PHYS102-23SU
Engineering Physics B: Modern Physics and Electromagnetism (2)
15 points, 0.125 EFTS, Summer Semester 2023.

Version 24TH Oct 2023.

IMPORTANT:

This Course outline applies only for the **SUMMER** occurrence of PHYS102. Please take note of the Assessment and Lab requirements for this Occurrence later in this document.

Of importance is that PHYS102-Summer CANNOT be completed totally online. In-person lab attendance and final exam attendance is required. Students can be remote from Christchurch up until the last few weeks of the summer semester – see details below on the Timetable.

Description

PHYS102 is a valuable course for students advancing in physical sciences and engineering who need a good understanding of electromagnetism and concepts of modern physics. The first section introduces aspects of Modern Physics such as Quantum Mechanics, subatomic particle physics and elements of Cosmology, Einstein's Theory of relativity. The second section extends the Electromagnetism of PHYS101 to DC and AC circuit theory, more advanced magnetic field concepts, which then leads to Maxwell's equations and electromagnetic waves.

Summary of the Course Content

The topics covered in this course are:

- Introduction to Quantisation through Planck's Law, wave-particle duality
- The quantum wavefunction and Schrodinger's equation
- Quantum tunneling - potential barriers and wells
- Quantum theory of matter
- Particle physics, fundamental forces, quarks and the Standard Model, Cosmology
- Gauss's Law determination of electric fields, Faraday cage
- DC circuit analysis from Kirchoff's Laws, RC circuits
- Biot-Savart and Ampere's Laws for magnetic field determination
- Basic AC circuits, RL and RLC
- Maxwell's equations and electromagnetic theory
- Gravitation, Kepler's Laws
- Special Theory of Relativity

Learning Outcomes

The goal of this course is to provide foundation knowledge of Modern Physics and Electromagnetism for students advancing in physical science and engineering degrees. Students will obtain basic competency in analysing and solving physical problems in these areas. They will also obtain basic physics laboratory skills and data analysis techniques.

Students will have developed and be able to demonstrate:

- basic scientific competency to solve appropriate physics problems in the concepts of the course
- basic physics laboratory skills
- data recording and analysis associated with physics laboratories
- writing and associated communication skills.

Textbook:

The **recommended text** is Volume 2 from either:

1. Serway, Jewett, Wilson & Wilson (SJW^2) "Physics Vol. 2" Asia-Pacific edition (2013).
2. Serway, Jewett, Wilson, Wilson & Rowlands "Physics for Global Scientists and Engineers" (2017).

Since this course is for students who have a good level of physics and mathematics preparations, some relevant but elementary sections of the text will not be covered. Allow yourself study time with the text to catch up on these. Chapters 1 and 2 of the text are assumed to be known for PHYS111, 101 and 102.

Lectures

PHYS102-Summer does NOT have a lecture schedule that requires a presence in Christchurch. Course material is made available from Learn (http://www.learn.canterbury.ac.nz) on a weekly basis. Echo recorded lectures from the semester 2 occurrence will be available.

Note that the Summer course has a shorter duration and thus students are expected to work through the material at a slightly faster pace than a normal 12 week semester.

It is the students' responsibility to work through the course material at the appropriate pace.

Online Homework

There will be 12 sets of online problems synced to the weekly course material. Instructions on accessing the assignment will be available from Learn and students can work through these at their own pace.

Helpdesk/Tutorial

A Tutor will be available at set times at a drop-in Help Desk that will be conducted through Zoom. They are there to help you and we really hope you will make use of this opportunity to ask questions and get assistance. You are welcome to discuss the week's online problems (but don't expect to be given the answers!) as well as the course material in general.

HELPDESK/Tutorial times will be announced on the LEARN website.

Test

An evening TERM TEST for PHYS102-summer will be held during one evening in week 5. It will be of 60 minutes duration.

The test will be online and will be a mix of questions answered via computer and fully worked problems that will require a solution upload to Learn. Coverage of test material will be announced via Learn.

Submit a **Special Consideration** application if you miss the Test through illness or your performance is impaired. The mark from the final examination will be used to allocate the test mark in such situations.

Final Examination

The final examination tests your grasp of the lectures, problems completed on-line, and reading material. It will be TWO hours duration and sat in-person in Christchurch. See Timetable.

To obtain an advancing grade for this course you must score at least 48% on the final exam AND 50% for the course overall. If you score less than 48% on the exam while obtaining >50% overall, the maximum grade you can be allocated is R. Note that this is not a progressing grade i.e. **you will not be able to use PHYS102 as a prerequisite for any other course.**

Laboratories

Capability in, and appreciation of experiments forms an essential part to the study of physics. Consequently, it is required that labs are attended in-person for a pass in PHYS102.

Students enrolled in the Summer occurrence of PHYS102 will be required to complete the lab component over 2 weeks of late Jan/early Feb of the following year – see Timetable.

The laboratories are situated on level 3 of the Ernest Rutherford Building in Room 312.

Before attending this first session, you must purchase a red or green laboratory notebook. If you have a notebook from PHYS101 you may use that instead. Laboratory manuals are provided free of charge by the School in the first laboratory. Bring your manual and notebook to all laboratory sessions.

The laboratory work complements the lecture material. Some experiments introduce you to particular experimental techniques, whilst others illustrate lecture topics.

Satisfactory performance in the laboratory work is required to pass the course as a whole.

Lab exemption: An exemption from the lab component of the course will be granted to students who have passed the laboratory component of an identical or comparable course with above average grades, but failed the course on other grounds. Since laboratory work is designed to reinforce the lecture content as well as teach practical skills, exempted students are encouraged to participate in any labs from which they feel they could benefit. Laboratory course credit can only be used to gain one consequent exemption.

Timetable

Because of the changing dates of different years, it is not possible to provide exact dates for course activities, but the timetable below shows the general principles.

Date	Event
13 November 2023 **(Week following end of semester 2 examination period)**	Start of Summer Course and material becomes available
11-15th December 2023 **(5th week of the summer semester)**	On-line test
22nd Jan – 2nd Feb 2024 **(2 weeks before exam)**	Lab attendance – in person requirement.
5-9th February 2024 **(Week before results release)**	Final examination held – in person requirement
16th February 2024 **(Friday of week before S1 start)**	Summer course grades released
19th February 2024 **(Mid February)**	Lectures begin for Semester 1

Assessment

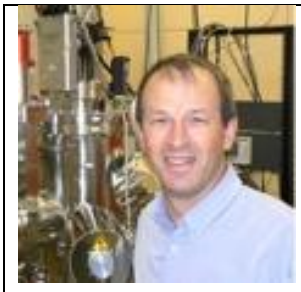
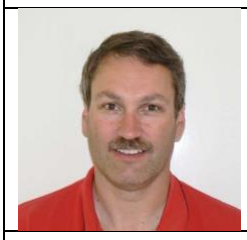
Value	Item
15%	Online Homework – 12 assignments
20%	Test – online in week 5
15%	Laboratory – to be completed in-person
50%	Final Examination – to be completed in-person.

Course Supervisor

We want you to benefit from this course as much as possible, and your personal feedback is welcome at all times. Please contact me if you have any problems or queries.

Prof. Roger J. Reeves, Course Supervisor
Room 623, von Haast Building
roger.reeves@canterbury.ac.nz

Course Lecturers and their sections are

	**Professor Roger Reeves** (roger.reeves@canterbury.ac.nz) Introduction to Quantum Mechanics Wave-particle duality, Uncertainty Principle Models of the Atom Nuclear Physics – decays and reactions, Particle Physics, Fundamental forces Quarks and the Standard Model, Elements of Cosmology. (6 weeks)
	**Dr Steven Marsh** (steven.marsh@canterbury.ac.nz) Electric flux, Gauss's law DC circuits and Kirchoff's Laws Capacitors and RC circuits Magnetic field Laws (Biot-Savart, Ampere), General form of Faraday's law, RL and RLC circuits, Basic AC circuits (selected topics) Maxwell's equations and electromagnetic waves (4 weeks)
	**Associate Professor Michael Albrow** (michael.albrow@canterbury.ac.nz) Universal Laws of gravitation (Newton, Kepler), Theory of Relativity. (2 weeks)
	**Cliff Franklin**, Lab Supervisor: Room 322 Ernest Rutherford cliff.franklin@canterbury.ac.nz
	Tutor - TBA

General Information

The School has general policies that apply to all courses regarding such matters as Dishonest Practice, allowed types of calculators, Marks and Grades boundaries, Late Work, Academic Liaison, Assistance for Students with Disabilities, Reconsideration of Grades, Special Consideration Applications, etc. This information is available on the *Physics & Astronomy Undergraduate Courses* section of the Learn site. https://apps.canterbury.ac.nz/1/science/phys-chem/PHYS%20-%20Course%20Outlines/General.PDF

EXPECTATIONS AND REQUIREMENTS OF STUDENT PARTICIPATION IN PHYSICS AND ASTRONOMY COURSES

An important principle operating in all our courses will be that of

***LEARNING THROUGH ACTIVE PARTICIPATION*.**

This means that you must be prepared to attend all the lectures, laboratories and tutorials and attempt all the homework assignments and all course tests. If you are unable to meet all these commitments, then you may not be well suited to studying physics.

The only exceptions to full participation in all aspects of the course will be

- students who have been issued with a written laboratory exemption;
- students who produce a doctor's certificate (or other evidence) to the Laboratory Supervisor (in the case of missed laboratory work) or to the Course Coordinator (in case of missing other work).

READING, HOMEWORK AND STUDY

You will get as much out of this (or any) course as you put in to it. **Here are some ways you can best help yourself.**

- **Reading.** *Read* the relevant part of the text before each lecture. (A reading and problem list will be circulated.) You will understand and enjoy it more, and learn much faster.
- **Problem-solving.** Nothing teaches more thoroughly than solving problems. *Attempt* the set work, especially the electronic homework, as well as past exams, and go over it with your tutor.
- **Study.** *Work over* your lecture notes with the text and problems. *Write a digest* of your notes, summarizing key points in your own way on one sheet of paper for each lecture. These summaries are invaluable in problem solving, in laboratories and in revising.