SOME BOOKS on

THERMODYNAMICS & STATISTICAL MECHANICS

This is a very short list. The number of books out there is really large. I've added a few comments. The first section is for books exclusively on thermodynamics - each of the 3 books given is very good, although very unrealistic about the variety in the real world. The 2nd section focuses on fairly traditional books on statistical mechanics of equilibrium systems – so again, the viewpoint is not so modern. Finally, I give in the 3rd section two books which can help you to understand why the real world is much bigger than most of these books – but even these books says little about most of the world we see around us.

(1) THERMODYNAMICS

A.B. Pippard: "The elements of Classical Thermodynamics" A fairly deductive approach, done pretty well and clearly, along with application to a few systems, plus a fairly decent discussion of phase equilibrium and & phase transitions (roughly 1/3 of the book). Worth looking at for the careful discussion of different topics, and for the discussion of phase transitions.

C.J. Adkins: "Equilibrium Thermodynamics" In some ways a much more extended and simpler version of Pippard's book, with less emphasis on rigour and more on completeness, along with a lot more examples.

M.W. Zemansky, R.H. Dittman: "Heat & Thermodynamics" A book with a very different style from the first two – far more digressive, with detail on a huge variety of physical systems and topics (so the book is considerably longer). Very easy to read.

(2) STATISTICAL MECHANICS

L.D. Landau, E.M. Lifshitz "Statistical Physics, part 1" This book is written by two of the great pioneers in the field of condensed matter physics (as well as in many other fields); Landau was one of the best known physicists of the 20th century. It covers both thermodynamics and statistical mechanics, and is sometimes quite advanced. Although it is a little hard to read sometimes, partly because of the unconventional notation and treatment of some topics, deep insights are scattered throughout the book.

R.K. Pathria "Statistical Mechanics" A clear and well organized book that covers most of the material in the course, plus much else, in much greater detail than we do – the book is quite long. The derivations are usually fairly clear and explicit. NB: the most recent 3rd edition of this book, published 2011, is considerably expanded (see R.K. Pathria, P.D. Beale, Statistical Mechanics, 3rd edition)

F. Reif "Fundamentals of Statistical and Thermal Physics" Covers all of the traditional topics in considerable detail, in a very organized way, with derivations made very explicit. Covers thermodynamics as well.

W.G.V. Rosser "Introduction to Statistical Physics" A book which is pedagogically exceptionally clear – it also covers roughly the same ground as this course, and at a similar level, and discusses even simple examples in great explicit detail.

K Huang "Statistical Mechanics" Most of this book is quite advanced, although it is very clear throughout, and often interesting. The early sections are well worth looking at, even for beginners (including the discussion of thermodynamics), and are not too advanced.

R.P. Feynman: "Statistical Mechanics: a set of lectures" A set of very detailed lectures by one of the most famous physicists and teachers of the 20th century (with the teaching culminating in the 'Feynman lectures on Physics'). This book is actually rather advanced, but very interesting for the treatments of particular problems.

D.C. Mattis: "Statistical Mechanics made Simple" This is not a systematic discussion at all, but more of a choice of interesting topics. However the topics chosen are discussed in a nice way – of particular interest are chapters 1-5. Contains some thermodynamics

(3) SOME DISCUSSION OF THE REAL WORLD

P.M. Chaikin, T.C. Lubensky: "Principles of Condensed Matter Physics" A really nice presentation of both theoretical methods deriving from statistical mechanics and of the way in which they work in the real world where many of the models required do not look at all like those in old-style statistical mechanics textbooks. Fascinating detail on everything from real H_2O to liquid crystals to polymers to disordered crystals to superfluids, etc….the approach is a mixture of statistical mechanics and lots of other methods.

P.W. Anderson "Basic Notions of Condensed Matter Physics" This book is a healthy antidote to the very restricted set of models that appear in statistical mechanics books. It is very informal, and this can make it hard to follow – but it gives a very broad vision of the behaviour of quantum many-particle systems, a vision which the author played a considerable role in shaping. Unfortunately he does not talk about 'glassy' systems (where almost all the assumptions of statistical mechanics fail), even though he was largely responsible for the insights in this field.

One book which is unfortunately not to be found on the internet is

D. Tabor: "Gases, Liquids, & Solids, and other states of matter" A fascinating and very simple discussion of the properties of real physical systems, embracing everything from colloids, glasses, polymers, and rubber, to different magnetic systems, as well as many kinds of liquid and gas.

There are many other such books – but this takes us well beyond the scope of the course.