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Preface

Acknowledgements

## 1 Studying Physics: An Introduction

Some of the common problems encountered by undergraduate physicists are described, together with their implications for learning physics. The concept of physics as a problem-solving, or research, process is developed, leading to identifiable critical thinking skills needed in experimental and theoretical physics

## 2 Mathematical Techniques in Experimental Physics

The basic mathematical techniques needed to analyse experiments are developed, including common mathematical functions, graph plotting, curve fitting, and elementary calculus.

## 3 Experimental Physics: Designing the Experiment

The physics of a particular problem influences the experimental method adopted and this chapter discusses the options open to the experimenter, especially in respect of the nature and sources of experimental errors. The principles of electronic instrumentation are also described.

## 4 Statistics, Physics and Probability

Probability is an important part of physics, and the most common probability distributions used by physicists are developed in detail. In particular, their use in the analysis of experimental data and experimental errors are described.

## 5 Theory in Physics

Physics as a separate discipline has its origins in the Renaissance and the development of theoretical and mathematical physics since that time is explored to show how the present-day methods of physics have evolved. In particular, the relationships between maths and physics, and theory and experiment, are explored and some general principles that can help you to understand theories are presented.

## 6 Mathematical Modelling

Different types of models, from those based purely on experimental data to first-principles theories, are discussed. Differential equations, as well as a number of other mathematical techniques are presented, along with examples of physical models from well-known and familiar branches of physics.

## 7 Presenting Scientific Information

A written or oral presentation is the last stage of the problem-solving process developed in chapter 1 and is the culmination of the theoretical and experimental activities presented in the book. The principles behind an effective presentation, in which all the critical thinking skills used in the work are demonstrated to maximise the impact, are described in detail.

Appendix 1: algebraic manipulation

Appendix 2: logarithms

Appendix 3: differentiation of common functions

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