

PHYSICS AND ELECTRONICS

Professor and Head of Department

ML Chithambo, BSc(Malawi), MPhil(Sussex),
PhD(Edinburgh)

Associate Professors

DG Roux, MSc(Rhodes), PhD(UCT)

AJM Medved, BSc, MSc, PhD(Manitoba)

Senior Lecturer

S Nsengiyumva, BSc(Rwanda), MSc(Stellenbosch),
PhD(UCT)

Lecturers

AJ Sullivan, MSc(Rhodes)

JA Williams, BSc(Hons)(Rhodes), HDE(Rhodes),
PhD(Cantab)

ADJ Giovannoni, BSc(Eng), GDE(Wits),
BSc(Hons), MSc(UCT)

Professor of Physics and Electronics & Director: Centre for Radio Astronomy Techniques and Technologies

JL Jonas, PhD(Rhodes)

Professor & SARChI SKA Chair in Radio

Astronomy Techniques and Technologies

O M Smirnov, PhD(Russian. Acad. Sci.)

Visiting Professors

RS Booth, PhD(Manchester)

L-A McKinnell, PhD(Rhodes)

FB Abdalla, D.Phil (Oxford), MPhys (Oxford)

A Karastergiou, PhD (Max-Planck)

A Kemball

Research Associates

R Haggard, PhD(Rhodes)

LMG Poole, MSc(Rhodes), PhD(Sheffield)

G Bernardi, PhD (Bologna)

JB Habarulema, PhD (Rhodes)

ZT Katamzi, MSc(Rhodes), PhD(Bath)

I Theron, PhD (Stellenbosch)

C Tasse, PhD (Paris)

SK Sirothia, PhD (Tata Inst.)

GIG Jozsa, PhD (Bonn)

Senior Research Associate

I Heywood, PhD (Manchester)

J Noordam, D-Ing (TUD)

Professor Emeritus

AWV Poole, PhD(Rhodes)

Physics with Electronics (PHY) is a six-semester subject which may be taken as a major subject for the degrees of BSc, BCom and BJourn.

To major in Physics with Electronics a candidate is required to obtain credit in the following courses: PHY 1; PHY 2; PHY 3; MAT 1 or MAT 1 C, MAT 2 or MAM 2.

Up to two, or in some cases four, Physics with Electronics semester-credits may be allowed for degree/diploma curricula in the Faculties of Humanities, Education and Pharmacy.

Besides the major course, the department offers two terminal semester courses in Physics and Electronics, namely PHY 1E1 (non-calculus *Elementary Physics*) and PHY 1E2 (*Electronics Literacy*).

Physics 1E1 is a service course designed to meet the needs of students in the Department of Human Kinetics and Ergonomics but is also well suited to students majoring in the biological sciences. Any student accepted into the university may register for PHY 1E2, which affords students in a wide range of disciplines an opportunity to gain an understanding of basic electronics and modern electronic devices such as computers.

PHY 101, PHY 102, PHY 1E1 and PHY 1E2 are highly recommended choices of prerequisites for students who wish to major in Chemistry. (Refer to the Department of Chemistry Calendar entry.)

See the Departmental Web Page <http://www.ru.ac.za/academic/departments/physics/> for further details, particularly on the contents of courses.

First-year level courses in Physics with Electronics

There are two first-year courses in Physics with Electronics for candidates planning to major in physical, computational, mathematical or earth science subjects. PHY 101 is held in the first semester and PHY 102 in the second semester. Credit may be obtained in each course separately and, in addition, an aggregate mark of at least 50% will be deemed to be equivalent to a two-credit course PHY 1, provided that a candidate obtains the required sub-minimum in each component. Supplementary examinations may be recommended in either course, provided that a candidate achieves a minimum standard specified by the Department. Class tests and reports

collectively comprise the class mark, which forms part of the final mark for each course.

Candidates wishing to register for PHY 101 must have obtained a rating of 4 in Mathematics in the National Senior Certificate examination, or the equivalent thereof. If the equivalent is a better pass at Standard Grade (in the old Matric) the symbol must be an A or B.

Adequate performance in PHY 101 is required before a student may register for PHY 102. Alternatively, candidates who attain a sufficiently high standard in PHY 1E1 may be allowed to register for PHY 102, obtain credit in PHY 1 and then proceed to PHY 2.

PHY 101

Theory Course: Mechanics 1, Mechanics 2, Elasticity and Properties of Matter.

Experimental course: Measurement and data analysis.

PHY 102

Theory Course: Waves, Fields, Modern Physics and Kinetic Theory.

Experimental course: Electrical circuits; elementary analogue and digital electronics.

The Department offers two other first-level courses in Physics and Electronics. PHY 1E1 is held in the first semester and PHY 1E2 in the second semester. Credit may be obtained in each course separately and, in addition, an aggregate mark of at least 50% will be deemed to be equivalent to a two-credit course PHY 1E, provided that a candidate obtains the required sub-minimum in each component. Supplementary examinations may be recommended in either course, provided that a candidate achieves a minimum standard specified by the Department. Class tests collectively comprise the class mark, which forms part of the final mark for each course. Entry into PHY 1E2 does not require that a student have attended or passed PHY 1E1. The course is open to all university students. Credit may be obtained in all three of the courses PHY 101, PHY 102 and PHY 1E2.

PHY 1E1: Elementary Physics for the Life Sciences

Theory course: Mechanics; fluids; thermal physics; vibrations and waves; electricity and magnetism;

the nucleus. Applications to the life sciences are emphasised.

Experimental course: Measurement practice and data analysis.

PHY 1E2: Electronics Literacy

Theory course: Basic electricity and electronics necessary to connect up and commission modern, popular commercial instrumentation, in particular microprocessor based devices.

Experimental course: Electrical circuits; elementary analogue and digital electronics; elementary interfacing and communication between computers and peripheral devices.

Second-year level courses in Physics with Electronics

There are two independent second-year courses in Physics with Electronics. PHY 201 is held in the first semester and PHY 202 in the second semester. Credit may be obtained in each course separately and, in addition, an aggregate mark of at least 50% will be deemed to be equivalent to a two-credit course PHY 2, provided that a candidate obtains the required subminimum in each component. No supplementary examinations will be offered for either course. Class tests, assignments and reports collectively comprise the class mark, which forms part of the final mark for each course.

Credit in Physics with Electronics (PHY 1), and in Mathematics (MAT 1C) is normally required before a student may register for PHY 201 or PHY 202.

PHY 201

Theory course: AC Theory, Vibrations, Waves, and Optics. Properties of Matter. Experimental course: AC circuits; analogue and digital electronics.

PHY 202

Theory course: Electrostatics, Classical Mechanics, Special Relativity, and Quantum Mechanics I. Experimental course: Physics laboratory techniques.

Third-year level courses in Physics with Electronics

There are two third-year courses in Physics with Electronics. PHY 301 is held in the first semester and PHY 302 in the second semester. Credit may be obtained in each course separately and, in addition, an aggregate mark of at least 50% will be deemed to be equivalent to a two-credit course PHY 3,

provided that a candidate obtains the required subminimum in each component. No supplementary examinations will be offered for either course. Class tests, assignments and reports collectively comprise the class mark, which forms part of the final mark for each course.

Credits in Physics with Electronics (PHY 2), and in Mathematics 2 (MAM 2 with the modules in Advanced Calculus and Linear Algebra) are normally required before a student may register for PHY 301 or PHY 302. Adequate performance in PHY 301 is required before a candidate may register for PHY 302.

PHY 301

Theory course: Electromagnetism, Quantum Mechanics II, Thermodynamics, Signals and Systems. Experimental course: Analogue electronics; advanced digital electronics.

PHY 302

Theory course: Spectra, Solid State Physics, Nuclear Physics, Statistical Physics. Experimental course: Physics laboratory techniques.

Honours courses

Candidates may choose to read for Honours degrees in Physics, Electronics, Telecommunications, Joint Physics and Electronics or in approved combinations with subjects offered by other departments. A BSc with a major in Physics with Electronics, and credit in second year mathematics (MAT 2 or MAM 2) or MAP 2 is the normal entrance requirement for these courses.

Practical work, essays, tests and a project done during the year form part of the final mark, and a full course typically includes an approved selection of five topics from those listed below, depending on the availability of lecturing staff.

Physics Honours

Classical Mechanics; Computer Interfacing 1; Electrodynamics; General Relativity; Nuclear Physics; Optics; Quantum Physics; Radio Astronomy; Particle Physics; Space Science; Solid State Physics; Statistical Mechanics, Signal Processing. Appropriate topics from the list of the Electronics Honours course may be chosen.

Electronics Honours

Computer Interfacing 1; Computer Interfacing

2; Control Theory; Electronic Design; FPGA, Optics; Telecommunications; Signal Processing; Waveguides, Antennas and Transmission Lines. Appropriate topics from the list of the Physics Honours course may be chosen.

Telecommunications Honours

Aeronomy; Computer Interfacing 1; Control Theory; Electronic Design; Optics; Radio Propagation; Signal Processing; Telecommunications; Waveguides, Antennas and Transmission Lines.

Joint Physics and Electronics Honours, and other combinations

For Joint Honours programmes, an approved selection of topics may be taken from the lists given for the Physics and Electronics Honours courses, so that the final proportion in each is between 40% and 60%. Similarly, Physics or Electronics may be combined with another approved Honours course (e.g. in Computer Science, Geology, Chemistry, Mathematics) to form a joint Honours course. A candidate may substitute approved topics from other Honours courses in the Faculty of Science for topics in any of the Honours courses in this Department.

Master's and Doctoral degrees

Suitably qualified students are encouraged to proceed to the research degrees of MSc and PhD under the direction of the staff of the Department. Requirements for the MSc and PhD degrees are given in the General Rules.

The Master's degree may be taken in Physics, or Electronics, and will be examined by thesis. Candidates may also be required to take an oral examination. Acceptance of the candidate will depend on previous academic record and availability of suitable projects. Current areas of specialisation include experimental solid state physics, nuclear physics, radio astronomy and upper atmosphere physics. The current areas of specialisation in Electronics are transducers, instrumentation and digital signal processing.

A PhD degree may be taken by thesis. Candidates may also be required to take an oral examination. Acceptance of the candidate will depend on previous academic record and availability of suitable projects, and is at the discretion of the Head of Department. Current areas of specialisation are as for the MSc degree.