PH4211 Statistical Mechanics
Book list

The book for the course is

***Topics in Statistical Mechanics, 2nd ed*. B. Cowan, World Scientific, 2022.**

The course is based around this book, indeed the book was written to accompany the course.

You will also find extensive lecture notes provided on the course web pages, together with the homework exercises and other materials: reprints etc.

I will also refer to a number of books during the course; these are listed below.

Recommended additional reading

1. *Introductory Statistical Mechanics*, R. Bowley and M. Sánchez, Oxford University Press, 2nd edition, 1999
   This book covers most of the material of the course – perhaps about 75% of it. The emphasis is different, particularly in the early stages of the course, but the treatment has the merit of exceptional clarity and a readable style. This is the first book to look in for elucidation of points after studying the course textbook and notes.

Further reading

2. *Equilibrium Statistical Physics*, M. Plische and B. Bergersen, Prentice-Hall, 1989
   This small book contains much of the subject matter of the course. It is rather compact and impenetrable in places. You will certainly need to refer to other books (listed below) for elucidation and explanation.

   There is a new edition of this book. It is not so small but the comments above still apply.

3. *Equilibrium Thermodynamics*, C. J. Adkins, Cambridge University Press. 3rd ed. 1983. Class: 536.7 ADK.
   A good standard text book for revising your thermodynamics. Interesting discussion of thermoelectricity.

4. *Thermodynamics* (*and Introduction to Thermostatistics*), H. B. Callen, J. Wiley. 1960. Class: 536.7 CAL.
   Inspirational, a classic! The treatment of thermodynamics has influenced much of the approach of this course. The coverage of extremum principles and the thermodynamic potentials is a model of clarity.

5. *Statistical mechanics, R. P. Feynman*, W. A. Benjamin. (1972). Class: 530.13 FEY.
   Not for learning from, but for reading when you have some confidence in the subject. This book is very much a personal view by one of this century's master physicists.

6. *An introduction to Statistical Thermodynamics*, T. L. Hill, Addison-Wesley. (1960). Class: 541.36 HIL.
   A very traditional approach to statistical mechanics presented with the utmost clarity. Look at the earlier parts of this book to revise your elementary statistical mechanics.

7. *Statistical Mechanics, K. Huang*, J. Wiley. (1963). Class: 530.13 HUA.
   A sophisticated treatment of the subject. The Ising model is covered very well and its connection with other models of phase transitions.

8. *Statistical Physics*, L. D. Landau and E. M. Lifshitz, Pergamon Press. (1980) Class: 530.13.
   This is another classic, treating statistical mechanics and thermodynamics from a common standpoint. Although clearly written, the book is too terse in places to use as an introductory text.

9. *Statistical Mechanics*, S-K Ma, World Scientific. (1985). Class: 530.13 MAS.
   An unusual treatment, covering many unusual applications of statistical mechanics. The book gives a very modern view on many topics.

10. *Quantum Mechanics*, E. Merzbacher, J. Wiley. (1970). Class: 530.12 MER.
    This is a standard text book on quantum mechanics. It treats identical particles and second quantisation in an exceptionally clear manner and (of particular relevance to this course) it derives the Bose-Einstein and the Fermi-Dirac distributions in a unified way showing how the statistics enter the expressions.

11. The Cluster Expansion, W. J. Mullin, *American Journal of Physics*, 40, 1473-1476 (1972).
    This pedagogical article shows how the cluster expansion for an interacting gas may be derived in a coherent but intuitive manner. This paper is available on the course web pages.

12. *A Modern Course in Statistical Physics*, L. E. Reichl, Arnold. (1980). Class: 530.13 REI.
    This book is a masterful survey of the entire field – quite remarkable. Not always as clear as it might be, but there are plentiful references to follow up. Beware the typos.

13. Fundamentals of Statistical and Thermal Physics, F. Reif, McGraw-Hill. (1965). Class: 530.13 REI.
    Another revolutionary book (in its day). Of importance for this course is the treatment of fluctuations and irreversible phenomena.

14. *Heat and Thermodynamics*, M. W. Zemansky (and R. H. Dittman), McGraw-Hill. (1968). Class 536 ZEM.
    A Thermodynamics classic. Zemansky is a late convert to the Caratheodorey approach to the Second Law, and the book is all the more complex as a consequence. For this course the value of the book is in the applications it treats and the wealth of experimental data it contains.

15. *Modern Thermodynamics*, D. Kondepundi and I. Prigogine, J. Wiley (1998). Class: 536.7 KON.
    The book claims to treat equilibrium and non-equilibrium thermodynamics from a common perspective. It discusses Onsager's reciprocity principle and the law of minimum entropy production.

16. *Noise and Fluctuations*, D. K. C. MacDonald, J. Wiley (1962). Unfortunately this book was out of print and there is no copy in the RHUL library. However it is now issued as a Dover reprint.
    This book is a highly idiosyncratic introduction to a selection of topics in non-equilibrium statistical mechanics. If you are interested in this topic you will find the book a good read with many insights into traditional questions.

BPC January 2022