DEPARTMENT OF PHYSICS AND ELECTRONICS

PHYSICS 1

COURSE BROCHURE

2026

INFORMATION FOR STUDENTS TAKING PHYSICS 1 (PHY 101 & PHY 102)

Contents

1. THE COURSE

Physics 1 consists of two one-semester courses: PHY 101 and PHY 102. PHY 101 runs in the first half of the year and is examined in June. PHY 102 runs in the second half of the year and is examined in November.

Physics 1 is a Calculus-based course designed for students who intend to major in Physical or Mathematical Sciences such as Chemistry, Computer Science, Geology, Mathematics, Statistics and, naturally, Physics.

Very little prior knowledge of Physics is assumed, although a Matric pass in Physical Science (or an equivalent) is normally required. If you have done Physics before, the course will seem familiar to you initially. The emphasis however is very different from that at school, so you must pay close attention, even when you think you already know the material.

Each semester-course is divided into 2 parts:

- THEORETICAL PHYSICS, covered in lectures and tutorials, and
- EXPERIMENTAL PHYSICS, covered in the laboratory.

These two parts are not alternatives. Each is an essential part of your training. To obtain a good pass, you must give due attention to both.

2. THEORETICAL PHYSICS

Class Meetings: You should attend all lectures — ***Attendance at lectures is compulsory***. One of the prerequisites for admission to the final examination (see Section 11 about the DP Certificate) is satisfactory participation in at least 80% of the semester's lectures. Lectures take place in the Physics Upper Lecture Theatre as follows:

Monday	Period 3	9:35 a.m.
Tuesday	Period 4	10.30 a.m.
Wednesday	Period 5	11:25 a.m.
Thursday	Period 1	7:45 a.m.
Friday	Period 2	8.40 a.m.

Weekly Problem Sets (WPS): Every week you will be given a set of problems to complete. These must be handed in every Monday by 9:30 am (the beginning of the lecture) to the assignment submission box outside the administrator's office. Some of the problems will be marked and they will count towards your class record, so keeping up with them will help to take the pressure off come exam time. The point of the problem sets is *not*, actually, to maximise your marks, but rather to help you test your understanding of the week's work. If you are struggling with the problem sets, you should get help as soon as possible! (See the Tutor on Call section) Don't use AI to do your Problem Sets for you — this is a short-sighted strategy that is likely to cause you to fail. Rather go and see the Tutor on Call as often as you can.

White Board Tutorials (WBT): Instead of meeting once a week during a lecture period, the tutorials will be run alternately with the practicals, during the afternoons. Again, check the RUconnected page to find out what you are doing each week. There are up to six tutorials a semester (depending on public holidays). During this time you will solve problems in small groups. There will be tutors available to assist.

Intelligent participation in the tutorials and with the problem sets is essential and it will help you to master the material with far less effort. It will also sharpen your understanding of the fundamental concepts and teach you to think like a scientist. So don't abuse the tutorial sessions, treat them seriously, put effort into them and you will profit enormously.

Refer to your practical manual and the RUconnected pages for the schedule of when practicals and tutorials occur.

Attendance at tutorials is compulsory. One of the prerequisites for admission to the final examination (see Section 11 about the DP Certificate) is satisfactory participation in at least 80% of the semester's tutorials. Failure to attend sessions, attempt problems or hand in work at the prescribed time, will be counted as absence from the tutorial for that week.

3. EXPERIMENTAL PHYSICS

Experimental Physics is taught in the laboratories. You are required to attend one laboratory session (practical) per week from 2 pm to 5 pm. The objectives of this course are

- to teach you experimental methods;
- to make you skilled in the use of equipment commonly employed by physicists;
- to make you proficient in the gathering of data and its analysis.

Note that the experimental physics course *is NOT intended to supplement or illustrate lectures*. It is an entirely separate aspect of your training in Physics, with different objectives. You will need an **A4-size, hard-covered book** for recording your results in the laboratory. This *must* be a different book to the one in which you take lecture notes during the mornings. You can chose whether to take notes in the morning lectures in a book or on an exam pad.

Just as with tutorials and lectures, attendance at practicals is compulsory. If you attend fewer than 80% of the semester's practicals you cannot obtain the DP certificate, and cannot sit for the final exam.

In the first semester you concentrate on physics experiments. In the second semester you have lecture-pracs in which you learn about electricity and electronics.

4. THE STAFF

Your lecturers this year will be

First term:	Prof Jennifer Williams
Second term:	Prof Jennifer Williams
Third term:	Prof Jennifer Williams, Dr Stanley Kuja and TBA
Fourth term:	Prof Joey Medved and Dr Jennifer Williams

Your course in experimental physics will be run by Mr Sullivan in the first semester and also by Mr Sullivan in the second semester. The whiteboard tutorials are run by Prof Williams in the first semester and the course lecturers in the second semester.

The Head of Department is Prof. Chithambo, although he is currently on sabbatical and so the Acting HoD this year is Prof Williams.

The course co-ordinator for Physics 1 is Prof Williams
(Room 37; email: Jennifer.Williams@ru.ac.za). Overall responsibility for the course rests with her, so please feel free to contact her if you have any problems with the course.

5. THE TEXTBOOK

There is a choice of two prescribed textbooks for the course:

- ERIC MAZUR, *Principles and Practice of Physics*, Pearson Education.
- OPENSTAX *University Physics* (all 3 volumes), found free online at
  https://openstax.org/details/books/university-physics
  You can use this book online, you do not need to print it!

You should have your own copy of one of the prescribed books. You can buy a new copy from a bookstore, e.g. Van Schaik in High Street (expensive!). You can also buy them online from Takealot.com (might be cheaper?). There are also a limited number of second hand books available. Keep your eyes open for notices.There are also a limited number of the prescribed textbook in the university library where they are on shortloan and may not be removed from the library. The OpenStax book is freely available on line and can be downloaded in pdf form.

We recommend the book "USED MATHS" by C E Swartz which covers the mathematics required for this course (and also Physics 2). This book is available in the Library for reference.

We shall supplement the textbook from time to time with various handouts as necessary. In addition you will be given laboratory manuals. In order to cover the costs of the above your University account will be debited with the amount of R200 for each semester.

There are many other good textbooks that deal with the same subject matter. Many of these are in the Library. Make use of them. They will enlarge your understanding and appreciation of the subject matter.

You are also required to own a scientific electronic calculator. We recommend one which can convert between rectangular and polar coordinates and convert between decimal, hexadecimal and binary. ***Bring it to all examinations, tests and practical laboratories.***

RUconnected: Course handouts, problem sets and solutions are posted on the course RUconnected sites. You should be enrolled onto the relevant Physics 101 and Physics 102 RUconnected sites automatically. You can find them under "My Courses" in RUconnected or in the list of Physics and Electronics courses.

6. THE PHYSICS RESOURCES CENTRE

Unfortunately this library has been CLOSED because books have gone MISSING.

Some books are kept on a Reserved Shelf in the main library. *These must not be removed from the library and must be replaced immediately after use.* Copies of the prescribed textbook can be found here.

REMEMBER: *This library is run on a system of honesty. We trust you and expect you to honour that trust.* If books are lost from the library, the collection will have to be transferred to the Main Library and all will suffer. Sadly, we are suffering.

7. TESTS

You are required to write a 45-minute test approximately every two or three weeks. The most important function of these tests is to ensure that you revise and master your work systematically throughout the year. This is essential if you are to get a good grasp of the subject matter and to get the most out of the course.

Use these tests to determine whether you understand the work. *Make sure that you consult with your lecturers or the tutors if your marks are unsatisfactory.*

A secondary function of these tests is to help us to assess your progress. If your marks are unsatisfactory, you will be required to attend additional tuition by the ADP tutors. A register will be taken during these sessions. *Non-attendance* will be noted, and will count in your disfavour.

The marks obtained in these tests count toward your DP requirement, and also toward your class record. They therefore substantially affect your final result (see section 10). Take the tests seriously and put effort into them. It is not difficult to do well consistently during the year and in this way to guarantee a good final result.

The **provisional dates** for the tests are:

1^{st} TERM:	2^{nd} TERM:	3^{rd} TERM:	4^{th} TERM:
17 February	14 April	21 July	1 September
3 March	28 April	11 August	22 September
17 March	12 May		2 October (Friday)

Notice that the normal test day is Tuesday, the others are at the end of the term or semester or to avoid clashes with public holidays. Any changes to these dates will be announced in lectures well in advance.

Announcements made in lectures are regarded as having been made to the whole class. You cannot use the fact that you skipped a lecture as an excuse for not knowing about changes to the programme.

8. EXAMINATIONS

The final examinations for each semester are held at the end of that semester.

The PHY 101 examinations in June consist of a 3-hour theory paper and a 3-hour practical. The theory paper counts approximately 80% of the exam mark and the practical approximately 20%. The material covered in the first semester is not examined explicitly in November, although the work covered in the first semester is foundational and always relevant.

The PHY 102 examinations in November also consist of a 3-hour theory paper and a 3-hour practical. The theory counts approximately 80% of the exam mark and the practical approximately 20%.

Your FINAL COURSE MARK in each semester includes a substantial contribution from your class record (see section 10).

IMPORTANT: To be admitted to an examination, you must have earned a DP certificate (see section 11).

If you fail PHY 101 in June, you *may* be given a second chance in a supplementary examination. Similarly, there is a supplementary examination for PHY 102. Supplementary examinations are written in November, after the second semester examinations. In both cases, a subminimum is required in order to be admitted to the supplementary examination. These subminima are an average mark of 40%. If you are given a supplementary examination, you will write *both* the practical and the theory components of the examination. In cases where a student has written a supplementary exam, the original class record will be used again to obtain the final result.

9. SUBMINIMA AND AGGREGATE PASSES

Subminima are enforced in both PHY 101 and PHY 102, with regard to admission to the second semester (PHY 102), and obtaining an aggregate pass in Physics 1.

If you obtain less than 40% for PHY 101 you will be excluded from doing PHY 102. Similarly, if you get less than 40% for PHY 102 you fail PHY 102 and Physics 1, but you keep the credit for PHY 101 (if you obtained one), and may combine it with PHY 102 in a subsequent year to earn a pass in Physics 1.

If you fail either PHY 101 or PHY 102, but obtain an average of at least 50% in the pair, you pass Physics 1 with two semester-credits, provided that you obtain at least 40% for PHY 101 and also at least 40% for PHY 102. A continuing credit (you may do Physics 2) is called an ACR (for aggregated credit). A non-continuing credit (you may not do Physics 2, but both the first-year credits count towards your degree) is called an NCR.

10. THE CLASS RECORD

This is a record of your performance during the year. It is used for two purposes.

Firstly, together with your attendance record, it determines whether you are awarded a DP certificate. *The Class Record is thus an important factor in determining whether you are allowed to write the final semester examinations.*

Secondly, **it is used in the calculation of your final course mark.** This is done according to the formula

$$\text{final course mark} = 45\% \times \text{class record}(\%) + 55\% \times \text{final exam mark}(\%)$$

The class record therefore supplies 45% of your final mark.

The message is:

ALL YOUR WORK THROUGHOUT THE YEAR COUNTS.

If you do not work consistently, you will fail.

The 45% Class Record contribution is made up as follows:

- 25% Tests (split equally between 5/6 tests);
- 10% Practical Class Record;
- 5% Weekly Problem Sets (marked weekly);
- 2% Assignments and Quizzes;
- 3% Participation (hand-in & collection and attendance).

11. DP CERTIFICATE

The Duly Performed certificate, or DP, is an acknowledgement that you have completed your coursework to our satisfaction. *To obtain it, you need:*

- **more than the subminima for your class record in PHY 101 and PHY 102 (more than 40%)**, and
- **registered attendance of at least 80% for lectures, practicals, tutorials, and hand-ins.** (Counted separately.)

BE WARNED:

- Absences from lectures, tutorials or practicals will count against you unless you excuse yourself with sufficient reason to the person in charge of the class.
- Absence from a test will result in your being awarded zero for that test unless you have expressly obtained leave of absence (LOA) *in writing from the Head of Department.* Generally such LOA will be granted only where an appropriate medical certificate is provided, preferably by a doctor.

12. HOW TO WORK

You are unlikely to do well at Physics if you do not work systematically and regularly throughout the year. **YOU NEED TO SPEND TIME ON PHYSICS EVERY DAY.** The recommended minimum is 1 hour daily. This time should be spent :

- *working through your class notes.*
- *understanding key concepts and definitions.*
- *solving problems.*
- *supplementing lecture notes* from your textbook as necessary.
- *revising* unfamiliar material.

The fact that we assign only a limited selection of problems should not prevent you from attempting others. The set problems are the *minimum number* to master the work, not the maximum!

Above all *STUDY ACTIVELY.*

- Write notes all the time you are reading the textbook.
- Summarise each section as you finish it.
- Close the book and try to recall the principle ideas of the section.

If you feel that there is something that you just don't get so that you need to "just learn" it, then you are *not studying correctly!*

Do not be afraid to come and ask! There will be an ADP tutor available ("Tutor in the hot seat") in the Physics resources centre most afternoons, and lecturers are also available to ask questions of.

13. FURTHER COURSES IN PHYSICS

If you intend to continue with Physics you may be interested to know what subjects are tackled in later years.

In Second Year you will do: AC Theory, Vibrations, Waves, and Quantum Mechanics, Advanced Classical Mechanics, Electrostatic Fields, Special Relativity and Optics.

In the Third Year you will do: Electromagnetism, Quantum Mechanics, Nuclear Physics, Signals and Systems, Thermodynamics, Statistical Physics, and Solid State Physics.

Electronics is covered in both second and third years during the practical sessions.

When you pass Physics 3 (with the necessary number of other credits), you will be awarded the B.Sc. degree in Physics with Electronics.

14. POSTGRADUATE COURSES

After you have obtained your B.Sc., you may apply to be admitted to the Honours course. Honours can be done in Physics, or Electronics, or a combination of both. Alternatively one of these two subjects may be taken together with some other subject such as Mathematics, Computer Science, Chemistry or Geology, leading to a joint Honours. To be admitted to the Honours course, you need to score a minimum of 60% in the third year.

The Rhodes B.Sc. Honours degree is internationally recognised and admits students to research degrees here and abroad.

After Honours you can continue to the M.Sc. and Ph.D. degrees. In these, you will be pursuing original research in some current problem in Physics. These degrees are awarded on the basis of a thesis.

15. RESEARCH IN THE DEPARTMENT

The Department has gained international recognition in a number of its lines of research.

Prof Makaiko Chithambo's research is concerned with the study of point defects in solids using time-resolved and conventional luminescence techniques and related methods as well as development of models of charge dynamics in insulators.

Prof Justin Jonas is the Director of the Centre for Radio Astronomy Techniques and Technologies (RATT) within the department and he conducts research in radio astronomy which uses the radio telescope at Hartebeesthoek to study star formation and supernova remnants. **Prof Oleg Smirnov** holds the SARChi SKA Chair in Radio Astronomy. His research interests are in the design and operation of radio telescopes, specifically the Square Kilometre Array (SKA).

Prof David G Roux is an experimentalist who studies spinning deformed nuclei at extreme angular momenta, using large gamma-ray detector arrays such as the AFRODITE array at iThemba LABS near Cape Town.

Prof Joey Medved works on semi-classical aspects of Quantum Gravity, which is the unification of General Relativity and Quantum Field Theory.

Prof Schradrack Nsengiyumva works on the experimental study of point defects induced by ion implantation.

Dr Stanley Kuja works on developing antennas and electronics for use mainly in Radio Astronomy telescopes.

Mr Anthony Sullivan's research interests are in the electronics areas of embedded control and instrumentation.

Prof Jennifer Williams' research interests are in Physics Education Research.

16. IMPORTANT NOTE for students intending to proceed to Physics 2

Students intending to proceed to Physics 2 should note that they **must** have passed the first year Mathematics course, MAT 1, for admission to this course. Of course, you should not be content to obtain only this minimum requirement. If you intend to continue with Physics, we suggest that you aim at 60% or more for MAT 1. Note that MAT 1 is **not** the same as enrolling in MAT 1F or MAT 1S1.

Physics 2 uses a good deal of mathematics that you will encounter only in Mathematics 2. *Students who do not take Mathematics 2 at the same time as Physics 2 are thus at a significant disadvantage.* A pass in Mathematics 2 (MAM 2) is required for entry into Physics 3.

IMPORTANT : *DO NOT DROP MATHS 1 WITHOUT FIRST CONSULTING THE HEAD OF THE PHYSICS DEPARTMENT OR THE COURSE COORDINATOR.*

If you intend to carry on with Physics beyond first year, MAKE SURE YOU DO NOT FAIL MATHS! If Maths is going badly for you, GET HELP SOON!

17. COURSE CONTENT, OBJECTIVES AND OUTCOMES

The first year physics course consists of modules in kinematics, dynamics, energy, momentum and collisions, rotations, oscillations, waves, thermal physics, electric and magnetic fields and modern physics.

Objectives

To introduce and describe the underlying theory of each module, illustrate its applications as well as methods of utilizing that knowledge to solve relevant practical and conceptual problems.

Outcomes

These outcomes are adjusted slightly from the Physics department at the University of Colorado, Boulder, (Pollock, Chasteen, Dubson, & Perkins, 2007, pg 261):

These "course-level learning goals" represent what we want students to be able to *do* at the end of the course (as opposed to what *content* is expected to be covered, as in a syllabus). In all items below, "..." should be read "A student should be able to ...":

1. **Maths/physics connection:** ... translate a physical description to a mathematical equation, and conversely, explain the physical meaning of the mathematics.
2. **Visualise the problem:** ... represent key aspects of physics through diagrams.
3. **Organised knowledge:** ... articulate the big ideas from each chapter, section, and/or lecture.
4. **Communication:** ... justify and explain their thinking and / or approaches, both in writing and orally.
5. **Problem-solving strategy:** ... choose, apply, and justify appropriate problem-solving techniques in novel contexts.
6. **Problem solving strategy:** ... organise and carry out long, complex physics problems.
7. **Expecting and checking solution:** ... articulate expectations for, and justify reasonableness of solutions.
8. **Intellectual maturity:** ... be aware of what they don't understand, evidenced by asking sophisticated, specific questions; articulating where they experience difficulty; and taking actions to move beyond that difficulty.
9. **Course content:** ... see the various laws in this course as coherent, and use them to solve problems.
10. **Build on earlier material:** ...

By the end of the practical course, participants should be able to:

- Make optimum use of the laboratory equipment.
- Make appropriate records of observations, measurements and actions.
- Analyse experimental data to provide appropriate information, using a calculator or computer.
- Draw appropriate conclusions from observations and analysis.
- Write a formal report of an experiment.

18. PLAGIARISM

The University has firm policies regarding plagiarism and the penalties are harsh. If you do not know what plagiarism is, find out. Also find out what will happen if you are guilty of it. You are urged to read the document titled "Common Faculty Policy and Procedures on Plagiarism" found at

https://www.ru.ac.za/institutionalplanningunit/qualitypromotion/rhodesuniversitypolicies/policiesa-z/

very carefully!

19. WEB PAGE

More details of the Department and the courses that are offered may be obtained on the Departmental web page that may be accessed via the University web page (http://www.ru.ac.za) or directly at *https://www.ru.ac.za/physicsandelectronics/*