Lucid applied math

MATHEMATICS FOR SCIENTISTS. By Thor A. Bak, Jonas Lichtenberg. 487 pp. W. A. Benjamin, New York, 1966. $15.00

by Peter L. Balise

With an ample choice of applied mathematics texts currently available, the appearance of another, especially a translation, is likely to be treated coolly. However, this revision of a 1960 Danish book, serving the authors' one-year course for chemists, biochemists and MD's doing basic research, is very attractive. Smoothly translated, it is marked by clear exposition and modern content. The problems (with answers) and index are sufficient.

The authors' empathy for the student is evident in the first chapter, on vectors and tensors, which carries the reader from elementary definitions to similarity transformations. Two- and three-dimensional illustrations dominate the presentation, but the extensions to n dimensions are made obvious. This reviewer shares the opinion of many teachers that geometric interpretations are most valuable in providing vividness with a modicum of rigor. Unfortunately, nonsymmetric matrices are ignored and there is only brief mention of repeated roots and complex matrices, important matters that would have been interesting to see treated by the authors with their accustomed clarity.

There are lucid expositions of other major topics usually found in applied mathematics texts: functions of one and several variables (elementary differential and integral calculus, including vector functions), infinite series, differential equations (including a brief summary of the calculus of variations and only a mention of partial differential equations, but with unusually good treatment of boundary-value problems in ordinary differential equations), complex variables (but omitting conformal mapping), and numerical analysis.

The modern cast of the book is demonstrated by an excellent introduction to groups, in which the abstract concept is tied to physical situations. Other associations are well illustrated also, such as the orthogonality of Legendre polynomials being related to the Schmidt orthogonalization of vectors. The concept of function space appropriately seems to underlie much of the presentation, although it is explicitly discussed only briefly.

In this reviewer's opinion, the Laplace transformation is relatively neglected (and is not associated with the Fourier integral). Other readers will have other such criticisms reflecting personal preferences; but every reader should appreciate the authors' lucid writing, which recommends the text for student use.

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The reviewer, a professor of mechanical engineering at the University of Washington, teaches courses in "engineering analysis," which relate the common underlying mathematics of different physical systems.

All the necessary math

MATHEMATICAL METHODS FOR PHYSICISTS. By George Arfken. 654 pp. Academic Press, New York, 1966. $12.75

by J. E. Romain

Here is a book of mathematics for physicists that truly fulfills its purpose. In an alert and dynamic style, it presents all that is necessary of an eclectic variety of mathematical topics that may be useful to a physicist at an undergraduate and beginning graduate level, without unnecessary details. Arfken knows what he is speaking about, as he has been teaching in the field for many years. The exposition is essentially oriented towards application. The motivation and the usefulness of the various concepts introduced are carefully stated. Numerous examples of application of the techniques described are offered, often borrowed from physics. Many problems are posed, a few (too few) of them with an answer or a hint.

The topics reviewed cover coördinate systems, vector and tensor analysis, matrices and determinants, infinite series and products, functions of complex variables, second-order differential equations, special functions, Fourier series, integral transforms, integral equations and calculus of variations. The reader is expected to have a working knowledge of calculus. The arrangement of the material renders the book quite adequate for self-teaching. (The only shortcoming in this respect is the lack of an answer to most problems.) At the end of each chapter a few references are given that should enable the student to dig deeper as necessary. An index of notations would have made the book even more useful to the student who opens it for a definite piece of information. A fairly detailed subject index has been set up, but it still is not fully complete. (In an occasional check, such items as solenoidal and irrotational vectors and Fourier-Bessel series were found to be lacking.)

The book is carefully printed and is pleasant to read and handle. The only slight misprints that the reviewer spotted are a missing constant factor in eq. (5.154) and a repeated (and slightly irritating after the third time) use of "principle" instead of "principal" (pages 272 to 277 and index).

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The reviewer formerly taught theoretical physics. He is presently a scientific adviser in applied mathematics and physics.

Thermo, stat mech and kinetic theory

STATISTICAL PHYSICS. By Gregory H. Wannier. 532 pp. Wiley, New York, 1966. $11.50

by George H. Weiss

This book represents a serious attempt to present the theories of equilibrium thermodynamics and statistical mechanics, together with an introduction to kinetic theory, in a single text. As one might expect for such an undertaking, the results tend to be uneven, with excellent coverage and explanation of some topics, and less satisfactory accounts of others.

The beginning of the book, containing a discussion of the foundations of thermodynamics, is reminiscent in its pace of the volume of Tolman. Partic-