Preface

It has been 36 years since the appearance of the first edition of this book, and 23 years since the second. Such intervals may be appropriate for a subject whose fundamental basis was completely established theoretically 134 years ago by Maxwell and experimentally 110 years ago by Hertz. Still, there are changes in emphasis and applications. This third edition attempts to address both without any significant increase in size. Inevitably, some topics present in the second edition had to be eliminated to make room for new material. One major omission is the chapter on plasma physics, although some pieces appear elsewhere. Readers who miss particular topics may, I hope, be able to avail themselves of the second edition.

The most visible change is the use of SI units in the first 10 chapters. Gaussian units are retained in the later chapters, since such units seem more suited to relativity and relativistic electrodynamics than SI. As a reminder of the system of units being employed, the running head on each left-hand page carries "—SI" or "—G" depending on the chapter.

My tardy adoption of the universally accepted SI system is a recognition that almost all undergraduate physics texts, as well as engineering books at all levels, employ SI units throughout. For many years Ed Purcell and I had a pact to support each other in the use of Gaussian units. Now I have betrayed him! Although this book is formally dedicated to the memory of my father, I dedicate this third edition informally to the memory of Edward Mills Purcell (1912–1997), a marvelous physicist with deep understanding, a great teacher, and a wonderful man.

Because of the increasing use of personal computers to supplement analytical work or to attack problems not amenable to analytic solution, I have included some new sections on the principles of some numerical techniques for electrostatics and magnetostatics, as well as some elementary problems. Instructors may use their ingenuity to create more challenging ones. The aim is to provide an understanding of such methods before blindly using canned software or even Mathematica or Maple.

There has been some rearrangement of topics—Faraday's law and quasistatic fields are now in Chapter 5 with magnetostatics, permitting a more logical discussion of energy and inductances. Another major change is the consolidation of the discussion of radiation by charge-current sources, in both elementary and exact multipole forms, in Chapter 9. All the applications to scattering and diffraction are in Chapter 10.

The principles of optical fibers and dielectric waveguides are discussed in two new sections in Chapter 8. In Chapter 13 the treatment of energy loss has been shortened and strengthened. Because of the increasing importance of synchrotron radiation as a research tool, the discussion in Chapter 14 has been augmented by a detailed section on the physics of wigglers and undulators for synchrotron light sources. There is new material in Chapter 16 on radiation reaction and models of classical charged particles, as well as changed emphasis.

There is much tweaking by small amounts throughout. I hope the reader will