12998-314(16) Statistical Physics A (Introductory Thermodynamics and statistical mechanics) (3l, 3p)

2016

Course summary:

The three laws of thermodynamics are formulated, analysed and applied to simple thermodynamic systems; statistical and thermodynamic functions; phase equilibrium; statistical basis of thermodynamics. Fermi and Bose statistics, the ideal gas, black body radiation and other applications.

Continuous assessment
P Physics 254
P Mathematics 214, 244

Outcomes of course:

The course establishes a basic working knowledge of thermodynamics, statistical mechanics, their relation and applications. Given the central role of thermodynamics and statistical mechanics in physics and physical applications, it is a core course on which many other applications build. It also lays the foundations for more advanced courses in statistical physics.

Lecturers:

Dr. JN Kriel
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Prof. EG Rohwer
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Mentor:

The Department of Physics has appointed a staff member as mentor for each year of its physics programme to be available to students for consultation. Students should feel free to discuss general issues related to the physics programme or specific modules in the programme with the relevant mentor, in addition to usual consultations with their individual lecturers of modules.

The mentor for third year programme and its modules is Dr CM Steenkamp cmsteen@sun.ac.za

Course content:

The laws of thermodynamics are formulated, analysed and applied to simple thermodynamic systems. An early emphasis is put on the statistical basis of entropy and the partition function to serve as a link between statistical physics and thermodynamics. Applications are made to the classical ideal gas, the ideal quantum gas, paramagnetic systems, heat engines, refrigerators and phase transformations. In particular the Clausius-Clapeyron relation and van der Waals model are discussed. Boltzmann statistics and its applications are studied in detail. In conjunction with the Gibbs factor this background is used to introduce the quantum statistics of bosons and fermions. Applications include the ideal Fermi gas, black body radiation, the Debye theory of solids and Bose-Einstein condensation.

Practical (Tutorials):

1 Tutorial every week as per schedule provided at start of course

Study material:

DV Schroeder, ***An Introduction to Thermal Physics*** (Addison-Wesley, 1999)

Learning opportunities:

3 Lectures per week

Assessment:

Methods of Assessments
Continuous Assessment

Venue and time of assessment opportunities
Merensky Building
Test schedule: See ***timetable*** on Physics home page

Availability of marks:
2 weeks after test

Calculation of final mark for the module:
25% Tasks,
25% Tutorial tests
25% Test 1,
25% Test 2