



University of Pretoria Yearbook 2019

Electronics, electromagnetism and quantum mechanics 356 (PHY 356)

Qualification Undergraduate

Faculty [Faculty of Natural and Agricultural Sciences](#)

Module content

Electronics (14 lectures)

Thévenin and Norton equivalent circuits, superposition principle, RC, LC and LRC circuits. Semiconductor diode. Bipolar transistor. Operational amplifiers. Computer controlled instrumentation.

Electromagnetism (21 lectures)

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 (28 lectures)

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.

Module credits 36.00

Programmes [BSc Computer Science](#)

[BSc Applied Mathematics](#)

[BSc Geology](#)

[BSc Mathematics](#)

[BSc Meteorology](#)

[BSc 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, 1 practical per week, 2 discussion classes per week



Language of tuition Module is presented in English

Department Physics

Period of presentation Semester 1

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