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# University of Pretoria Yearbook 2019

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

<b>Qualification</b>	Undergraduate
<b>Faculty</b>	<a href="#">Faculty of Natural and Agricultural Sciences</a>
<b>Module credits</b>	36.00
<b>Programmes</b>	<a href="#">BSc Computer Science</a> <a href="#">BSc Applied Mathematics</a> <a href="#">BSc Geology</a> <a href="#">BSc Mathematics</a> <a href="#">BSc Meteorology</a> <a href="#">BSc Physics</a>
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	PHY 255 GS and PHY 263 GS and WTW 211 GS and WTW 218 GS and WTW 248 GS
<b>Contact time</b>	4 lectures per week, 1 practical per week, 2 discussion classes per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Physics
<b>Period of presentation</b>	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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