

## University of Pretoria Yearbook 2019

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

Faculty Faculty of Natural and Agricultural Sciences  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	Qualification	Undergraduate
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	Faculty	Faculty of Natural and Agricultural Sciences
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	Module credits	36.00
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	Programmes	BSc Computer Science
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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		BSc Geology
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		BSc Mathematics
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<b>Department</b> Physics	Department	Physics

Period of presentation Semester 1



## 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.

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