UNSW Course Outline

PHYS9140 Modern and Thermal Physics for Teachers - 2024

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General Course Information

Course Code : PHYS9140
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Physics
Delivery Mode : Online
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This is an online course covering thermal and modern physics. Lecture material and tutorial problems will be presented online. This is the fourth course in the graduate certificate for physics teachers. This course will cover thermal physics, and introduce quantum mechanics

including the Schrodinger equation for simple situations, the standard model will be discussed and applications of quantum mechanics considered. This course includes laboratory exercises that are completed at home and submitted online.

Assumed knowledge: Students need to be able to differentiate and integrate polynomials and write and solve simple differential equations to complete the course. A good understanding of HSC level extension 1 mathematics is recommended.

Course Aims

This course aims to give students an understanding of thermal physics, quantum mechanics and applications of these fields and how they can teach these concepts to high school students.

Relationship to Other Courses

This is the fourth and final course in the Graduate Certificate in Physics for Science teachers. The previous courses: PHYS9110, PHYS9120 and PHYS9130 are pre-requisites for PHYS9140.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Safely plan and conduct experiments and simulations related to thermal physics and quantum mechanics using high school equipment, include reliable estimates of the uncertainties in the results.
CLO2 : Design experimental and simulation activities to use with high school students related to thermal physics and quantum mechanics.
CLO3 : Use appropriate mathematical techniques, including calculus, to solve problems involving thermal physics and modern physics.
CLO4 : Apply knowledge of thermal physics and quantum mechanics, alongside critical thinking skills, to explain the underlying physics in a range of conceptual physical situations.
CLO5 : Draw and interpret graphs and diagrams to describe physical phenomena related to thermal physics and quantum mechanics.

Course Learning Outcomes	Assessment Item
CLO1 : Safely plan and conduct experiments and simulations related to thermal physics and quantum mechanics using high school equipment, include reliable estimates of the uncertainties in the results.	• Experiments
CLO2 : Design experimental and simulation activities to use with high school students related to thermal physics and quantum mechanics.	• Experiments
CLO3 : Use appropriate mathematical techniques, including calculus, to solve problems involving thermal physics and modern physics.	• Online tests • Final Examination
CLO4 : Apply knowledge of thermal physics and quantum mechanics, alongside critical thinking skills, to explain the underlying physics in a range of conceptual physical situations.	• Online tests • Final Examination
CLO5 : Draw and interpret graphs and diagrams to describe physical phenomena related to thermal physics and quantum mechanics.	• Online tests • Experiments • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System | Openlearning

Learning and Teaching in this course

This course is delivered entirely online. Each week the students will have a series of videos to view that will cover some aspects of thermal or modern physics. Videos will include the

presentation of theory, demonstrations and worked examples. After watching each video students will consolidate their knowledge by answering a question or completing an activity. Students will have a set of tutorial problems so solve each week to check that they are able to apply the theory presented to them to solve problems. They will have access to solutions and a discussion board if they need assistance with this.

Additional Course Information

All learning materials for this course are on Openlearning.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Online tests Assessment Format: Individual	20%	
Experiments Assessment Format: Individual	30%	
Final Examination Assessment Format: Individual	50%	

Assessment Details

Online tests

Assessment Overview

You will complete three online tests based on the theory covered in lectures. Each test will typically consist of six three part questions. Most questions will focus on calculations. You may attempt these tests as many times as you want with your highest mark counting. The tests will be available for a week, during weeks 4, 7 and 10. You will be given feedback about incorrect answers.

Course Learning Outcomes

- CLO3 : Use appropriate mathematical techniques, including calculus, to solve problems involving thermal physics and modern physics.
- CLO4 : Apply knowledge of thermal physics and quantum mechanics, alongside critical thinking skills, to explain the underlying physics in a range of conceptual physical situations.
- CLO5 : Draw and interpret graphs and diagrams to describe physical phenomena related to thermal physics and quantum mechanics.

Assessment Length

6 questions in each test

Assignment submission Turnitin type

This is not a Turnitin assignment

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Experiments

Assessment Overview

You will be expected to complete three laboratory experiments (each weighed equally) using high school lab equipment during the course. You will develop a worksheet for high school students related to each of these experiments. These experiments will be due after the relevant content has been covered in the online lectures.

Course Learning Outcomes

- CLO1 : Safely plan and conduct experiments and simulations related to thermal physics and quantum mechanics using high school equipment, include reliable estimates of the uncertainties in the results.
- CLO2 : Design experimental and simulation activities to use with high school students related to thermal physics and quantum mechanics.
- CLO5 : Draw and interpret graphs and diagrams to describe physical phenomena related to thermal physics and quantum mechanics.

Assessment Length

Each report will be around 5 pages long

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Generative AI Permission Level

Assistance with Attribution

This assessment requires you to write/create a first iteration of your submission yourself. You are then permitted to use generative AI tools, software or services to improve your submission in the ways set out below.
Any output of generative AI tools, software or services that is used within your assessment must be attributed with full referencing.

If outputs of generative AI tools, software or services form part of your submission and are not appropriately attributed, your Convenor will determine whether the omission is significant. If so, you may be asked to explain your submission. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Final Examination

Assessment Overview

You will sit a two hour open-book exam with five questions assessing the theory taught during the course. The exam will consist of a combination of conceptual and calculation based questions. You will sit this exam at your school or another location approved by course staff.

Course Learning Outcomes

- CLO3 : Use appropriate mathematical techniques, including calculus, to solve problems involving thermal physics and modern physics.
- CLO4 : Apply knowledge of thermal physics and quantum mechanics, alongside critical thinking skills, to explain the underlying physics in a range of conceptual physical situations.
- CLO5 : Draw and interpret graphs and diagrams to describe physical phenomena related to thermal physics and quantum mechanics.

Assessment Length

5 questions

Assignment submission Turnitin type

This is not a Turnitin assignment

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Rationale for assessment

The Dunlosky et. al. meta-analysis showed that the best study techniques students could use to

prepare for an exam was to practice answering a lot of questions over the course. The assessments for this course have been designed with this in mind. Students are given quizzes every three weeks with an unlimited number of attempts to ensure that they are confident answering questions on course material.

The final exam is used to ensure that students are able to solve problems quickly and correctly. As exams are used to access high school physics this also gives teachers an opportunity to experience these from a student perspective.

Labs are also assessed, as physics is an experimental science, students need to be able to conduct measurements to test models. Students are asked to adapt the three lab exercises they complete so that they can be used with a high school class. This lends authenticity to the assessment as the students end up with resources that they can directly use in the classroom.

Grading Basis

Standard

Requirements to pass course

Students must score above 50 overall for the course in order to pass.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 2 September - 8 September	Other	Learning materials for the course will be available this week for students who would like to make a head start.
Week 1 : 9 September - 15 September	Topic	Thermodynamics of solids and liquids
Week 2 : 16 September - 22 September	Topic	Thermodynamics of ideal gasses
Week 3 : 23 September - 29 September	Topic	The first law of thermodynamics and thermal processes
	Laboratory	Experiment 1, Specific and Latent heat, due this Sunday
Week 4 : 30 September - 6 October	Topic	Entropy and second law of thermodynamics
	Assessment	Online test 1 is due this Sunday.
Week 5 : 7 October - 13 October	Topic	An introduction to quantum mechanics
Week 6 : 14 October - 20 October	Topic	Schro dinger'sequation
	Laboratory	Experiment 2, Measuring Planck's constant, is due this Sunday.
Week 7 : 21 October - 27 October	Topic	Models of Hydrogen and atomic physics
	Assessment	Online test 2 is due this Sunday.
Week 8 : 28 October - 3 November	Topic	Nuclear Physics
Week 9 : 4 November - 10 November	Topic	The Standard model
	Laboratory	Experiment 3, Radioactive decay simulation, is due this Sunday.
Week 10 : 11 November - 17 November	Topic	Cosmology
	Assessment	Online test 3 is due this Sunday.

Attendance Requirements

Not Applicable - as no class attendance is required

General Schedule Information

There is one module to work through each week on Openlearning.

Course Resources

Prescribed Resources

All resources needed for the course are made available through Openlearning.

Recommended Resources

Halliday, D., Resnick, R., & Walker, J. (2014). Fundamentals of Physics, John Wiley & Sons.
Note: the library has an eBook subscription to this. The link is provided on the Moodle site. The book can be purchased from the publisher here: http://www.wileydirect.com.au/buy/fundamentals-of- physics-10th-edition/

Additional Costs

No aditional costs.

Course Evaluation and Development

This course has recieved very positive reviews. When it ran for the first time in 2018 the laboratory experiments were conducted on campus over a weekend. This was difficult for teachers in rural schools so in 2019 the laboratory experiments were changed to ones that are conducted in schools.

Feedback is very welcome. In particular I welcome feedback about the assessment structure. In 2022 students (in conversation and when asked on openlearning) indicated that they were happy this course had a final exam. Other options I have considerd are changing the exam to something like a lesson plan with video of teaching. The students felt that this would take them a lot longer and appreciated the exam experience as it reminded them about what their students experience. However, other viewpoints are welcome to ensure this course remains as relevant as possible to teaching physics in high schools.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Elizabeth Angstmann		G61F OMB	Please email	Please email (e.angstmann@unsw.edu.au) to arrange a time to meet in person or online.	Yes	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

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. 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, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant

circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines