



# University of Pretoria Yearbook 2020

## Statistical mechanics, solid state physics and modelling 364 (PHY 364)

**Qualification** Undergraduate

**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 356 and WTW 211 and WTW 218 and WTW 248 GS

**Contact time** 2 discussion classes per week, 2 practicals per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Physics

**Period of presentation** Semester 2

### Module content

Statistical mechanics (28 lectures)

Isolated systems in thermodynamical equilibrium. Systems in equilibrium with a heat bath: the canonical ensemble, Gibbs' entropic formula, classical statistical mechanics, energy equipartition theorem, thermodynamic potentials, paramagnetism.

The classical limit of perfect gases: non-distinguishable character of quantum particles, the equation of state of the classical ideal gas. Quantum perfect gases: Black body radiation, the grand canonical ensemble, Fermi-Dirac distribution, the free electron gas in metals, the Bose-Einstein distribution, Bose-Einstein condensation.

Solid state physics (28 lectures)

Crystal structures, the reciprocal lattice, x-ray diffraction, lattice vibration, the Debye model, characteristics of solids, the free electron model, Pauli paramagnetism, electronic heat capacity, the relaxation time, electrical conduction, the classical Hall effect, thermal conduction in metals, failures of the free electron model, the independent electron model, band theory of solids.

Computational Physics and modelling. Assessment will be done through a portfolio of project reports. The topics for the projects will be selected from various sub-disciplines of Physics.



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