				
6	1 Sep	Electromagnetism 3 (Magnetostatics)	Lectorial, laboratory	Weekly quiz
7	8 Sep	Electromagnetism 4 (Time-dependent EM fields)	Lectorial, laboratory	Weekly quiz
8	15 Sep	Electromagnetism 5 (EM waves)	Lectorial, laboratory	Weekly quiz; homework (electromagnetism)
9	22 Sep	Optics 1 (Light and its interactions)	Lectorial, laboratory	Weekly quiz; lab report (EM waves)
Recess				
10	6 Oct	Optics 2 (waves nature of light)	Lectorial, laboratory	Weekly quiz
11	13 Oct	Optics 3 (wave nature of light, continued)	Lectorial, laboratory	Weekly quiz, lab report (optics)
12	20 Oct	Optics 4 (Diffraction)	Lectorial, laboratory	Weekly quiz; project poster; homework (optics)
13	27 Oct	-	Group project poster presentation	Project written report
Exams				
Exams				

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 (Mondays by midday)	Individual	10%	1, 2
2	3 Homework Assignments	Three times during the semester as indicated on the given assignment sheet	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 formal 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 up to 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 (Mondays by midday)
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
Opportunity to Reattempt Students will not be given the opportunity to reattempt this assessment.

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 as indicated on the given assignment sheet
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 - Provided within 2 weeks of submission deadline.
Opportunity to Reattempt Students will not be given the opportunity to reattempt this assessment.

Assessment 3 - 3-5 Tutorial/Laboratory Exercises

Assessment Type Tutorial / Laboratory Exercises
Purpose Perform experiments, communicate results, work in a team (learning outcomes 3, 4 and 5)
Description Written lab reports based on laboratory exercises. For experimental labs, each student will

	be required to submit their laboratory workbook and/or a written lab report as specified in the lab manual. 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 Written reports to be submitted online via Canvas. Workbooks must be attached as an Appendix, or as a standalone document depending on lab requirement.
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.
Opportunity to Reattempt	Students will not be given the opportunity to reattempt this assessment.

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 formal 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
Opportunity to Reattempt	Students will not be given the opportunity to reattempt this assessment.

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.
Opportunity to Reattempt	Students will not be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

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 those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Learning Analytics

The University uses an evidence-based approach to enhancing student learning and delivering support. Our careful analysis of data through learning analytics informs decision making processes related to student learning, academic outcomes, and support services. Learning analytics may be used to identify targeted individual opportunities for additional support services or interventions.

Interviews on Assessment Items

An Interview may be conducted on any assessment item in this course, in accordance with the Interview on Assessment Items Procedure. The purpose of the interview is to verify the author of the material submitted in response to the assessment task and provide a quality assurance measure.

In the event the Course Coordinator is not satisfied that a student's oral responses are consistent with the work originally submitted, the matter will be referred to the Student Academic Conduct Officer, who will take appropriate action under the Student Conduct Rule.

Academic Integrity and Ethical Academic Conduct Policy

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations.

Please refer to the Academic Integrity and Ethical Academic Conduct Policy

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s).

Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. 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;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure.

Use of generative artificial intelligence in course assessments

It is critical that any work submitted for assessment is your own original work. Before using generative AI tools (such as ChatGPT, Perplexity, Microsoft Copilot, etc) in any assessable work you must ensure that such use is in line with the requirements for the course and expectations of your Course Coordinator

Misuse of AI tools may be considered a breach of the University's Student Conduct Rule and could result in disciplinary action.

Artificial Intelligence detection software may be used to review any work you submit. If you have used AI in any way other than has been expressly permitted by your course coordinator, you may be engaging in academic misconduct and be subject to penalties.

For information, refer to:

- Generative AI Tools
- Academic Integrity

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/respect-at-uni/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.