This graduate textbook includes coverage of important topics that are not commonly featured in other textbooks on condensed matter physics, such as treatments of surfaces, the quantum Hall effect, and superfluidity. It avoids complex formalism, such as Green’s functions, which can obscure the underlying physics, and instead emphasizes fundamental physical reasoning. Intended for classroom use, it features plenty of references and extensive problems for solution based on the author’s many years of teaching in the Physics Department at the University of Michigan. This textbook is suitable for physics, chemistry and engineering graduate students, and as a reference for research students in condensed matter physics. Engineering students will find the treatment of the fundamentals of semiconductor devices and the optics of solids of particular interest.

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To Mae & Evelyn
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This book is intended as a textbook for a graduate course in condensed matter physics. It is based on many years’ experience in teaching in the Physics department at The University of Michigan. The material here is more than enough for a one-semester course. Usually I teach two semesters, and in the second, I add material such as the renormalization group.

In this book advanced techniques such as Green’s functions are not used. I have tried to introduce as many of the concepts of modern condensed matter physics as I could without them. As a result, some topics that are of central importance in modern research do not appear.

The problems are an integral part of the book. Some concepts that are used in later chapters are introduced as problems.

Students are expected to have a good background in statistical physics, non-relativistic quantum theory, and, ideally, know undergraduate Solid State physics at the level of Kittel (2005).

I decided to write this book as a result of coming back to teaching Condensed Matter after a number of years covering other subjects. I had hoped to find a substitute for the grand old standards like Ziman (1972) or Ashcroft & Mermin (1976) which I used at the beginning of my teaching career. Though there are newer texts that are interesting in many ways, I found that none of them quite fit my needs as an instructor. It is for the reader to decide how well I have succeeded in giving a modern alternative to the classics – they are very hard acts to follow.

Many people have helped me in writing this book. Craig Davis and Cagilyan Kurdak have been remarkably generous with their time, and found many errors. Jim Allen and Michal Zochowski have given valuable advice. I would like to particularly thank Brad Orr, Andy Dougherty, Dave Weitz, Jim Allen, Roy Clarke, and Meigan Aronson for figures. And, of course, my students have given invaluable feedback over more than three decades.