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BOOK REVIEWS

The mathematics of physics and chemistry. By Henry Margenau and George Moseley Murphy. D. Van Nostrand Company, Inc. New York, 1943. xii+581 pp. $6.50.

Contents: 1. The mathematics of thermodynamics. 2. Ordinary differential equations. 3. Special functions. 4. Vector analysis. 5. Vectors and curvilinear coordinates. 6. Calculus of variations. 7. Partial differential equations of classical physics. 8. Eigenvalues and eigenfunctions. 9. Mechanics of molecules. 10. Matrices and matrix algebra. 11. Quantum mechanics. 12. Statistical mechanics. 13. Numerical calculations. 14. Linear integral equations. 15. Group theory.

The need for comprehensive manuals of mathematical tools is widely felt by workers in various applied fields. The readers of this Quarterly may, therefore, envy the theoretical physicists and chemists for whom the present book is primarily intended. However, it appears from the above table of contents that the book covers such a great variety of topics that almost everyone will find some chapter of particular interest. In this connection the chapters on special functions and special coordinate systems deserve particular mention.

The authors have well succeeeded in making the book appear as a homogeneous unit although the individual chapters are independent and show a refreshing lack of formal uniformity. In some chapters physical theories are treated at very considerable length, while other chapters are quite mathematical in form. Formal deductions are given in general, but often it seemed more desirable merely to record formulas or facts. "The degree of difficulty of the treatment is such that a Senior majoring in physics or chemistry would be able to read most parts of the book with understanding."

Occasionally, a more daring departure from customary lines would have made the book still more useful. Thus some numerical methods which are often presented and hardly ever used would better have been omitted in favor of a more thorough presentation of the really useful techniques. The modern statistician will regret to find the theory of errors treated along conventional, obsolete lines. The magic spell of purely conventional but impressive terms such as "probable error" has proved very dangerous indeed and inspires an unjustified confidence. The physicist who still believes in the normalcy of observational errors should consult W. A. Shewhart's "Statistical Method From the Viewpoint of Quality Control" (Washington 1939). There, starting on p. 66, he will find a most interesting analysis of some measurements among the very elite (velocity of light, the gravitational constant, Planck's constant). They all show complete lack of statistical control, and even the simplest methods of industrial quality control could be used for an improvement.

In general, the presentation is very clear. Only occasionally an attempt at mathematical sophistication makes itself felt. Thus the authors first introduce vectors in the usual (most satisfactory) manner. Then (pp. 134–135), rather unclear references are made to a more restrictive analytical definition. The passage culminates in the puzzling statement that $[y, x]$ (which, by the way, is the gradient of the function xy) "does not define a vector." It does. And the authors themselves make free use of gradients and, on the other hand, they (p. 135) "do assume that *all* of the vectors discussed are proper vectors."

W. FELLER

Navigational trigonometry. By P. R. Rider and Ch. A. Hutchinson. The Macmillan Company. New York, 1943. ix+232 pp. $2.00.

The reviewer has considered this book more from the standpoint of a person studying the principles underlying the art of navigation, either for the first time or as a refresher, than as a mathematical textbook.

The book, as the authors say, is "a revision and expansion of part of Rider's Plane and Spherical Trigonometry." The general arrangement of the material is very good, both as to the sequence of topics taken up by chapters and the presentation of the material in each chapter itself. Chapter by chapter it leads the student from fundamental definitions through the solutions of right spherical triangles and oblique spherical triangles which are necessary for the student to know if he is to thoroughly understand his navigation. Admitting that one can learn to navigate and use the short cuts common to practical navigation without a very thorough background of spherical trigonometry, nevertheless the more complete his knowledge of this branch of mathematics, the better navigator he will be and the more he will enjoy working out navigational problems. This phase has, in the reviewer's opinion, been very well handled by the authors, who have shown good judgment in maintaining the proper balance between the amount of detail used in "proofs" and the confidence shown in the intelligence of the student in assuming that he will either accept certain facts or will be able to complete the detailed proofs himself.

The chapters on The Terrestrial Sphere, Charts, The Sailings, Astronomical Triangle and Lines of Position are presented in clear, concise English and in logical order, giving the student the information necessary for him to understand the problems which will confront him later when he takes up navigation as a working tool. The authors very sensibly do not attempt to include in these chapters everything that a man must know in order to actually navigate, but leave that to other books written especially for this purpose.

Throughout the book the method of presentation of material is excellent. Each chapter contains certain proofs and facts followed by problems or exercises based on preceding information, giving the student an opportunity to apply the principles discussed. The fact that the answers to certain problems are given in the back of the book gives the student the chance to know whether or not he has used the proper method of solution, and also the satisfaction of knowing that he has successfully accomplished his task.

The inclusion of an appendix discussing briefly the standards of accuracy is, in the reviewer's opinion, very well worth while. This subject, often neglected, is not well understood by students who have had little experience in mathematics, and is all too often not recognized even by those who have had such experience.

The problems throughout the book are well thought out and the authors have given careful study to the matter, laying special emphasis on the authenticity of materials and assumptions so that the problems are as practical as possible in a text of this size.

The book contains a complete five place table of natural and logarithmic haversines with one minute intervals, which is a notable and welcome innovation in a textbook on trigonometry. It has been the reviewer's experience that the beginner finds it confusing to use the table in Bowditch with its variable interval. This table, along with the table of Common Logarithms of the Trigonometric Functions makes it necessary for the student to make less frequent use of Bowditch, which, because of its size, is rather awkward to manipulate.

All in all, the authors have accomplished what they set out to do. The book fulfills their claims even better than might be expected and should prove to be very popular in the teaching and studying of the basic mathematical problems underlying the principles of navigation.

LEIGHTON T. BOHL

Table of circular and hyperbolic tangents and cotangents for radian arguments. Prepared by the Mathematical Tables Project, Work Projects Administration of the Federal Works Agency; conducted under the sponsorship of the National Bureau of Standards. Official Sponsor: Lyman J. Briggs. Technical Director: Arnold N. Lowan. Columbia University Press. New York, 1943. xxxviii+410 pp. $5.00.

The main table gives the values of tan x, tanh x, cot x and coth x over the range $x=0$ to $x=2$ at intervals of 0.0001. Circular and hyperbolic tangents are given to 8 significant figures for $0<x\leqq 0.01$ and for $0.1\leqq x\leqq 2$, and to 9 decimal places for $0.01\leqq x\leqq 0.1$. Circular cotangents are given to 8 significant figures for $0.1\leqq x\leqq 1.57$ and $1.575\leqq x\leqq 2$, to 8 decimal places for $0<x\leqq 0.1$ and to 13 decimal places for $1.57\leqq x\leqq 1.575$. Hyperbolic cotangents are given to 8 decimal places for $0\leqq x\leqq 0.1$ and to 8 significant figures for $0.1\leqq x\leqq 2$. The second central differences for all these functions are given wherever linear interpolation is not sufficient. Auxiliary tables contain the values of the circular and hyperbolic tangents and cotangents to 10 decimal places over the range $x=0$ to $x=10$ at intervals of 0.1; the values of the interpolation coefficients for the formulas of Gregory-Newton and of Everett; the values of $n\pi/2$ for integer values of n from 1 to 100; and values facilitating the conversion from radians to degrees and from degrees to radians.

W. PRAGER