



DEPARTMENT OF
PHYSICS
UNIVERSITY OF CAPE TOWN

PHY2004W
Intermediate Physics
2018

Course Information Sheet

PHY2004W is a calculus-based courses that aims to develop the foundations of a major in Physics and allows continuation to third year Physics. The theory component features a set of intermediate topics, and the laboratory component develops both experimental and computational skills. The course includes the following theoretical and experimental work:

- **Electromagnetism (EM):** Vector calculus (div, grad, curl), electrostatics, special techniques for potentials, electric fields in matter, magneto-statics, magnetic fields in matter, current, Ohm's law, circuits, electromagnetic induction, electrodynamics, Maxwell's equations.
- **Mechanics (M):** Waves, diffraction, interference, review of Newton's laws, inertial and non-inertial frames, transformations, equations of motion for 1D systems, oscillations, resonance, non-linear systems, Euler's equation, Lagrange's equation, generalized coordinates and constrained systems, Hamiltonian formalism, phase space and Liouville's theorem, planetary motion, systems of particles, angular momentum, rigid bodies, coupled oscillators, wave equation, special relativity, relativistic mechanics.
- **Quantum mechanics (QM):** The basic assumptions of quantum mechanics, solutions of Schrodinger's equation, properties of wave functions and operators, one-dimensional applications, angular momentum in quantum mechanics, three-dimensional applications, the hydrogen atom, approximate methods.
- **Laboratory:** Practical and computational tasks designed to develop advanced skills of experimentation and problem solving within the context of Mechanics, Electromagnetism and Quantum Mechanics.

Course entry requirements: PHY1004W, a full first year course in Mathematics, and MAM2000W or (MAM2004H and MAM2047H) as co-requisite.

Prescribed textbooks *The prescribed textbooks for this course are:*

1. **INTRODUCTION to ELECTRODYNAMICS** (4th edition) by D.J. Griffiths (PEARSON, 2013).
2. **CLASSICAL MECHANICS** by John R. Taylor (University Science Books, 2005).
3. **INTRODUCTION to QUANTUM MECHANICS** (2nd edition) by D.J. Griffiths (PEARSON, 2005).

Convener: Dr. Sahal Yacoob, 5.05 RW James, sahal.yacoob@uct.ac.za

Lectures: RW James LT4B, 4th period (11:00 - 11:45), Monday to Friday.

Course website: The course content will be provided on Vula. Please remember that if you want feedback from the lecturers on a question posted to Vula you should use “Q&A”, and not the chatroom.

Class tutors: The tutors are here to help you, you will see them at the whiteboard tutorials, and at regularly scheduled weekly sessions where they will help you through difficulties with the course material. You should feel free to try to schedule additional time with them if you need further help.

You should also feel free to schedule meeting with the lecturers as required.

The course tutors are listed below for EM and Mechanics. Contact details will follow

EM: Nicole Moodley, Salahuddeen Ahmad

Mechanics: Luke Lippstreu, Salahuddeen Ahmad

QM: TBD

Weekly problem sets: Each week a problem set will be issued. Answers must be handed in each Friday before 11:05 a.m. All problem sets must be placed in a box which will be outside LT4B. Solutions must be written completely and legibly to receive full marks. Students may work together on the problems, and discuss the results together, but the handed-in script must be each student’s own work. **Please take care to show the steps you have taken.**

Tutorials: Whiteboard style tutorial on each Tuesday (except when there is a test), 14:00 to 16:00, upstairs in the course 1 Laboratory. Attendance will be recorded and used for DP purposes. Solutions to tutorials will not be posted, so students are to ensure that they use the tutorial time effectively.

Laboratory: Each Monday, 14:00 to 17:00, PHYLAB2. See the ‘Laboratory’ folder on Vula for more information and the schedule. Prof M. Blumenthal is responsible for the administration of the laboratory course.

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. A mark of zero may be awarded, or a nominal mark may be awarded at the discretion of the course convener.

Exemptions: 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 (available on the course Vula 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. Completion of the form is not required for medical certificates obtained on the day of the unplanned illness. These should be submitted in the usual way to the course convener.

Assessment:

7 x class tests	20%
25 x weekly problem sets	10%
laboratory record	20%
1 x Jun. exam paper (EM and Mech. 1) [2 hours]	20%
1 x Nov. exam paper (Mech. 2 and QM) [3 hours]	30%

There is a sub-minima criterion of a 40% on the average of the two examinations (see Science Faculty Handbook).

Students may bring a self-generated formula sheet (2 A4 pages double-sided) to all tests and examinations. Additional formula and/or data sheets will be provided.

Tests will take place during the lecture period, or the tutorial slot.

Duly Performed (DP) requirement: In order to qualify for writing the final examination, the DP requirements must be met during the week starting 22 October. This requires

- a minimum of 40% in class record (weighted combination of tests and WPS);
- attendance at all tests;
- completion of all laboratory reports and a laboratory record of at least 50%;
- completion of 75% (19) of weekly problem sets;
- attendance and completion at least 75% (17) of the Tuesday afternoon tutorials.
- Exemption from class tests will not be granted; students missing a test due to illness will sit another test as soon as they have recovered, provided that a medical certificate has been produced. Exemption from practical, tutorial and weekly problem set requirements will only be considered on medical or compassionate grounds and normally requires a medical certificate or a letter of support.

There are 4 lecture modules:

EM	Electromagnetism	40 lectures	Prof Mark Blumenthal
M1	Mechanics	15 lectures	Dr Katie Cole
M2	Mechanics	33 lectures	Dr Sahal Yacoob
QM	Quantum Mechanics	32 lectures	Dr Spencer Wheaton

The Physics Department is aware that PHY2004W may require a greater time commitment than your other second year courses. Below are our weekly expectations:

Structured: 3 hours and 45 minutes of lectures, a 2-hour whiteboard tutorial, and a 3-hour laboratory session.

Deliverables: 4 hours on each WPS, 3 hours on the computational lab write-ups (12 in the course), and about 10 hours on the experimental lab reports (there are 7 in the course).

Self-study: You should also plan to spend a few hours each week reading (in addition to the reading related to the WPS) on your own to make sure you understand everything, and to prepare for lectures by reading ahead.

The time that it takes to understand the material in the course will vary from student to student: this is entirely natural. If you have bits of understanding "missing" from first year, then you will find that you might need to work extra hard on certain topics in second year. Please talk to the course convener, the other lecturers, or even the student advisor for physics if you find that you are not completing the tasks demanded in the course in the times suggested above. We see you all as part of the future of physics and want to make PHY2004W both engaging and enjoyable for everyone in the course.

Lecture calendar for PHY2004W 2018:

Wk	Dates	Mon	Tues	Weds	Thurs	Fri
1	19 – 23 Feb	EM + Lab	EM + Tut (EM)	EM	EM	EM
2	26 Feb – 2 Mar	EM + Lab	EM + Tut (EM)	EM	EM	EM
3	5 – 9 March	EM + Lab	EM + Tut (EM)	EM	EM	EM
4	12 – 16 March	EM + Lab	EM + Tut (EM)	EM	EM	Test 1 (EM)
5	19 – 23 March	EM + Lab	EM + Tut (EM)	Human Rights Day	EM	EM
6	26 – 30 March	EM + Lab	EM + Tut (EM)	EM	EM	Good Friday
1ST VACATION 30 March – 8 April						
7	9 – 13 April	EM + Lab	EM + Tut (EM)	EM	EM	EM
8	16 – 20 April	EM + Lab	EM + Test 2 (EM)	EM	EM	EM
9	23 – 27 April	EM + Lab	EM + Tut (EM)	Mech 1	Mech 1	Freedom Day
10	30 Apr. – 4 May	M1 + Lab	Workers Day	M1	M1	M1
11	7 – 11 May	M1 + Lab	M1 + Tut (M1)	M1	M1	M1
12	14 – 18 May	M1 + Lab	M1 + Tut (M1)	M1	Test 3 (M1)	M2
13	21 – 25 May	M2 + Lab	M2 + Tut(M1/2)	M2	M2	Consolidation
15	28 May – 1 Jun.			Exams Start		
16	4 – 8 June					
17	11 – 16 June					Youth Day
2ND VACATION 16 June – 22 July						

Wk	Dates	Mon	Tues	Weds	Thurs	Fri
1	23 – 27 July	M2 + Lab	M2 + Tut M2	M2	M2	M2
2	30 Jul – 3 Aug.	M2 + Lab	M2 + Tut M2	M2	M2	M2
3	6 – 10 August	M2 + Lab	M2 + Tut M2	M2	Women's Day	test 4 (M2)
4	13 – 17 August	M2 + Lab	M2 + Tut M2	M2	M2	M2
5	20 – 24 August	M2 + Lab	M2 + Tut M2	M2	M2	M2
6	27 – 31 August	M2 + Lab	M2 + Tut M2	M2	M2	QM
7	3 – 7 Sept.	QM + Lab	QM + Test 5 (M2)	QM	QM	QM
3rd VACATION 8 – 16 September 2018						
7	17 – 21 Sept.	QM + Lab	QM + Tut QM	QM	QM	QM
8	24 – 28 Sept.	Heritage Day	QM + Tut QM	QM	QM	Test 6 (QM)
9	1 – 5 Oct	QM + Lab	QM + Tut	QM	QM	QM
10	8 – 12 Oct	QM + Lab	QM + Tut	QM	QM	QM
11	15 – 19 Oct	QM + Lab	QM + Test 7 (QM)	QM	QM	QM
12	22 – 26 Oct	QM + Lab	QM + Tut	Consolidation	Consolidation	Consolidation
13	29 Oct – 2 Nov			Exams Start		
14	5 – 9 Nov					
15	12 – 16 Nov			Exams End		
VACATION 19 November 2018						