PHYSICS 120 Advancing Physics 1 2018

Offered:	Semester 1
Credit:	15 points
Pre-/Co-requisites:	None
Restriction:	Physics 160

Description

This is a core course for students progressing in physical science. Key topics are mechanics; oscillations and waves; and thermodynamics. This is a calculus-based course that focuses on fundamental principles, problem solving and hands-on exercises.

Knowledge of mathematics and physics equivalent to NCEA Level 3 Physics and Mathematics or PHYSICS 102 is assumed, and students are advised to take recommended mathematics courses concurrently with this course. This course complements PHYSICS 121 Advancing Physics 2, which is offered in both semesters and is a prerequisite for core second-year physics courses.

Aims

1. To build a sound foundation in physics knowledge and practice for later courses in physics and other physical sciences through consolidating and extending secondary school physics.
2. To encourage curiosity, and develop intellectual, organisational, communication, interpersonal skills.

Skills and knowledge to be gained

Students who pass this course should be able to:

- articulate the big ideas from each topic (mechanics; oscillations and waves; thermodynamics), indicating that they have understood the core concepts.
- translate a physical description of a first-year physics problem to a mathematical formulation, using sketches or diagrams where appropriate.
- evaluate the process and outcomes of an experiment qualitatively and quantitatively.
- solve analytical/numerical problems and complete practical tasks that require application of core concepts to new situations.
- justify, in written and verbal form, their approaches to solving a problem or completing a practical task.
- check the validity of the solutions they have reached by methods such as dimensional analysis, order of magnitude, literature review, etc.

- take responsibility for their own learning by consulting available resources, reflecting and asking questions, seeking challenging opportunities and taking action to overcome difficulties.

Please see Canvas for week-by-week learning objectives.

Syllabus

Class meeting times and instructors

Students need to enrol and participate in one of the three streams in this course. Each stream meets three times a week for two hours in the Physics Teaching Laboratory (303-G03). Please ensure that there is no timetable clash with any of the three weekly meeting times for the stream that you enrol in.

Stream 1: M / W / F 9.00 - 11.00 (Peter Wills)
Stream 2: M / W / F 11.00 - 13.00 (Geoff Willmott, Tra Dinh)
Stream 3: Tu / W / Th 15.00 - 17.00 (Anna Yang)

Course coordinator: Anna Yang

Workload

The time commitment required for studying four first-year university courses in a semester is equivalent to working full-time. Thus, the average weekly workload for this course would be approximately 10 hours a week, including 6 hours in class. It is realistic to expect that the actual workload will vary somewhat from week to week across the semester; a course schedule is provided on Canvas for reference.

Recommended text

Knight, R. (2016). *Physics for Scientists and Engineers: A Strategic Approach with Modern Physics* (4th edition). Pearson.

Enrolled students will be granted free online access to the e-text and the assignment system after the course commences. Hard copies of the recommended text are available for lending at the university library and for purchase at "ubiq", the bookshop on campus.

Core physics topics

Mechanics (18 classes): Dimensional analysis; vectors; linear kinematics; projectile motion; forces; equilibrium; Newton's laws of motion and gravitation; uniform (and non-uniform) circular motion; rotational motion; torque; moment of inertia; linear and rotational momentum; collisions; work, kinetic energy, potential energy and interactions; conservation laws.

Oscillations and Waves (6 classes): Simple harmonic motion; pendulum; damped and driven oscillations; mechanical waves; wave equation; sound waves; superposition; standing waves; interference.

Thermodynamics (8 classes): Work, heat, temperature, thermal energy; ideal-gas law and basic thermal processes; first law of thermodynamics; specific heat; calorimetry; heat transfer mechanisms; molecular speeds and collisions; pressure in a gas; irreversible processes and the second law of thermodynamics; heat engines and refrigerators; Carnot cycle.

Learning activities and teaching methods

Students are required to complete pre-readings to make the most of the interactive and collaborative two-hour classes. These two-hour sessions consist of integrated mini-lectures, laboratory work and tutorial exercises using whiteboards. Instructors are available during specified office hours and the department offers daily 4-hour drop-in tutorial help at the Faculty Assistance Room (302-170).

Assessments

Assessment type	Weight	Short description
Pre-readings	5 %	Weekly pre-readings online. Best 10 out of 12 marks are counted.
Laboratories	12 %	Laboratory work in class and submissions. Best 4 out of 5 marks.
Quizzes	8 %	Weekly quizzes in class. Best 10 out of 12 marks.
Assignments	20 %	All four online assignments contribute to the final course grade.
Tests	15 %	Two 1-hour evening tests, which are scheduled on Monday 16 April and Tuesday 29 May in 2018. Location to be advised in class and on Canvas.
Final exam	40 %	Time and location of the 3-hour exam will be advised on Student Services Online by the Examinations Office.

To achieve a pass in this course, students are required to achieve a 50% pass in coursework.

Academic integrity

The University expects that, over the course of their study, all students will become independent learners, able to communicate their ideas and the material supporting those ideas clearly and accurately.

The University encourages students to seek ways to improve their writing skills, including through the use of advice on coursework from third parties. When getting help with your university work, you must ensure that this assistance does not endanger the academic integrity and originality of the work. The University views cheating - including "submitting without acknowledgement work to which others have contributed" - as a serious academic offence. When seeking assistance with written work, it is your responsibility to ensure that the third party also understands the limits of providing help.

A student's assessed work may be reviewed against electronic source material using computerised detection mechanisms. Students may be required to provide an electronic version of their work for review.

UoA student policies and regulations:

- Academic integrity and copyright
- Third party assistance in UG and PG coursework guidelines