index or bibliography, but there are historical and bibliographical notes at the ends of the first two chapters. This is in every way a welcome and useful addition to the literature of logic.

ORRIN FRINK, JR.

Mathematical theory of optics. By R. K. Luneberg. (Supplementary notes by M. Herzberger.) Providence, Brown University, 1944. 17+6+401+93 pp. $4.00. (Mimeographed.)

In this book, geometrical optics and diffraction are both treated as special applications of the electromagnetic theory of light. This treatment has advantages in some respects and disadvantages in others. Some types of problems, for instance those of polarized light, are handled easily, while the development of the problems of geometrical optics proper becomes somewhat involved.

The author has made several ingenious contributions in this connection. The idea of treating geometrical optics as a special limiting case of wave optics has never been carried out before in so much detail. The author has nowhere restricted himself to homogeneous media, following in the path of W. R. Hamilton. He covers first-order theory in general systems, third-order image-error theory in rotationally symmetrical systems, and the diffraction theory of spherical and near-spherical waves. A special chapter is devoted to media with parallel layers of constant refractive index.

Luneberg's treatment of diffraction optics is an important step forward. His fundamental contribution may be described as follows:

The light distribution is assumed to be known in a plane of infinite extent, and represented by the function $f(x_0, y_0)$. The light distribution may be only sectionally continuous inside a finite area, but outside this area the function must be small and continuous, and grow smaller with increasing distance from the center of the plane. Specifically, outside the limited area, f, $\partial f/\partial x_0$, and $\partial f/\partial y_0$ must all be continuous and smaller than $B(x_0^2+y_0^2)^{-1/2}$, where B is a constant. A further condition is that the resulting light distribution in space, represented by the function $u(x, y, z)$, shall be indistinguishable from that of a spherical wave at great distances from the plane, since at great distances the finite area of the plane is indistinguishable from a point. Mathematically, this condition is that, beyond a certain large distance from the center of the plane represented by $R=(x^2+y^2+z^2)^{1/2}$, the absolute values of u and $\partial u/\partial R$ shall be smaller than C/R, and the absolute value of the expression $\partial u/\partial R-iku$ shall be smaller than D/R^2, where D and C are constants.