



University of Pretoria Yearbook 2023

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

Qualification Undergraduate

Faculty Faculty of Natural and Agricultural Sciences

Module credits 36.00

NQF Level 07

Programmes BSc (Applied Mathematics)

BSc (Chemistry)

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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