Bessel Functions

By Andrew Young and Alan Kirk. Part 4: Kelvin Functions. (Royal Society Mathematical Tables, Vol. 10.) Pp. xxvii+97. (Cambridge: At the University Press, 1964. Published for the Royal Society.) 60*s*. net.

THIS volume continues the series of tables of Bessel functions issued by the Mathematical Tables Committee of the Royal Society and its predecessor, a similar committee of the British Association for the Advancement of Science. The functions tabulated are the real and imaginary parts, and the modulus and phase, of the Bessel functions $i^n I_n(xe^{\pi i/4})$ and $i^{-n}K_n(xe^{\pi i/4})$ for real x and n. These occur in the solution of the diffusion equation in cylindrical co-ordinates, in the description of eddy currents in cylindrical conductors due to fluctuating magnetic fields, and other problems.

In a mathematical introduction, formulae relating to these functions are listed, the calculation of the tables is described, and a bibliography is provided. In the main tables, the functions are tabulated for $n = 0(1)10$ and $x = 0(0{\cdot}1)10$ to 7 figures, with differences given as aids to interpolation. Basic 15-figure tables for the functions of order 0 and 1 are also given and are believed to be free of errors. There are also 8-figure tables for $n = 0, 1, 2$ and $x = 0\ (0{\cdot}01)\ 2{\cdot}5$, and auxiliary tables for the functions $i^n x^{-n} I_n(xe^{\pi i/4})$ and $i^{-n}x^n K_n(xe^{\pi i/4})$.

The arrangement and printing of these tables are excellent. A. Erdélyi

Non-Metallic Inclusions in Steel

By Roland Kiessling and Nils Lange. Pp. 104. (London: The Iron and Steel Institute, 1964.) 42*s*.

ALL commercial steels contain non-metallic inclusions which often have important effects on the properties of the steels. Thus, from the earliest days of metallography, these inclusions have been extensively investigated, Swedish metallurgists playing a prominent part in such investigations. The most recent report by Prof. R. Kiessling and Mr. N. Lange, of the Swedish Institute for Metal Research, is a fine example of Swedish research.

The investigation of inclusions has been revolutionized by the development of the technique of electron-probe analysis, which enables a quantitative analysis of the inclusions to be carried out *in situ*. The use of this technique, together with optical microscopy of the highest standard, has produced a report on inclusions which will be a standard text for all metallographers who are interested in ferrous alloys.

The authors state that a great many inclusions in steel belong to the system $MnO—SiO_2—Al_2O_3$, and the presentation in the report has been based on this system, but inclusions of the general formula:

$$Fe_xMn_{1-x}O—SiO_2—Cr_yAl_{2-y}O_3$$

and a discussion of the different iron oxides are also included. The report consists of a discussion of the various phases present in these systems illustrated by photomicrographs of hybrid inclusions. Each photomicrograph is accompanied by details of the type of steels, its analysis, the electron probe analysis of the various phases in the inclusion and comments. There are also useful introductory remarks and comments through the text. J. H. Rendall

Galvanomagnetic Effects in Semiconductors

By Albert C. Beer. (Supplement 4 to Solid State Physics: Advances in Research and Applications.) Pp. xiv+418. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1963.) 96*s*. 6*d*.

THE importance of measurements of the Hall effect and electrical conductivity in determining the carrier concentration and mobility in a simple extrinsic semiconductor is universally recognized. However, the simple band model and scattering mechanisms that were widely accepted fifteen years ago are now known to be only rarely a good approximation. It is in the more complex realistic situations that the more detailed investigations of the galvanomagnetic effects become particularly fruitful. For example, measurements of the various Hall and magnetoresistance coefficients at low magnetic fields have been used in determining the effective mass tensors in the multi-valley energy bands of several materials. Such measurements are particularly useful when the carrier mobility, even at low temperatures, is too small to allow cyclotron resonance and similar effects to be exploited. The extension of the measurements to high magnetic fields is especially useful for mixed or intrinsic semiconductors.

Dr. A. C. Beer's book gives a really comprehensive treatment of the galvanomagnetic effects, starting from the simplest extrinsic model and progressing, for example, to multiple bands, non-quadratic energy surfaces and complex scattering process. It is not a practical book in the sense that it does not describe techniques, but it is nevertheless most suitable for experimentalists since it sets out the theory in an exceptionally plain and straightforward manner. It is a pity that so little attention is paid by Dr. Beer to the thermomagnetic effects, since they can often be measured easily at the same time as the galvanomagnetic effects and they provide useful additional information; they are, moreover, finding practical application in low-temperature energy convertors. However, having restricted himself to the galvanomagnetic phenomena, which are, of course, themselves utilized in devices ranging from magnetometers to amplifiers, Dr. Beer has produced an excellent text, well up to the highest standards of the series of which this book forms part. H. J. Goldsmid

The Natural Philosopher

Vol. 3. Edited by Daniel E. Gershenson and Daniel A. Greenberg, in association with Dennis Flynn. (A Series of Volumes containing Papers devoted to the History of Physics and the Influence of Physics on Human Thought and Affairs through the Ages.) Pp. 111. (New York and London: Blasdell Publishing Company, a Division of Ginn and Company, 1964.) 15*s*.

THIS little manual deals, in four chapters, with a variety of themes of interest in the history and evolution of physics. Its particular merit is that the subjects selected are off the beaten track, and illuminate some unusual recesses of the mind. The first contribution sets Einstein well in the centre of the stage during the period of the wave-particle discussion. We see an aspect of quantum mechanics too often over-simplified, namely the properties of radiation and gases, with special reference to the Bose statistics. This happened in 1924 when Planck's radiation law was derived, not from classical electromagnetic theory as hitherto, but directly from light quanta; in the event, the prelude to Schrödinger's work.

The next paper deals with that somewhat obscure Swiss mathematician Le Sage (1724–1803), who evolved an ingenious theory of gravitation of a strictly mechanical kind, comprising his 'ultramundane corpuscles'. At the time there was no experimental evidence in support of such a system, but about a hundred years later the matter was taken up again, only to be proved untenable by Clerk Maxwell and Poincaré.

Next comes a useful table of references to Faraday's papers on electricity, with explanations and notes.

Finally, the reader is given a very clear account of the Eleatic School of Greek philosophy, and its impact on physics. In effect, this was the fundamental role of logic, even if it contradicted experience. Time was to correct this, without destroying the quest for vigour. We also owe to this school the beginnings of metaphysics, in the recognition of various levels of being, an accomplishment essentially due to Parmenides. F. I. G. Rawlins

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