School of Information and Physical Sciences

PHYS2211: Modern Physics 1

Callaghan
Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description

Modern Physics 1 deals with the application of quantum mechanics to understand the properties of atoms and materials. As such, Modern Physics 1 is fundamental to our understanding of the building blocks of the Universe as well as the engineering and technology of atomic systems and electronic devices.At its core Modern Physics 1 studies: (a) wave-particle duality, and its application to atomic systems and solids (b) the thermal, electrical and optical properties of materials (c) atomic structure and systems. This course provides an intermediate level calculus-based treatment of Quantum, Atomic and Solid State Physics.Blended problem-based conceptual learning (lectorials) will be used to gain an understanding of key developments, ideas and theories covered in Modern Physics 1. Blended problem-based hands-on learning (laboratory workshops) will be used to gain an understanding of key experiments, models and analysis covered in Modern Physics 1.

Academic Progress Requirements

Nil

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 PHYS2170 they cannot enrol in this course.

Assumed Knowledge

MATH2310

Contact Hours

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

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

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Teaching Staff

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School Office

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9am-5pm (Mon-Fri)

SYLLABUS

Course Content

The topics to be covered include:• Quantum Mechanics: waves particle duality; Schrodinger equation; bound states, expectation values & operators, unbound states; three dimensional systems;• Atomic Physics: the hydrogen atom; fundamentals of atomic structure; describing multi-electron atoms; spin-orbit coupling; atomic radiation; atoms in electric and magnetic fields.• Solid State Physics: introduction to crystal structures; the band theory of solids; thermal, electrical and optical properties of materials.
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Course Learning Outcomes

On successful completion of this course, students will be able to:
1. Apply the principles of quantum mechanics to describe the properties of atoms and solids, and their interaction with electromagnetic radiation.

2. Explain the connection between the crystal structures of solids, their electron behaviour, and how these control the physical properties of solids.

3. Solve qualitative and quantitative problems, using appropriate mathematical and computing techniques.

4. Perform experiments which involve 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.

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

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

Course Materials

Recommended Text:

- Please check Canvas for recommended textbooks for each module.

SCHEDULE

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Weekly Quiz		Individual	20%	1, 2, 3
2	Tutorial/Laboratory exercises	1-2 Weeks after completion of relevant laboratories. Details of due dates for each individual assignment will be provided in the laboratory handout information sheets.	Individual	40%	4, 5, 6
3	Formal Examination		Individual	40%	1, 2, 3

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 Quiz

Assessment Type Quiz
Purpose Provide exercises on weekly learning content
Description Weekly Quizzes in Class
Weighting 20%
Length 30 mins
Due Date
Submission Method In Class
Assessment Criteria will be provided for each quiz
Return Method In Class
Feedback Provided In Class - one week after each submission.
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Tutorial/Laboratory exercises

Assessment Type Tutorial / Laboratory Exercises
Purpose Provide laboratory exercises on experimental or theoretical content covered in the learning materials.
Description Written Reports and Assignments based on work conducted during Laboratory Workshops
Weighting 40%
Length 3 hours
Due Date 1-2 Weeks after completion of relevant laboratories. Details of due dates for each individual assignment will be provided in the laboratory handout information sheets.
Submission Method In Class
Assessment Criteria Will be provided with laboratory instructions.
Return Method In Class
Feedback Provided In Class - One week after each submission. Return work
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Formal Examination

Assessment Type	Formal Examination
Purpose	Provide a formal test on the content covered in this course.
Description	A 2 hour final exam during the formal examination period.
Weighting	40%
Due Date	
Submission Method	Formal Exam
Assessment Criteria	Assess problem solving ability and recall fundamental facts related to modern physics - Display recall of the key principles in modern physics principles - Demonstrate logical progression towards a final solution that explicitly displays a knowledge of the relevant principles. - Provide worked solutions and/or figures with adequate detail for markers to understand all logical steps taken to reach a solution
Return Method	Not Returned
Feedback Provided	
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:

- 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.

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.

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/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.