

## PHYS1220: Advanced Physics II

Callaghan

Semester 2 - 2023



THE UNIVERSITY OF  
NEWCASTLE  
AUSTRALIA

## OVERVIEW

### Course Description

Physics underpins most aspects of modern engineering, technology, and medicine. For example, about 25% of the world's economy is tied to the quantum mechanics of silicon, and many of the most important practical advances in chemistry and biology can be traced to the precise understanding of the behaviour of atoms and molecules provided by quantum mechanics. Knowledge of physics is therefore vital to understanding the world around us. This calculus-based course continues on from PHYS1210 and covers the topics of mathematical tools, electromagnetism, optics and physics of matter.

### Assumed Knowledge

Mathematics Extension 1 with a result in Bands 3 or 4. It is also recommended that students have undertaken Physics and achieved a result in Band 5 or 6. PHYS1210

### Contact Hours

#### Callaghan

#### Computer Lab

Face to Face On Campus

3 hour(s) per Week for 2 Weeks (Weeks 2 & 3)

#### Laboratory \*

Face to Face On Campus

3 hour(s) per Week for 6 Weeks (Weeks 5,6,7,9,10 & 12)

#### Lecture

Face to Face On Campus

3 hour(s) per Week for Weeks 1-12

#### Tutorial

Face to Face On Campus

1 hour(s) per Week for 12 Weeks (Weeks 2-13)

### Unit Weighting Workload

\* This contact type has a compulsory requirement.

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

# COURSE OUTLINE

[www.newcastle.edu.au](http://www.newcastle.edu.au)

CRICOS Provider 00109J

# CONTACTS

<b>Course Coordinator</b>	<b>Callaghan</b> Dr Karen Livesey Karen.Livesey@newcastle.edu.au (02) 4055 7559 Consultation: After lectures on Wednesday and Thursday, or by appointment. Office P112
<b>Teaching Staff</b>	Dr Xiaojing Zhou xiaojing.zhou@newcastle.edu.au (02) 4921 6732 Office P110  Other teaching staff to be listed on Canvas.
<b>School Office</b>	<b>School of Information and Physical Sciences</b> SR233, Social Sciences Building Callaghan CESE-SIPS-Admin@newcastle.edu.au +61 2 4921 5513 9am-5pm (Mon-Fri)

# SYLLABUS

<b>Course Content</b>	<p>A calculus based course aimed at students who have completed HSC Physics and Mathematics, and may wish to continue their study of physics beyond first year.</p> <ul style="list-style-type: none"><li>• Integrated Physics: introduction to the key mathematical techniques used in physics.</li><li>• Electromagnetism: static electric and magnetic fields, electromagnetic induction.</li><li>• Optics: behaviour and properties of light, and its interactions with matter, as well as instruments used to detect it.</li><li>• Physics of Matter: quantum mechanics, atoms, molecules, solids and nuclear physics.</li></ul>
<b>Course Learning Outcomes</b>	<p><b>On successful completion of this course, students will be able to:</b></p> <ol style="list-style-type: none"><li>1. Explain the basic principles of electromagnetism, optics and quantum mechanics and their relevance to aspects of engineering, technology, physical phenomena, matter and everyday situations.</li><li>2. Solve qualitative and quantitative problems using mathematics and the principles of physics.</li><li>3. Perform laboratory and computational experiments and interpret the significance of the results with regards to the principles and applications of physics.</li><li>4. Communicate the results and significance of both theoretical and experimental work in written reports.</li><li>5. Contribute to team and group work for scientific investigations and for the process of learning.</li></ol>
<b>Course Materials</b>	<p><b>Recommended Text:</b></p> <ul style="list-style-type: none"><li>• University Physics with Modern Physics (Global edition) by Young and Freedman. 15th edition. Available for free through the library: <a href="https://ebookcentral-proquest-com.ezproxy.newcastle.edu.au/lib/newcastle/detail.action?docID=5853696">https://ebookcentral-proquest-com.ezproxy.newcastle.edu.au/lib/newcastle/detail.action?docID=5853696</a> Print ISBN: 9781292314730, eBook ISBN: 9781292314815</li></ul> <p><b>Other Resources:</b></p> <ul style="list-style-type: none"><li>• A ruler is needed for experimental laboratories, exams/tests and in the Optics lectures and tutorials.</li><li>• A scientific calculator (non-programmable) may be used for in-class tests and may be useful in experimental labs too.</li></ul> <p><b>Required Text: PHYS1220 Laboratory Workbook</b> Students must order the PHYS1220 Laboratory Workbook online from the Print Centre (<a href="http://www.uni-print.com.au">www.uni-print.com.au</a>) and then pick it up on campus when informed via email that their copy is ready. Please note that printing may take a few days. <u>Please bring the Workbook to the first experimental laboratory session in Week 5.</u></p>

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# COMPULSORY REQUIREMENTS

In order to pass this course, each student must complete ALL of the following compulsory requirements:

**Contact Hour Requirements:**

- Laboratory Induction Requirement - Students must attend and pass the induction requirements before attending these sessions. In order to participate in this course students must complete a compulsory safety induction.
- The University of Newcastle has a 80% minimum attendance requirement in all 1000-level courses.

# SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	17 Jul	Electromagnetism 1: Electric charge, Coulomb's Law, Electric Field. With Dr Livesey	3 Lectures (please come!)	11:59pm Friday: Online Quiz 1
2	24 Jul	Electromagnetism 2: Flux & Surface Integrals, Gauss's Law, Electric Potential. With Dr Livesey	3 Lectures (please come!) 1 Tutorial (Electromag 1) 1 Computer Lab	11:59pm Friday: Online Quiz 2 11:59pm Friday: Computer Lab 1
3	31 Jul	Electromagnetism 3: Magnetic fields and cross products, Charges and currents in a magnetic field. With Dr Livesey	3 Lectures (please come!) 1 Tutorial (Electromag 2) 1 Computer Lab	11:59pm Friday: Online Quiz 3 11:59pm Friday: Computer Lab 2
4	7 Aug	Electromagnetism 4: Magnetic fields & the Biot-Savart Law, Magnetic fields & Ampere's Law & Line Integrals, Electromagnetic induction. With Dr Livesey	3 Lectures (please come!) 1 Tutorial (Electromag 3)	<b>11:59pm Saturday: ONLINE TEST 1 (Electromag)</b> 11:59pm Friday: Online Quiz 4
5	14 Aug	Electromagnetism 5: Inductance and solving differential equations, AC circuits, Maxwell's equation and magnetic materials. With Dr Livesey	3 Lectures (please come!) 1 Tutorial (Electromag 4) 1 Experimental Lab (Electromagnetism)	11:59pm Friday: Online Quiz 5 End of lab time: Experimental Lab 1
6	21 Aug	Optics 1: Reflection and refraction, Mirrors and images, Lenses. With Dr Zhou	3 Lectures (please come!) 1 Tutorial (Electromag 5) 1 Experimental Lab (Electromagnetism)	11:59pm Friday: Online Quiz 6 End of lab time: Experimental Lab 2
7	28 Aug	Optics 2: Interference I and double slit, Interference II and thin films, Diffraction. With Dr Zhou	3 Lectures (please come!) 1 Tutorial (Optics 1) 1 Experimental Lab (Optics)	11:59pm Friday: Online Quiz 7 End of lab time: Experimental Lab 3
8	4 Sep	Quantum Mechanics 1: Photons & photoelectric effect, Uncertainty principle, deBroglie's relation. Dr Zhou	3 Lectures (please come!) 1 Tutorial (Optics 2)	11:59pm Friday: Online Quiz 8
9	11 Sep	Quantum Mechanics 2: Bohr model & spectra, Particle in a box, Wavefunctions. With Dr Zhou	3 Lectures (please come!) 1 Tutorial (Quantum 1) 1 Experimental Lab (Quantum)	11:59pm Friday: Online Quiz 9 End of lab time: Experimental Lab 4
10	18 Sep	Atoms, Molecules & Solids 1: 3D H atom, Zeeman effect & electron spin. With Dr Zhou	3 Lectures (please come!) 1 Tutorial (Quantum 2) 1 Experimental Lab (Quantum)	11:59pm Friday Online Quiz 10 End of lab time: Experimental Lab 5
<b>Mid Term Break</b>				
<b>Mid Term Break</b>				
11	9 Oct	Atoms, Molecules & Solids 2: Molecular bonds, Vibration & rotation of molecules, Solid state physics. With Dr Zhou	3 Lectures (please come!) 1 Tutorial (AMS 1)	<b>11:59pm Saturday: ONLINE TEST 2 (Optics + QM)</b> 11:59pm Friday: Online Quiz 11
12	16 Oct	Nuclear Physics: The nucleus, Radiation & decay, Nuclear power and radiation dose. With Dr Livesey	3 Lectures (please come!) 1 Tutorial (AMS 2) 1 Experimental Lab (Nuclear)	11:59pm Friday: Online Quiz 12 End of lab time: Experimental Lab 6
13	23 Oct		1 Tutorial (Nuclear)	
<b>Examination Period</b>				
<b>Examination Period</b>				

# ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Online Tests	Saturday 11:59pm of Weeks 4 and 11	Individual	10%	1, 2
2	Online Quizzes	Friday 11:59pm of Weeks 1-12	Individual	10%	1, 2
3	Laboratory Reports	By the end of lab time, Weeks 5,6,7,9,10,12.	Individual	40%	2, 3, 4, 5
4	Formal Examination	During formal exam period	Individual	40%	1, 2

**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 – Online Tests

<b>Assessment Type</b>	Test
<b>Purpose</b>	The purpose and benefit of the online tests is to provide the students with feedback on student learning in a similar format to the final exam.
<b>Description</b>	Two online tests worth 5% each. Each test will consist of one long-problem to solve, containing multiple parts.
<b>Weighting</b>	10%
<b>Length</b>	25 mins + 5 mins upload time
<b>Due Date</b>	Saturday 11:59pm in Weeks 4 (Electromagnetism) and 11 (Optics and Quantum Mechanics)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	Demonstrate a level of conceptual understanding and quantitative problem solving abilities
<b>Return Method</b>	Online
<b>Feedback Provided</b>	Online - .

## Assessment 2 - Online Quizzes

<b>Assessment Type</b>	Quiz
<b>Purpose</b>	Designed to provide students with instant feedback on progress
<b>Description</b>	Weekly multiple choice quizzes. The top 10 scores from 12 weekly quizzes will count (10%).
<b>Weighting</b>	10%
<b>Due Date</b>	11:59pm each Friday (Weeks 1-12).
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	Demonstrate a level of conceptual understanding on lecture content and some quantitative problem solving abilities.
<b>Return Method</b>	Online

## Assessment 3 - Laboratory Reports

<b>Assessment Type</b>	Tutorial / Laboratory Exercises
<b>Purpose</b>	The purpose of laboratory activities is to enable peer-to-peer learning; develop oral communication skills and the ability to record data, synthesise an argument, and convey this clearly in a well presented and articulate manner. Basic computing skills will also be taught and incorporated into data presentation.
<b>Description</b>	2 Computer Labs (5% each) = 10% 6 Experimental Labs (5% each) = 30%
<b>Weighting</b>	40%
<b>Due Date</b>	11:59 Friday for Computer Labs (Weeks 2-3) At the end of your scheduled lab time for Experimental Labs (Weeks 5, 6, 7, 9,10,12)
<b>Submission Method</b>	Online
<b>Assessment Criteria</b>	Demonstrate a level of conceptual understanding on lecture content and quantitative problem solving skills. Communicate results effectively. Demonstrate competency in performing experiments, analysing results and making plots using computer software.
<b>Return Method</b>	Online

## Assessment 4 - Formal Examination

<b>Assessment Type</b>	Formal Examination
<b>Purpose</b>	The final formal examination is designed to test the individual student's knowledge of the course material and their ability to describe, analyse and hypothesise from this material. See the UoN Course Management and Assessment Procedure Manual for more information: <a href="https://policies.newcastle.edu.au/document/view-current.php?id=183&amp;version=6">https://policies.newcastle.edu.au/document/view-current.php?id=183&amp;version=6</a>
<b>Description</b>	The exam will consist of six long-answer questions.
<b>Weighting</b>	40%
<b>Length</b>	2 hours and 10 mins
<b>Due Date</b>	During formal Exam Period
<b>Submission Method</b>	Formal Exam
<b>Assessment Criteria</b>	Demonstrate a level of conceptual understanding on lecture content and quantitative problem solving skills.

## 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:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

### Attendance

Attendance/participation will be recorded in the following components:

- Laboratory (Method of recording: Sign-in in person on entry to the lab)
- Tutorial (Method of recording: Attendance Check-in app via MyUON)

### 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.

As a result of student feedback, the following changes have been made to this offering of the course:

- In 2021, a new experimental lab was introduced -- replacing an old one -- to better support and connect with the lecture material.
- In 2023, the experimental labs are moved to different weeks to better line-up with the lecture content relevant to the labs.
- We are always working to enhance the student experience and student learning.

**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 [Oral Examination \(viva\) Procedure](#). 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 [Student Conduct Rule](#).

**Academic Misconduct** 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. For the Student Academic Integrity Policy, refer to <https://policies.newcastle.edu.au/document/view-current.php?id=35>.

**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 available at:  
<https://policies.newcastle.edu.au/document/view-current.php?id=236>

**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.*

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