# University of Pretoria Yearbook 2025

# Electronics, electromagnetism and quantum mechanics 356 (PHY 356)

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| **Qualification** | Undergraduate |
| **Faculty** | Faculty of Natural and Agricultural Sciences |
| **Module credits** | 36.00 |
| **NQF Level** | 07 |
| **Programmes** | BSc in Applied Mathematics |
| | BSc in Chemistry |
| | BSc in Chemistry 4-year programme |
| | BSc in Mathematics |
| | BSc in Mathematics 4-year programme |
| | BSc in Meteorology |
| | BSc in Meteorology 4-year programme |
| | BSc in Physics |
| **Service modules** | Faculty of Education |
| **Prerequisites** | PHY 255 GS and PHY 263 GS and WTW 211 GS and WTW 218 GS and WTW 248 GS |
| **Contact time** | 4 lectures per week, 2 discussion classes per week, 1 practical per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physics |
| **Period of presentation** | Semester 1 |

## Module content

Electronics
Thévenin and Norton equivalent circuits, superposition principle, RC, LC and LRC circuits. Semiconductor diode. Bipolar transistor. Operational amplifiers. Computer controlled instrumentation.
Electromagnetism
Electrostatics: Coulomb's law, divergence and curl of E, Gauss' law, Laplace's equation, image charge problems, multipole expansion.
Magnetostatics: Lorenz force, Biot-Savart law, divergence and curl of magnetic field strength, Ampère's law, magnetic vector potential, multipole expansion, boundary conditions.
Electrodynamics: Electromotive force, electromagnetic induction, Maxwell's equations, wave equation.
Electric and magnetic fields in matter: Polarisation, electric displacement and Gauss's law in dielectrics, linear dielectrics. Magnetisation (diamagnets, paramagnets, ferromagnets), auxiliary field H and Ampère's law in magnetised materials, linear and nonlinear media.
Quantum mechanics
The Schrödinger equation, the statistical interpretation of the wave function, momentum, the uncertainty principle, the time-independent Schrödinger equation, stationary states, the infinite square well potential, the harmonic oscillator, the free particle, the Delta-Function potential, the finite square well potential, Hilbert spaces, observables, eigen functions of a Hermitian operator, Dirac notation, the Schrödinger equation in spherical coordinates, the hydrogen atom, angular momentum spin.

### General Academic Regulations and Student Rules

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations. The G Regulations are updated annually and may be amended after the publication of this information.

### Regulations, degree requirements and information

The faculty regulations, information on and requirements for the degrees published here are subject to change and may be amended after the publication of this information.

### University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQSF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to

contact their faculties if they have any questions.