

# PY3104 Statistical Thermodynamics

Lecturer: Calum Ross<sup>1</sup>

**Office:** 101 A, Kane Building.

**Lectures:** Two per week: Monday, 14:00-15:00; Thursday, 13:00-14:00 (Online initially but timetabled for Boole 3 on Monday and Boole 2 on Thursday if eventually in person)

**Tutorials:** One per week: Friday, 12:00-13:00 (online at first but timetabled for Boole 3 if eventually in person)

**Zoom link:** <https://us02web.zoom.us/j/88644108025?pwd=Wk1idndVU0JYTk9LTEVSOXJyYVZqdz09>

**Textbooks:** The course will cover the same material as in previous years. It is based on material from several textbooks. There are copies of most of these in the library and it is worth looking at some combination of them as they will compliment the lecture notes.

- C, Kittel, and H, Kroemer. Thermal Physics. W. H. Freeman, 1980.
- A.M. Guenault. Statistical Physics. Student Physics Series. Springer Netherlands, 2007.
- F. Mandl. Statistical Physics. Manchester physics series. Wiley, 1971.
- F.W. Sears and G.L. Salinger. Thermodynamics, Kinetic Theory, and Statistical Thermodynamics. Addison-Wesley principles of physics series. Addison-Wesley Publishing Company, 1975.

## Course Outline:

- Recap of Classical thermodynamics:
  - Extensive/intensive variables, exact differentials
  - 1<sup>st</sup> and 2<sup>nd</sup> laws
  - Equilibrium conditions
  - Thermodynamic potentials
- Basic ideas of statistical mechanics
- Thermodynamic ensembles
  - Boltzmann factor and partition function
  - Chemical potential
  - Gibbs factor and grand canonical partition function
- Quantum Gases: Fermi-Dirac and Bose-Einstein distribution
  - Free Electron gas and conduction in metals
  - Bose-Einstein condensation
- Transport in classical gases
  - Maxwell-Boltzmann distribution
  - Diffusion and random walks
  - Heat Equation

**Assessment:** 80% final exam, 20% continuous assessment (homeworks).

**Homework:** 5 Problem sheets.

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