UNIVERSITY OF CAPE TOWN
Department of Physics
PHY2004W Intermediate Physics 2026

Instructors

Dr Spencer Wheaton **(Convener)** (VC, QM) : spencer.wheaton@uct.ac.za
A/Prof Mark Blumenthal (Lab) : mark.blumenthal@uct.ac.za
Prof Andy Buffler (VW) : andy.buffler@uct.ac.za
A/Prof Steve Peterson (CM, VC) : steve.peterson@uct.ac.za
Dr Mawande Lushozi (EM Part 1) : mawande.lushozi@uct.ac.za
Dr Trisha Salagaram (EM Part 2) : trisha.salagaram@uct.ac.za

Course Tutors

The course tutors can be consulted (at times still to be arranged) if you have problems with the course material or the weekly problem sets.

David Roth / RTHDAV010@myuct.ac.za
Stephan Potgieter / PTGJAK001@myuct.ac.za

Pre-/Co-requisites

PHY1004W, MAM1031F and MAM1032S (or equivalents) as prerequisites, and MAM2010F and MAM2011F as co-requisites. A final mark of 60% and higher in PHY1004W is highly recommended.

Website

Course material and announcements will be posted on Amathuba.

Syllabus

Vibrations and Waves (VW) (25 lectures):
Simple harmonic motion; damping; complex numbers; forced oscillations and resonance; coupled oscillators; mechanical waves; normal modes of different systems in 1D and 2D; Fourier analysis; travelling waves; sound.

Classical Mechanics (CM) (25 lectures):
Brief review of Newtonian Mechanics; the stationary-action principle; the Euler-Lagrange equation; Lagrangian mechanics; constrained systems; symmetries; conservation laws and cyclic coordinates; Noether's theorem; non-inertial reference frames, centrifugal and coriolis forces; special relativity; relativistic mechanics.

Vector Calculus (VC) (10 lectures):
Coordinate systems; scalar and vector fields; div, grad and curl; line integrals; surface integrals; volume integrals; Gauss' theorem; Stokes' theorem.

Electromagnetism (EM) (30 lectures):
Electrostatics; special techniques for potentials; electric fields in matter; magneto-statics; current; Ohm's law; electromagnetic induction; electrodynamics; Maxwell's equations.

Quantum Mechanics (QM) (30 lectures):
The basic assumptions of quantum mechanics; solutions of Schrödinger's equation; properties of wave functions and operators; one-dimensional applications; angular momentum in quantum mechanics; three-dimensional applications; the hydrogen atom.

Textbooks

Vibrations and Waves
VIBRATIONS and WAVES by A.P. French, (M.I.T. Introductory Physics Series, Van Nostrand).

Classical Mechanics
CLASSICAL MECHANICS by John R. Taylor (University Science Books, 2005).

Electromagnetism
INTRODUCTION to ELECTRODYNAMICS (5th edition) by D.J. Griffiths (Cambridge: Cambridge University Press, 2023).

Quantum Mechanics
INTRODUCTION to QUANTUM MECHANICS (3rd edition) by D.J. Griffiths and D.F. Schroeter (Cambridge: Cambridge University Press, 2018).

Lectures RW James LT4B, 11h00 - 11h45, Monday to Friday.

Laboratory RW James PHYLAB2, 14h00 - 17h00, Monday/Tuesday (refer to detailed course calendar on Amathuba).

Practicals will start in the first week of Term 1 on Monday 16 February in PHYLAB2.

Tutorials RW James 3B, 14h00 - 16h00, Tuesday (refer to detailed course calendar on Amathuba).

Tutorials will start in the first week of Term 1 on Tuesday 17 February in RW James 3B.

Problem Sets A weekly problem set (WPS) will be issued each Tuesday at 14h00 during the tutorial. It is due on the Friday at 23h59 via Amathuba. The WPS will be worked on during part of the tutorials. The WPS are part of the DP requirements and count 6% towards the final mark.

Class Tests There will be two class tests in each semester (refer to the detailed course calendar on Amathuba).

Assessment The final grade for the course will be a weighted average of: Class Tests (24%), Problem Sets (6%), Laboratory Record (20%), 2 Mid-Year 2-Hour Exams (12.5% each), 2 Year-End 2-Hour Exams (12.5% each). A final (aggregate) mark of 50% is required to pass the course.

There is a sub-minimum criterion of 40% for the average of the two mid-year exams and 40% for the average of the two year-end exams. Any student who scores below 50% for the average of the mid-year exams will be required to complete a 3-hour reassessment in the last week of the mid-year vacation. The result of this reassessment, which will be capped at 50%, will replace the mid-year exam results if this reassessment result is higher than the average mark scored in the mid-year exams.

Any student still short of the 40% exam subminimum will then need to deregister from the course, since no further reassessment of Semester 1 material will be offerred.

Any student awarded a deferred exam at mid-year will also need to sit the reassessment in the last week of the mid-year vacation.

Formula Sheets Students may bring a self-generated formula sheet of 2 double-sided A4 pages to all tests and examinations.

DP Certificates In order to obtain a duly performed (DP) certificate (i.e., to qualify to write the final exams) students must have obtained an average of 40% for the class record (a weighted combination of the class tests, lab record and problem sets), must have attended **ALL** lab sessions, tutorials and tests and must have submitted **ALL** lab reports.

Exemptions

Participation in all practicals, tutorials, tests and examinations is compulsory. All students are expected to attempt all experimental and computational laboratories for the course, and complete all laboratory reports and laboratory tests, and attend all tutorials.

If you are ill and miss any grade-carrying activity, then a medical certificate from a registered medical practitioner needs to be emailed to the course convener within 2 days of returning from illness, and a short form will need to be completed (available on the PHY2004W Amathuba site). Students missing a test due to illness will be asked by the course convener to write a make-up test within a few days.

An application for exemption from laboratory activities for students who are repeating the course must be made by email to A/Prof Mark Blumenthal within the first two weeks of Term 1 (mark.blumenthal@uct.ac.za).

If a student wishes to be granted an exemption or extension for a course requirement associated with a planned short absence from the course, then there is a form to complete (Science Faculty short leave form available on the course Amathuba site). This form needs to be submitted to the course convener at least 3 working days prior to the period in question. Irreversible plans (such as flight bookings) must not be made before approval of leave is granted.

Plagiarism

The real criterion is this: work that you hand in for credit is work that you must yourself understand. If copying from others is detected, the work of both the copier and the copied will not be marked, and a mark of zero will be awarded to each, and university disciplinary procedures may be invoked. Submitting the solutions taken from the solutions posted on the website by the class tutor in previous years also constitutes copying. The University of Cape Town's official statement of general rules and policies, including a statement of values and expected student and staff conduct, can be found in UCT Handbook 3. Please commit to this by completing the "Code of Honour" Quiz on the PHY2004W Amathuba site.

AI Statement

The UCT Faculty of Science recognises that some AI tools may aid learning, and that developing AI literacy is essential (see UCT Libraries AI Guide). Therefore, in PHY2004W, the use of generative AI tools may be permitted for specific assessments, when this is determined to support the course learning goals.

Science students are required to develop critical thinking, problem solving, data analysis, scientific writing and other core academic skills independently of AI. Inappropriate use of AI may undermine learning in this regard and lead to academic dishonesty. Students must be able to defend any work that they submit.

Assessments in which AI tools are permitted will be clearly identified by the lecturer-in-charge with specific details of allowed AI usage included in the assessment instructions. A student that chooses to use AI tools for any part of such an assessment (from brainstorming to text editing), must include a clear declaration with their submission.

This should state:
"I have used [*name of AI tool*], as permitted by the lecturer, for the purpose of [*brief description of use*]. I take full responsibility for the final content of this submission."

It is therefore essential that students keep detailed records of AI usage throughout an activity.

Failure to properly declare AI tools is considered a violation of the University of Cape Town's rules on academic conduct and plagiarism, as provided in Handbook 3: General Rules and Policies. Students unsure of what constitutes an AI tool, must check with the course convener.