School of Mathematics

Course 443, Statistical Physics (JS, SS Theoretical Physics, SS Mathematics, SS Two-subject Moderatorship)

Lecturer: Dr. Stefan Sint

Requirements/prerequisites: 241

Duration: 21 weeks

Number of lectures per week: 3

Assessment:

End-of-year Examination: One 3-hour examination

Description:

Review of Thermodynamics. Classical Statistical Mechanics: microcanonical, canonical and grand canonical ensembles. Classical ideal gas, inclusion of interactions, van-der Waals gas, the cluster expansion and virial coefficients, first order phase transition. Quantum Statistical Mechanics: density matrix formalism, Fermi-Dirac and Bose-Einstein statistics, free Fermi gas, free Bose gas, Bose-Einstein condensation, photon gas (black body radiation), phonons in a solid (Debye model). Chemical reactions, law of mass action. Applications to Astrophysics: white dwarf stars, Saha ionisation formula, neutron stars. Magnetic properties of Fermi systems: Landau diamagnetism, Pauli paramagnetism. Ising Model of a Ferromagnet, brief introduction to mean field theory, critical phenomena and the renormalisation group. **Textbooks:**

- 1. L.D. Landau and E.M. Lifshitz, "Statistical Physics"
- 2. K. Huang, 'Statistical Mechanics"
- 3. I. Sachs, S. Sen and J. Sexton, "Elements of Statistical Mechanics"
- 4. R. K. Pathria, "Statistical Mechanics"

March 26, 2007

2006-07