UNSW Course Outline

ZPEM1503 Engineering Physics 1A - 2024

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General Course Information

Course Code : ZPEM1503
Year : 2024
Term : Semester 1
Teaching Period : Z1
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : UC Science
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Is it possible to hurl a 10-tonne projectile into space using a centrifuge spinning at six times the speed of sound? Why is there a 600-tonne steel ball hanging from the top of a Taiwanese skyscraper? Can you estimate the strength of a nuclear bomb using nothing but a magazine and

a ruler? If the answers to these questions intrigue you, then ZPEM1503 Engineering Physics 1A is the course for you. ZPEM1503 explores the fundamental physics of mechanics, waves, fluids and thermodynamics which are essential to engineers of all disciplines. The course emphasises both conceptual understanding and quantitative problem-solving, tied to real-world applications in engineering and military contexts.

Course Aims

ZPEM1503 Engineering Physics 1A is a foundational course taken by all engineering and technology majors at UNSW Canberra. After completing the course, you will be able to apply and connect key concepts in mechanics, waves, fluids and thermal physics to real-world problems in science and engineering. In addition to the physics upon which modern engineering is built, the course will equip you with the essential analysis skills, mathematical techniques and problem-solving strategies which underpin your ongoing engineering studies. Since physics is an experimental science, ZPEM1503 also contains an integrated laboratory component, where you will conduct short, topical experiments to contextualise what you learn in lectures and tutorials.

Relationship to Other Courses

Many of the mathematical concepts used in Engineering Physics 1A - in particular vectors and calculus - will be covered in the required first-year Engineering Mathematics courses ZPEM1303 and ZPEM1304. We find that success in maths courses is strongly correlated to success in physics and vice versa, so don't neglect either subject. Extra maths help is available through the Physics Support Program (PSP) from Week 2. In second semester, all students majoring in electrical engineering must also complete ZPEM1504 Engineering Physics 1B, which covers electromagnetism and modern physics and builds on the foundational knowledge acquired from ZPEM1503.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.
CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.
CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.
CLO4 : Demonstrate experimental and practical skills, via the careful recording and analysis of measurements and their uncertainties in laboratory experiments.

Course Learning Outcomes	Assessment Item
CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.	• Weekly Quizzes • Class Tests • Laboratory Experiments • Final Examination
CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.	• Weekly Quizzes • Class Tests • Laboratory Experiments • Final Examination
CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.	• Weekly Quizzes • Class Tests • Laboratory Experiments • Final Examination
CLO4 : Demonstrate experimental and practical skills, via the careful recording and analysis of measurements and their uncertainties in laboratory experiments.	• Laboratory Experiments

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

The course will be delivered through a combination of interactive face-to-face lectures, weekly tutorials and teaching laboratories. The three 50-min lectures each week have been designed for guidance, to highlight important points or pitfalls, and deepen conceptual understanding via demonstrations, worked examples and interactive activities. Small-group tutorial sessions are the venue to seek assistance with problem-solving from your tutor and consolidate your understanding through weekly problem sets.

You should build on this foundation during your own private or peer group study outside of class. The University expects you to allocate *at least* the same amount of time you spend in classes on personal preparation and revision, or in self-organised peer learning groups. For example, an hour-long lecture should mean at least another hour of revision, reading the textbook, attempting tutorial and textbook problems or preparing for the next lecture. Disciplined study outside of class is essential for success in this challenging course.

Educational research shows that learning is most effective when students are actively engaged, can work collaboratively and take responsibility for their learning. Learning also needs to be

supported by effective teaching and assessment, which includes strategies such as peer instruction, formative assessment and scaffolding of problem solving (e.g. the "I do - we do - you do" approach, see below).

You are expected to actively participate in lectures through questions and peer instruction discussions. Worked examples in lectures provide the first "I do" stage in scaffolding your problem-solving skills. In tutorials and small group study outside of class, weekly problem sets and textbook questions provide you with an opportunity to work with the support of your peers and a tutor (“we do”). This learning is then reinforced and assessed through individual weekly quizzes and the class tests ("you do"). The weekly quizzes are formative (assessment as learning) and provide an opportunity for feedback and reflection on your progress. The summative class tests allow you to demonstrate your mastery of the course material and prepare for the final examination. The laboratory program also provides opportunities for hands-on practical work, with some degree of autonomy. The experiments are completed in pairs and with the support of demonstrators (“we do”).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Weekly Quizzes Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Not Applicable
Class Tests Assessment Format: Individual	30%	Start Date: Not Applicable Due Date: Not Applicable
Laboratory Experiments Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Not Applicable
Final Examination Assessment Format: Individual	35%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Weekly Quizzes

Assessment Overview

Students will complete weekly formative quizzes, the best 10 of which will be considered in calculating their final grade.

Course Learning Outcomes

- CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.

- CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.
- CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.

Detailed Assessment Description

The weekly quizzes are completed outside of class from Week 2. They will be posted on Moodle immediately after the Monday lecture and are due the following Sunday night. Each quiz consists of several computer-based questions on that week's material which require a short calculation and correct use of significant figures. Feedback and solutions are provided following each quiz. The best 10 out of 12 weeks will be considered in calculating the final quiz grade.

Class Tests

Assessment Overview

Students will complete two summative class tests during the semester, each of 15% weighting.

Course Learning Outcomes

- CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.
- CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.
- CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.

Detailed Assessment Description

Class Test 1 (15%) will take place in Week 5 on Monday, 25 March during the usual lecture time. It will cover material from Weeks 1-4 and Lectures 2-11 (measurement, kinematics, forces, work and energy).

Class Test 2 (15%) will take place in Week 10 on Monday, 13 May during the usual lecture time. It will cover material from Weeks 5-9 and Lectures 12-23 (momentum, rotational motion, oscillations and waves).

Students who do not achieve a grade of 50% in a class test will be offered the opportunity to re-sit a supplemental test to achieve a maximum grade of 50% for that test. The supplemental test is optional and the higher of the original and supplemental test grades will be used in the final course grade calculation.

Assessment Length

50 min (normal lecture time)

Laboratory Experiments

Assessment Overview

Students will complete eight laboratory experiments during the semester. The laboratory mark includes contributions from online pre-lab activities and reports submitted at the conclusion of each experiment.

Course Learning Outcomes

- CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.
- CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.
- CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.
- CLO4 : Demonstrate experimental and practical skills, via the careful recording and analysis of measurements and their uncertainties in laboratory experiments.

Detailed Assessment Description

Laboratory work is an important part of the course and contributes 20% to the final grade, comprising 5% for the online pre-lab activities and 15% for the wriitten reports of the 8 experiments undertaken during the semester. Students must also complete a mandatory safety induction.

The experiments are designed to complement material covered in lectures and tutorials, develop experimental and practical measurement skills, and teach the practice of real-time documentation of technical results which is expected in science and engineering disciplines. Each experiment will require specific preparation and the completion of pre-lab activities in Moodle. While the laboratory program has been developed and is presented in the context of the course material, it also has a role to teach practical skills. It therefore runs in parallel with the lectures, but is not directly tied to them.

Assessment Length

8 two-hour laboratory sessions

Final Examination

Assessment Overview

Students will sit a final examination covering all course material during the formal examination period at the end of the semester.

Course Learning Outcomes

- CLO1 : Explain and connect key concepts in mechanics, waves, fluids and thermal physics using words, diagrams and mathematics.
- CLO2 : Apply the techniques of idealisation, approximation, estimation and dimensional analysis to problems in physics and engineering.
- CLO3 : Solve quantitative problems in mechanics, waves, fluids and thermal physics, and relate the solutions to real-world contexts.

Detailed Assessment Description

The final exam covers material delivered across the entire course, with an emphasis on Parts 2 (oscillations & waves) and 3 (fluids & thermal physics). The questions will be similar in complexity and format to those seen in the Class Tests.

Assessment Length

2 hours

General Assessment Information

Feedback and solutions will be provided for all assessments except the final examination. All previously-assessed material is considered assumed knowledge for later work in the course.

Use of Generative AI (e.g. ChatGPT) during assessments - It is prohibited to use any software or service to search for or generate information or answers. If its use is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion. However, you are free to use such software as part of your own learning outside of assessments. For instance, for guidance with tutorial or textbook problems during self- or peer-group study.

Grading Basis

Standard

Requirements to pass course

Students must achieve a total overall mark of 50% across all assessments for the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	1. Administrative matters
	Lecture	2. Measurement & Dimensions (Chapter 1)
	Lecture	3. Kinematics in 1D (Chapter 2)
	Tutorial	
Week 2 : 4 March - 8 March	Lecture	4. Vectors/Kinematics in 2D & 3D (Chapters 3 & 4)
	Lecture	5. Projectile Motion (Chapter 4)
	Lecture	6. Circular & Relative Motion (Chapter 4)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 3 : 11 March - 15 March	Lecture	7. Newton's Laws (Chapter 5)
	Lecture	8. Drag & Friction Forces (Chapters 5 & 6)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 4 : 18 March - 22 March	Lecture	9. Other Forces (Chapters 5 & 6)
	Lecture	10. Work & Energy (Chapter 7)
	Lecture	11. Conservation of Energy (Chapter 8)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 5 : 25 March - 29 March	Assessment	Class Test 1 (1410-1500, Monday, 25 March)
	Lecture	12. Momentum & Collisions (Chapter 9)
	Lecture	13. Applications of Momentum (Chapter 9)
	Tutorial	No Tutorials on Friday (Good Friday)
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 6 : 1 April - 5 April	Lecture	14. Rotational Motion (Chapter 10)
	Lecture	15. Moments of Inertia; Torque (Chapters 10 & 11)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 7 : 22 April - 26 April	Lecture	16. Rolling & Angular Momentum (Chapter 11)
	Lecture	17. Oscillations (Chapter 15)
	Tutorial	No Tutorials on Thursday (ANZAC Day)
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 8 : 29 April - 3 May	Lecture	18. Pendulums (Chapter 15)
	Lecture	19. Damping & Resonance (Chapter 15)
	Lecture	20. Introduction to Waves (Chapter 16)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night

Week 9 : 6 May - 10 May	Lecture	21. Wave Interference & Superposition (Chapter 16)
	Lecture	22. Sound Waves (Chapter 17)
	Lecture	23. Applications of Sound Waves (Chapter 17)
	Tutorial	No Tutorials on Friday (Military Training Day)
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 10 : 13 May - 17 May	Assessment	Class Test 2 (1410-1500, Monday, 13 May)
	Lecture	24. Fluids & Pressure (Chapter 14)
	Lecture	25. Fluid Mechanics (Chapter 14)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 11 : 20 May - 24 May	Lecture	26. Temperature (Chapter 18)
	Lecture	27. First Law of Thermodynamics (Chapter 18)
	Lecture	28. Energy Transfer (Chapter 18)
	Tutorial	
	Laboratory	Individual lab group schedules may vary. See the lab schedule on Moodle for more information.
	Online Activity	Quiz due Sunday night
Week 12 : 27 May - 31 May	Lecture	29. Ideal Gases (Chapter 19) Monday timetable on Tuesday
	Lecture	30. Kinetic Theory (Chapter 19)
	Tutorial	
	Online Activity	Quiz due Sunday night
Week 13 : 3 June - 7 June	Lecture	31. Entropy and the Second Law of Thermodynamics (Chapter 20)
	Lecture	32. Cycles & Engines (Chapter 20)
	Lecture	33. Thermal Physics revision (Chapters 18-20)
	Tutorial	
	Online Activity	Quiz due Sunday night

Attendance Requirements

Students are expected to attend all lectures, tutorials, laboratory sessions and assessments unless their absence has been approved by the course coordinator. Students who have missed assessments or a laboratory, or expect to miss such a requirement, must inform the appropriate staff member(s) below **by email** at the earliest practicable date:

- **Laboratory:** email the laboratory coordinator
- **Tutorial:** email the tutor and copy the lecturer
- **Quiz or Test:** email the lecturer and copy the course coordinator
- **Final Examination:** email the lecturer and copy the course coordinator

In typical circumstances of missed assessments, a formal application for Special Consideration via the prescibed University procedure is appropriate. Alternative assessment can then be arranged. Otherwise, in the case of absence a mark of zero will be awarded for the assessment.

General Schedule Information

For lecture, tutorial and laboratory times please see the UNSW timetable and the lab schedule posted on Moodle. The final schedule of lecture topics is subject to change to accommodate the needs of the class.

Course Resources

Prescribed Resources

The prescribed textbook for the course is Halliday's Fundamentals of Physics, 1st Australian & New Zealand Edition (UNSW Library link), published by Wiley Australia in 2020. The Academy Library maintains a small number of hard copies and e-book licenses for use during the semester, or the book is available for purchase from the publisher or other outlets.

The textbook is available as a hard copy (ISBN 978-0-730-38287-4) or an e-book (ISBN 978-0-730-38286-7). Note that the printed textbook also provides a personal access code for the e-book. The UNSW Library also has unlimited e-book access to an earlier edition of the textbook which may be useful for accessing end-of-chapter problems.

Calculators - Students are required to have a non-graphic, non-programmable scientific calculator such as the Casio fx-82AU or similar. Calculators permitted in Year 12 examinations are generally acceptable. For more information, see the UNSW list of allowed calculators or discuss your options with the course coordinator. Note that phone calculator apps are not permitted in assessments.

Recommended Resources

Additional notes and links to relevant online resources will be provided on Moodle as the course progresses.

Physics Support Program (PSP) - Students whose performance in the course is of concern are provided with extra tutoring support through the Learning & Teaching Group's Physics Support Program. The aim of weekly PSP classes is to provide these students with extra assistance in problem-solving and conceptual understanding of the content covered in lectures. One-on-one consultations with PSP staff are also available throughout the semester. Participation in the PSP is by invitation and attendance each week is expected in addition to normal tutorial classes. Invitations are based on assessment results throughout the semester and are regularly reviewed. Walk-ins are also welcome.

Course Evaluation and Development

The teaching staff and course coordinator welcome constructive feedback about the ongoing development of the course and how we can improve students' learning. Both formal and informal feedback will be sought from the class as the course progresses. This may include informal discussions during lectures/labs/tutorials, opportunities to provide feedback on learning and course matters during the weekly quizzes, Moodle submissions, via class representatives to the School's Student-Staff Liaison Committee or formal end-of-semester feedback through the MyExperience survey. Students are encouraged to provide feedback early and often, so that any changes can be considered and implemented immediately for the benefit of the class. The Moodle page provides more information on recent changes to the course in response to student feedback.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Dr Simon Murphy		Building 26, Room 118 (upper level)	(02) 5114 5187	Available for walk-in consultations, or email for an appointment	No	Yes
Lecturer	Associate Professor Heiko Timmers		Building 26, Room G20 (lower level)	(02) 5114 5048	Email for an appointment	No	No
Lab director	Dr Wayne Hutchison		Building 26, Room G22 (lower level)	(02) 5114 5040	Email for an appointment	No	No

Other Useful Information

Academic Information

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student

opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: Student Code of Conduct (unsw.edu.au)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Submission of Assessment Tasks

Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

Late Submission of assessment tasks (other than examinations)

UNSW has a standard late submission penalty of:

- 5% per day,

- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

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

Electronic submission of assessment

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

Release of final mark

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.