NEW BOOKS.

Analytical Mechanics. By MILLER AND LILLY. Boston: D. C. Heath and Co., 1915. Pp. xv+297.

This text-book is the result of collaboration by a mathematician and an engineer and appears to be fairly successful in meeting the needs both of engineering students and of those whose chief interest is in applied mathematics. In the main it follows conventional lines of development, but the problems, which are numerous and apparently well chosen, have a distinctly "practical" character, especially those in statics. Gravitational units of force are used throughout.

A few criticisms of a minor character may be mentioned. On p. 4 and again on p. 127, acceleration is defined by the equations

$$a = \frac{dv}{dt} = \frac{d^2s}{dt^2};$$

in the first case there is no intimation that this definition is restricted to motion in a straight line, and in the second case the restriction is not made very conspicuous. The normal component of the acceleration is first introduced on p. 163 by a process which seems unnecessarily complicated. An earlier introduction of work and energy might be desirable; they do not appear until Chapter XI. is reached. In the treatment of the motion of a rigid body, p. 236 et seq., a rather formidable array of mathematics is used, considering the very simple applications which follow. This and some other similar cases appear to be deliberate since, in the preface, the authors say: "We have chosen the older methods of treatment, such as the resolution of forces, etc., because we believe that in this way the student keeps in a little closer touch, at least in the beginning, with the physics of the problem." There is room for difference of opinion as to the validity of this conclusion in all cases; certainly there are several places in the book where adherence to the method of resolution along the coördinate axes does not conduce to perspicuity or physical insight.

H. A. B.

Elements of Optics. By GEORGE W. PARKER. New York: Longmans, Green and Co., 1915. Pp. 1+122. Price, $.75 net.

After a student has mastered Euclid, he is at the threshold of physical theory, and how to introduce him to this realm is the problem of the teacher. The author's solution is simple geometrical optics. Nothing could be more appropriate. The fact that light travels in straight lines immediately enables us to

apply geometry. The laws of reflection and refraction are extremely simple, and follow directly from experiment. With Euclid in one hand and these two laws in the other, he can lead the admiring student past a wealth of phenomena, understanding all as he goes. In no other field of physics is such immediate success possible. One cannot but admire the conception behind this little book.

The author carefully preserves the essential sameness of physical theory and mathematical deduction, and yet strongly emphasizes the essential difference, approximation, which he keeps carefully before the reader. The first chapter describes rectilinear propagation, and states the laws of reflection as experimental facts, and then applies them to the phenomena of reflection. The second chapter does the same for refraction. The eye and optical instruments are explained in the third chapter, and the book ends with a description of Newton's experiment which discovered the dispersion of light, and with this basis briefly treats of achromatic lenses.

P. V. W.