School of Physics

Course Outline 2022

# PHYS9120

# MECHANICS FOR TEACHERS

**School of Physics**

**Faculty of Science**

**Term 1, 2022**

## 1. Information about the Course

NB: Some of this information is available on the UNSW Handbook[1]

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| **Year of Delivery** | *2022* |
| **Course Code** | *PHYS9120* |
| **Course Name** | *Mechanics for Teachers* |
| **Academic Unit** | *School of Physics* |
| **Level of Course** | *1* |
| **Units of Credit** | *6UOC* |
| **Term(s) Offered** | *Term 1* |
| **Assumed Knowledge, Prerequisites or Co-requisites** | *PHYS9110 is a pre-requisite*<br>*Calculus (3 unit mathematics) is required* |
| **Hours per Week** | *12 hours per week* |
| **Number of Weeks** | *10 weeks* |
| **Commencement Date** | 14th February |
| **Component** | **Details** |
| Lectures | *These are available online through Openlearning. Lectures consist of short videos followed by questions and activities.* |
| Experiments | *You will conduct experiments at home/school and write them up for submission. You will need to adapt the experiment to suit the equipment you have access to.* |
| *Tutorial problems* | *Each topic will have tutorial problems available for you. These are to give you practice using the content of the lectures to solve the types of problems you will get in the final examination.* |

## 2. Staff Involved in the Course

| Staff | Role | Name | Contact Details | Consultation Times |
|---|---|---|---|---|
| **Course Convenor** (and lecturer) | | *A. Prof. Elizabeth Angstmann* | *e.angstmann@unsw.edu.au*<br>*Room G61F, OMB*<br>*School of Physics* | *Email to arrange a time* |
| Other Support Staff | | Seda Cokcetin (contact Seda for administrative matters) | s.cokcetin@unsw.edu.au | |

[1] UNSW Online Handbook: http://www.handbook.unsw.edu.au

## 3. Course Details

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| **Course Description** (Handbook Entry) | This is an online course covering mechanics. Lecture material and tutorial problems will be presented online. This is the second course in the graduate certificate for physics teachers. The course will cover classical Newtonian mechanics and special relativity. Classical mechanics is used to describe the motion of bodies under a system of forces. Special relativity is needed to describe the motion of bodies traveling with high speeds. Students will watch short video lectures online and solve problems related to the material. This course includes laboratory exercises that are completed at home and submitted online.<br><br>**Assumed Knowledge:** Students need to be able to differentiate and integrate polynomials to complete this courses. A good understanding of HSC level extension 1 mathematics is recommended. |
| **Course Aims** | This course aims to give students a solid foundation in mechanics. After undertaking this course students should be confident in their ability to present mechanics to high school students. Students will be able to solve problems involving moving objects (including those moving very quickly). They will be able to plan experiments and carry them out. |
| **Student Learning Outcomes** | By the end of this course students should be able to:<br>1. Apply Newton's three laws of motion to explain, understand and predict the motion of objects undergoing uniform translational or rotational acceleration.<br>2. Explain and understand how the two key conservation laws – conservation of momentum and conservation of energy – relate to Newton's Laws in translation and rotation, use these to solve problems involving different situations such as collisions.<br>3. Explain the difference between kinetic and potential energy and use the law of conservation of energy and the work-energy theorem to solve problems.<br>4. Apply the law of universal gravitation and Kepler's laws in combination with other laws covered in this course to describe, predict and explain the motion of satellites, planets, stars and galaxies.<br>5. Describe the theory of special relativity and use it to solve problems involving quickly moving objects; in this context recognise the limits (and slight reformulation) of Newtonian mechanics.<br>6. Recognise that physics is an experimental science, have skills to plan and conduct experiments and analyse the outcomes, include estimates of the uncertainty in |

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| | measurements. |
| **Relationship to Other Courses within the Program** | This course is a pre-requisite for PHYS9130 and PHYS9140 in the Graduate Certificate in Physics for Science Teachers. |

## 4. Rationale and Strategies Underpinning the Course

This course will be entirely online. Each week the students will have a series of videos to view that will cover some aspects of mechanics. Videos will include the presentation of theory, demonstrations and worked examples. Where relevant suggestions of how to adapt demonstrations for use with a high school class will be included. 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.

Every three weeks students will complete an online quiz to ensure they are keeping up with and able to apply the material covered in lectures to solve problems. Students may attempt this quiz as many times as they want with their highest mark counting. Distributed practice and practicing answering exam like questions has shown to improve exam performance[2].

Students will complete experiments at school, this will familiarise them with experiments that they can use with their students.

[2] Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14(1), 4-58.

## 5. Course Schedule

| Week (starts on) | Work through (watch videos, answer tutorial questions, try activities) the module on: | Assignment and Submission dates (see also 'Assessment Tasks & Feedback') |
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| Week 1<br>14th Feb | Vectors | |
| Week 2<br>21st Feb | Motion | |
| Week 3<br>28th Feb | Forces | |
| Week 4<br>7th March | Work and Energy | Online test 1<br>HECS census date: 13th March |
| Week 5<br>14th March | Collisions and Momentum | First experiment due |
| Week 6<br>21st March | Rotation and Torque | |
| Week 7<br>28th March | Universal gravitation | Online test 2 |
| Week 8<br>4th April | Special relativity 1 | Second experiment due |
| Week 9<br>11th April | Special relativity 2 | Third experiment due |
| Week 10<br>18th April | Lagrangians and Hamiltonians (not assessed) | Online test 3 |

## 6. Assessment Tasks and Feedback

| Task | Knowledge & abilities assessed | Assessment Criteria | % of total mark | Date of | | Feedback | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Release | Submission[3] | WHO | WHEN | HOW |
| Online tests | Assesses ability to solve problems based on first five learning outcomes | Students need to correctly perform calculations and recall a few facts, can re-attempt with highest mark counting | 6.67 % × 3 = 20% | 04/03/22<br>25/03/22<br>15/04/22 | 13/03/22<br>03/04/22<br>24/04/22<br>At 11:59 PM | *Automated through Moodle* | *Feedback is provided during the quiz* | *Marks on Moodle and sulutions solutions* |
| Experiments and experiment reports | Be able to investigate the physics behind phenomenon and develop skills associated with good experimental technique | Will be given at the end of each exercise. | 3 × 10% = 30% | 14/02/22 | 20/03/22<br>10/04/22<br>17/04/22 | Lecturer | 28/03/22<br>18/04/22<br>27/04/22 | Through rubric on Turnitin |
| Final exam | Be able to solve problems based on the content covered in this course | Students will receive marks for correctly answering questions | 50% | TBA: in exam period, 29th April-12th May | | Convener | Mark included in final grade | |

[3] All times and dates are given for Sydney. If a student is submitting from overseas it is their responsibility to check that they submit it by the due time.

## 7. Additional Resources and Support

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| **Text Books** | Halliday, D., Resnick, R., & Walker, J. (2014). Fundamentals of Physics, John Wiley & Sons.<br>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/ |
| **Course Manual** | Experiments will be available through Openlearning |
| **Required Readings** | All required resources made available through Openlearning |
| **Additional Readings** | Most calculus based introductory physics text books are suitable. Physics Vol 1 by Serway, Jewett, Wilson and Wilson is an example of one of these. |
| **Recommended Internet Sites** | Will be made available on Moodle and Openlearning |
| **Support for students** | • The Current Students Gateway: student.unsw.edu.au<br>• Academic Skills and Support: student.unsw.edu.au/skills<br>• Student Wellbeing, Health and Safety: student.unsw.edu.au/wellbeing<br>• Disability Support Services: student.unsw.edu.au/disability<br>• UNSW IT Service Centre: www.it.unsw.edu.au/students |

## 8. Required Equipment, Training and Enabling Skills

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| **Equipment Required** | Calculator |
| **Enabling Skills Training Required to Complete this Course** | 3 unit mathematics: need to be able to use trigonometry, logarithms, vectors and calculus |

## 9. Course Evaluation and Development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

| Mechanisms of Review | Last Review Date | Comments or Changes Resulting from Reviews |
|---|---|---|
| **Major Course Review** | | This course ran for the first time in 2018. |
| **myExperience**[4] | | |
| **Other** | 2018<br><br>2020 | Based on student feedback this course has been completely re-written for 2019. It now includes demonstrations and predict-observe-explain activities.<br><br>First two tutorials updated |

[4] CATEI process

## 10. Administration Matters

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| **Expectations of Students** | Even though this course is completely online the assumption is that students will spend the same amount of time working on it as a face-to-face year physics course. Students should spend approximately eight hours a week engaging with the online materials and a similar amount of time in self directed study of the subject. | | |
| **Assignment Submissions** | All submission times are Sydney times.<br>**If a student experiences any difficulty submitting an assignment through Moodle they must email a copy of the assignment to e.angstmann@unsw.edu.au before assignment is due, with a report of what went wrong (so that we can fix it).**<br>If there are special circumstances causing a student to miss a deadline they should apply for special consideration through myUNSW, a doctor's certificate or other suitable documentation will be needed.<br>All assignments need to be typed. | | |
| **Occupational Health and Safety**[5] | Is very important. You must complete and abide by a risk assessment for each of the investigations you conduct, including the one for your final report. | | |
| **Assessment Procedures**<br><br>**UNSW Assessment Policy**[6] | The school of physics special consideration policy can be found here: https://www.physics.unsw.edu.au/current-students/special-consideration | | |
| **Equity and Diversity** | Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.studentequity.unsw.edu.au/ ).<br><br>Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. | | |
| **Student Complaint Procedure**[7] | **School Contact** | **Faculty Contact** | **University Contact** |
| | A. Prof. Elizabeth Angstmann<br>First year Physics Director<br>e.angsmtann@unsw.edu.au<br>Tel: 9385 4542<br><br>Or<br><br>Prof. Adam Micolich,<br>Director of Teaching,<br>Physics<br>adam.micolich@unsw.edu.au | Deputy Dean Education<br>A. Prof. Alison Beavis<br>a.beavis@unsw.edu.au | Student Conduct and Appeals Officer (SCAO) within the Office of the Pro-Vice-Chancellor (Students) and Registrar.<br><br>Telephone 02 9385 8515, email studentcomplaints@unsw.edu.au<br><br>University Counselling and Psychological Services[8]<br>Tel: 9385 5418 |

[5] UNSW OHS Home page
[6] UNSW Assessment Policy
[7] UNSW Student Complaint Procedure
[8] University Counselling and Psychological Services

## 11. Academic integrity, referencing and plagiarism

**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 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.[9] 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 and plagiarism can be located at:*

- *The Current Students site* student.unsw.edu.au/plagiarism*, and*
- *The ELISE training site* subjectguides.library.unsw.edu.au/elise

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

[9] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.