

The Theory of Spherical and Ellipsoidal Harmonics. By E. W. Hobson. Cambridge, University Press, 1931. vi+500 pp.

This is a comprehensive treatise on the properties of the ordinary and generalized functions of Legendre, with a final chapter on functions of Lamé. The work is all that one would expect from a writer who has himself made many original contributions to the subject, and whose style as an expositor is well known through his text book on real variables. As an up-to-date handbook of spherical harmonics, the new book will undoubtedly be welcomed by both pure and applied mathematicians, and become the standard reference in its field.

PHILIP FRANKLIN

Partielle Differentialgleichungen. By J. Horn. Göschens Lehrbücherei. I. Gruppe, Bd. 14. Berlin and Leipzig, de Gruyter, 1929. 225 pp.

The book is the second edition of the author's *Einführung in die Theorie der partiellen Differentialgleichungen*, which appeared as volume LX in Sammlung Schubert, and contains essentially the same material. Its arrangement, however, has been considerably altered. The three normal forms of linear partial differential equations of the second order (hyperbolic, elliptic, parabolic) are treated successively in the first 6 chapters, the two remaining ones being devoted to non-linear equations with two variables, of the first and second order respectively. Instead of appending a special chapter on partial differential equations in physics, as in the old edition, the author has introduced numerous physical problems and illustrative examples into the text. A discussion of linear integral equations in the earlier pages, sufficiently extensive to render it applicable to later problems, adds greatly to the usefulness of the treatise.

The exposition is clear and logical, and the proofs, while thoroughly rigorous, are always easily followed and enjoyed even by those who seek primarily practical information. The book contains considerably more material than textbooks on advanced calculus, but its size limits it to much less than is to be found in more special treatises on the subject, such as Weber, and Goursat.

HENRY MARGENAU

James Clerk Maxwell; A Commemoration Volume 1831-1931. Essays by J. J. Thomson, Planck, Einstein, Larmor, Jeans, Garnett, Fleming, Lodge, Glazebrook, Lamb. New York, The Macmillan Company, 1931. 146 pp.

This collection of essays, written on the occasion of the celebration of the centenary of Maxwell's birth, gives a vivid impression of the famous man's personality and an idea of the deep influence he has had on the world of natural science. The essays by Thomson and Larmor are not only interesting but very valuable for the sidelights they throw upon the foundation of the Cavendish Laboratory which has since proved so fruitful. There is consolation for us all in the sentence about Maxwell's lectures: "Each term he gave a course of lectures which did not attract as large an audience as they deserved."

F. D. MURNAGHAN

Thermodynamics. By Alfred W. Porter. New York, E. P. Dutton and Co., 1931. 96 pp. \$1.10.

This book is one of the series known as *Monographs on Physical Subjects*,

It gives a compact and accurate statement of the modern status of the subject in hand, paying especial attention to the logical and historical foundations. It is recommended to those who want a brief treatment of this important branch of physics.

C. A. SHOOK

Collected Geometrical Papers, Part II. By Syamadas Mukhopadhyaya. Calcutta, University Press, 1931. 139–295 pp.

Part I of the Collected Papers was published in 1930, and reviewed in this Bulletin, vol. 36 (1931), p. 614. In Part II the pagination continues, and the make-up is the same as that of Part I. It contains two recent essays on plane topology which appeared in the *Mathematische Zeitschrift* in 1931 and the *Tôhoku Mathematical Journal* in 1931, respectively, and seven on parametric representation of curves in n -space, all but one of which (the Griffiths Memorial Prize Essay of 1910) were published in the Bulletin of the Calcutta Mathematical Society from 1909 to 1915. The argument and points of view of the papers on topology are similar to those in Part I. Only elementary methods are employed, but with striking originality and richness in new results. Most of these concern cyclic and sextactic points on continuous ovals.

The other essays are on the differential geometry of analytic curves in a euclidean n -space. Properties are expressed in terms of determinants of derivatives of various orders of the coordinates as to the parameter.

The first intrinsic parameter is the arc length. The second is the projection of the area of the triangle formed by three points which approach coincidence on the curve, summed over the interval of integration, etc. A curve in S_n has n such intrinsic parameters. They are independent of the coordinates chosen and of the parameter. Any $n-1$ independent equations connecting these parameters will determine a curve in S_n , intrinsically. The generalized idea of curvature, spheric of osculation, quadric of osculation etc. can now be expressed. The results in the case of plane curves are compared with those obtained by projective differential geometry. The same ideas are then extended to curves in S_n . At times the amount of machinery necessary seems a bit bewildering, but one is soon consoled by an unexpected general theorem evolving from the maze of formulas. The various kinds of singular points and the associated parametric representation in series are treated in great detail. The Papers contain a powerful weapon with which to attack metric problems on analytic curves of hyperspace.

VIRGIL SNYDER