Books

Mathematical Methods of Physics

by Jon Mathews and R. L. Walker

W. A. Benjamin, Inc. $12.50

Reviewed by Charles H. Papas, professor of electrical engineering

This book is a delightful exposition on the mathematical methods of physics. It is written in a charmingly informal style and covers a remarkably large number of topics. Throughout the text, carefully selected examples are worked out in detail to illustrate the principal points of the subject, and at the end of each chapter an abundance of original problems is provided to test and train the reader.

As is evident from the approach the authors have used, the main purpose of the book is a pedagogical one — to teach physics students how to use the mathematical tools of physics. It is this reviewer's opinion that the authors have succeeded admirably in writing a book that not only meets the didactic needs of the first-year graduate student, but also satisfies the practicing physicist who for some time has been hungry for a readable book on mathematical methods written for physicists by physicists.

Although there are other books on the subject, none of them seems to come as close to the mark as this one does. They are either too mathematical in the sense that they are preoccupied with questions of uniqueness, existence, and pathological behavior, or they are overly detailed and hence too unwieldy to cover in a one-year course. What makes this book stand out for the physicist is the fact that it covers so much so well, and does it all in the lively jargon of mathematical physics.

Some idea of the scope of the book can be got by examining the following list of chapter headings: Ordinary Differential Equations; Infinite Series; Evaluation of Integrals; Integral Transforms; Further Applications of Complex Variables; Vectors and Matrices; Special Functions; Partial Differential Equations; Eigenfunctions, Eigenvalues and Green's Functions; Perturbation Theory; Integral Equations; Calculus of Variations; Numerical Methods; Probability and Statistics; Tensor Analysis and Differential Geometry; Introduction to Groups and Group Representations. Clearly, the scope of the book is very broad and includes most of the useful mathematical methods of modern physics. To present all this material in a book that has less than 500 pages and to do so with sufficient depth to satisfy the practical needs of the physicist is an enviable achievement.

I offer my congratulations to the authors — Jon Mathews, associate professor of theoretical physics; and R. L. Walker, professor of physics at Caltech.

I recommend this outstanding book not only to physicists but also to electrical engineers whose bread and butter all too often depends on how well they can calculate.

Quantitative Chemistry (Revised Edition)

by Jurg Waser

W. A. Benjamin, Inc.....Paper $3.95, Cloth $6

Reviewed by W. P. Schaefer, assistant professor of chemistry

The revised edition of this book puts between hard covers the laboratory manual used by freshman chemistry students at Caltech for the past six years. The preliminary edition of the text was issued in 1961 for use in fresh-

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man laboratory work in the new chemistry program (new, that is, in 1957). The new program revised many of the established courses of the division, but the biggest change was in the laboratory part of the freshman course. All of the material formerly covered in the first part of the year — simple inorganic preparations and semiquantitative "tests" of elementary chemical principles — was replaced by the traditional work of the sophomore year, i.e., quantitative analysis. No textbook was available for a quantitative analysis course at the freshman level; Dr. Waser (who is professor of chemistry at Caltech) has remedied this lack.

Since the book was written for a specific freshman course, it should be evaluated in terms of its intended use. Preliminary instructions and directions for weighing are unusually complete; no presumption is made that the student will be familiar with laboratory work. Each assignment which follows consists of a thorough, detailed description of the principles underlying the experiment, and a briefer section containing specific directions. The theoretical sections for the experiments represent the major difference between this book and conventional introductory analytical texts; they are undoubtedly its greatest strength. The essential chemistry and calculations are explained in depth here and an effort has been made to cover every detail. No apologies are made for rigorous, accurate descriptions; Caltech students appreciate not being talked-down-to.

The freshman course was designed to introduce the students to as many different kinds of quantitative measurements made on chemical systems as possible and the assignments in the text reflect this decision. They include one gravimetric, one colorimetric, one gasometric, one coulometric, and seven volumetric determinations, plus an example of the use of the method of "Continuous Variations" for finding the formula of a complex ion. The volumetric determinations cover acid-base, precipitation, complexometric, and oxidation-reduction titrations; thus most of the techniques of analytical chemistry are presented, but with at most two examples. Teachers in conventional courses, still (subconsciously?) training chemical analysts, may object to the absence of repetition but the coverage seems just right for the freshman course at the Institute, where even the mathematicians must now learn to read a buret accurately.

The book is well set-out and adequately illustrated; in its paperback version, it is remarkably low-priced for a college textbook. As a rigorous introduction to chemical measurements, *Quantitative Chemistry* is probably the best book presently available. It is a pleasure to teach from such a text.

Ancient Ruins and Archaeology

By L. Sprague de Camp and Catherine C. de Camp

Doubleday $5.95

The prolific L. Sprague de Camp '30 (who has now written more than 40 books) has collaborated with his wife on this lively volume dealing with 12 famous mysteries of the ancient world — including the lost continent of Atlantis, the pyramids, Stonehenge, Troy and Mycenae, King Solomon's mines, King Arthur's court, Angkor Wat, and Easter Island. The De Camps write about these ancient ruins and riddles with spirit and vigor, as well as with scientific accuracy.

Mathematical Methods for Physicists George Arfken (Academic Press, 1970, 2nd ed.) Chapter 2. Coordinate systems.Â We did introduce the radial distance r but even this was treated as a function of x, y, and z, Unfortunately, not all physical problems arc well adapted to solution in cartesian coordinates. For instance, if we have a central force problem, F = 1'0 F(r), such as gravitational or electrostatic force, cartesian coordinates may be unusually inappropriate. Such a problem literally screams for the use of a coordinate system in which the radial distance is taken to be one of the coordinates, that is, spherical polar coordinates. The point is that the coordinate system should be chosen to fit th Mathematical methods of Physics is a book on common techniques of applied mathematics that are often used in theoretical physics. It may be accessible to anyone with beginning undergraduate training in mathematics and physics. It is hoped that the book will be useful for anyone wishing to study advanced Physics. Mathematical Methods in Physics is a self-contained presentation, driven by historic motivations, excellent examples, detailed proofs, and a focus on those parts of mathematics that are needed in more ambitious courses on quantum mechanics and classical and quantum field theory. A comprehensive bibliography and index round out the work. Methods of Mathematical Physics I. A set of lecture notes by. Michael Stone. PIMANDER-CASAUBON Alexandria â€¢ Florence â€¢ London.Â These notes were prepared for PHYCS-498MMA, a fairly traditional one-semester mathematical methods course for begining graduate students in physics. The emphasis is on linear operators and stresses the analogy between such operators acting on function spaces and matrices acting on nite dimen-sional spaces.