Preface

mandakaviyaśaḥprārthī̄	Like a dwarf aiming at
gamisyāmyupahāsyatām	fruits atop a lofty tree,
prāṁśu labhye phale	I may be attracting scorn for
lobhādudbahuriba vāmanaḥ	aspiring to be a bard.
athabā kṛtabāgdvāre	Or, maybe, achievements of my
baṁśesmin pūrvasuribhiḥ	predecessors will make me
maṇau vajrasamūtkī̄rṇe	A thread through the eyes on
sūtrasyebāsti me gatiḥ	the gems to make a wreath.
Kālidāsa: Raghuvaṁśam 1:3-4	English translation.

This book grew out of the two-semester course of lectures that we have been delivering for a number of years to the first year Masters level students at the University of Kalyani. This book can be used in final year Senior level undergraduate Course or a first year Graduate level Course.

The first four chapters, § 1–§ 4, are the backbone of the discipline of Statistical Physics. Here the basic concepts of the subject as well as the description of states, their time evolution and the methods of Statistical Physics have been introduced and developed. All throughout, connection of Statistical Physics to Thermodynamics has been emphasized.

In the next four chapters, § 5–§ 8 , Classical Statistical Physics and its application to Chemical Equilibria, Interacting Systems and Strong Electrolytes have been explained.

The next three chapters, § 9–§ 11 are concerned with Quantum Statistical Physics and its application to two topical subjects, *viz.* Bose-Einstein Condensate and Statistical Astrophysics.

The next chapter, § 12, is an introduction to the systematics of Phase Transition and Landau Theory for systems *not very close* to the phase-coexistense line. We have also included a condensed introduction of the modern theory of phase transition *very close* to the phase-coexistense line, but have omitted the Renormalization Group Technique of calculating the Critical Indices.

Though the book is mainly comcerned with equilibrium processes, in § 13 we have discussed the Linear Response Theory of Irreversible Processes and Fluctuation-Dissipation Theorem. Physics consists of both static and dynamic processes and the large Resonance and Relaxation community always use this Kubo formalism to analyze their data of dynamic processes away from equilibrium

The purely mathematical tools that we needed in our development and which do not form a component part of Statistical Physics proper, have been collected in the last chapter § 14 as Mathematical Appendix.

Finally, we confess that this book is **not** a *Treatise on Statistical Physics*. Were it such a Treatise it would have covered at least two very important topics: (i) a topological discussion on validity of the *Ergodic Hypothesis*; (ii) a graphical method of calculation of the Virial Coefficients of Real Gases. Another lacuna is the absence of the modern field of activity in *Mesoscopic Systems*.

We have omitted many steps in the deductions of results in the body of the text and have set the completion of the proof for some of them as the problems set for the students. Most of the materials in the book are for ordinary 3-dimensional materials. The formulations for the 2-dimensional thin films and 1-dimensional linear polymers have been set as the other members of the problem sets.

Here is a note about numbering of the equations, figures, postulates, tables and theorems. They are all numbered sequentially in separate sections of each chapter. And we have consistently used the Gaussian units.

In an old and established subject like Statistical Physics there are many books that have by now become *classics* and many books that are mainly concerned with some still developing topics. Our target readers are masters

level or beginner level graduate students who have not yet decided what their chosen line of research would be. So we have included just a few references as typical specimens and some comprehensive review articles on the newer applications of Statistical Physics.

We are aware of Dr Johnson's 1766 statement: 'People have now-a-days got a strange opinion that everything should be taught by lectures. Now, I cannot see that lectures can do so much good as reading the books from which the lectures are taken.' We, however, firmly believe that a good teacher is essential to the students for admiring the beauty, elegance and power of the subject. This book is a suggestion to the teacher that the course followed here may be one of many ways of developing the subject.

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