Thermal Physics and Statistical Mechanics: Basic Physics Through Problem Series. S. K. Roy. New Age International (P) Ltd, 4835/24 Ansari Road, Daryaganj, New Delhi 110 002. 2001. 418 pp. Price: Rs 200.

Thermal physics and statistical mechanics form an integral part of undergraduate and postgraduate course curriculum in physics and engineering. The thermal properties of matter help us understand the world we live in and are of fundamental interest to researchers working in varied fields, including physics, chemistry, biology, geology, engineering and astronomy. Thermodynamics and statistical mechanics have markedly increased the progress made in detailed understanding of the phase transformations and chemical reactions occurring in diverse systems, including biomolecules, rock-forming materials, high-temperature superconductors and technologically important materials. Quantum statistical mechanics has been successfully used to understand critical phenomena, the physics of superfluid helium, Bose–Einstein condensation, relativistic Fermi gas, white dwarfs, neutron stars, etc. The sheer range of applications of thermal and statistical physics precludes a complete list and only some typical applications are indicated above.

Although there are several good books, including some well-recommended recent publications[1–3], due to its wide scope and importance, a good Indian publication of *Thermal Physics and Statistical Mechanics* could still be very useful. The book under review deals with problems involving kinetic theory of gases, transport phenomena, thermodynamics, heat transfer, radiation of heat, classical and quantum statistical physics and applications. It is a part of the project on *Basic Physics Through Problems Series* which aims at (i) explaining in a precise and concise manner, the basic laws and formulae, and (ii) stimulates the reader in solving analytical and numerical problems. This series is designed to meet the requirements of the undergraduate students of colleges and universities not only in India, but also in other Third World countries. This effort is commendable, as problem solving would definitely lay a strong foundation required for mastering the fundamentals and enhance conceptual understanding.

This book has over 350 solved questions (and around 100 supplementary problems with answers) of varying levels of complexity. The author must be congratulated for the excellent job in the selection of problems and the step-by-step solution offered. The problems include derivations, short numerical calculations, order of magnitude estimates, justifications, physical reasoning, and several illustrative applications. The problems covered include a wide-spectrum of applications like Bose–Einstein condensation, properties of superfluid helium, thermodynamic properties of relativistic Fermi gas, white dwarfs and Chandrasekhar limit. Armed with this, even an average student can derive quantitative relationships amongst various microscopic and macroscopic physical variables that characterize a real physical system. The book is a good attempt at encouraging mastering of fundamentals through problem-solving exercises and should definitely be recommended for undergraduate physics and engineering students in the whole country. A few shortcomings are however listed, which could be used to improve future editions:

(1) The book provides only the basic definitions and principles and therefore can only *supplement* (and *not replace*) existing textbooks on these topics. A chapter-wise list of text books recommended for reading *prior to* solving the problems in this book is absolutely necessary, but unfortunately missing in the present edition. (2) To develop problem-solving skills, the student must be encouraged to first seek independent solutions and then verify with the given solution. To this end, physical separations of problems (with suitable hints for difficult problems) and solution will be helpful. The problems and solutions appear together in the present edition. The student should also be cautioned against memorizing the solutions without appreciating the steps involved, which could lead to serious gaps in the understanding. (3) Tables of physical constants required for solving the problems should be separately provided. (4) The choice of problems has been restricted to those that can be analysed in terms of simple analytical formulae. Including problems requiring computers is highly desirable, as it would develop programming and numerical analysis skills along with understanding basic physics. This would also enable handling real-life examples. (5) To improve conceptual understanding of physics, it would be useful to summarize the evolution of thermodynamics, kinetic theory and statistical mechanics in the preface. Historically, the laws of thermodynamics were postulated prior to understanding the atomic nature of matter. The laws were largely phenomenological, dealing with macroscopic properties of aggregates of bulk matter such as pressure, temperature and their inter-relations, without reference to their atomic structure. The kinetic theory of gases was the first effort at expressing pressure, temperature and other macroscopic properties of gases in terms of the average kinetic energy of their constituent molecules. Statistical mechanics provided the vital link between the microscopic structure of matter and its macroscopic behaviour and has been very useful in deriving the physics of real systems. Its applications include the understanding of Bose–Einstein condensation, critical phenomena, interacting fluids, fluctuations, etc. While the present book tries to strike a balance and refers to the microscopic viewpoint wherever possible, explicit declaration would help the student appreciate the reasoning behind classical thermodynamics, which directly begins from a macroscopic viewpoint. (6) On a more general note, computers and the Internet today provide innovative techniques for delivery of scientific curriculum. The use of simulations, animations and virtual reality tool-kits has revolutionized the manner of imparting science education, worldwide. It is hoped that in future, in addition to regular study materials, including textbooks and problem sessions, our instructors too will take note of these facilities and incorporate these teaching aids in the mainstream of science education, where possible. It would enhance mental imagery and visualization leading to quantum leaps in understanding.

1. Gould, H., *Phys. Today*, 2000, **53** (8), 44.
2. Baierlein, R., *Thermal Physics*, Cambridge University Press, New York, 1999.
3. Schroeder, D. V., *An Introduction to Thermal Physics*, Addison-Wesley, San Francisco, 2000.

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