

## SHORTER NOTICES

*Elementary Differential Equations.* By Thornton C. Fry. New York, D. Van Nostrand Company, 1929. x+255 pp.

This book presents a specialized type of course in differential equations, which has been developed in the Out-of-Hour Courses of the Bell Telephone Laboratories, and is intended primarily for students of engineering. Quite naturally technical applications and illustrations play a prominent part in the work. The author has a style of presentation which is so plausible that, to the scientific student, formal proofs are likely to appear superfluous. But he has been careful to point out that physical intuition is not a substitute for abstract logic and that understanding of principles is more important than proficiency in operating mathematical machinery. In order to emphasize this view, the mathematical ideas and the illustrative material are presented in separate chapters.

To illustrate the range of subject matter in the applications we find in Chapter III under the development of differential equations from physical laws the following illustrations: the law of mass action in chemistry, the catenary, the flow of current in an electrical network, the conduction of heat, irrotational motion in a perfect fluid, and the equation of the potential distribution in a vacuum tube. The author remarks that some of the examples require the use of physical laws with which the student may not be familiar, but it is not expected that every student will digest every illustration. To quote from the preface: "The freedom of choice provided by this excess of material may perhaps be of little value to the instructor, who will probably draw his illustrations largely from the subject in which he is at the moment most interested, whether it be in the text or not; but the Out-of-Hour courses have shown it to have another sort of merit, in that the better students develop a spontaneous interest in these illustrations, even when they are not assigned, and follow them up on their own initiative. The educational value of such voluntary effort needs no special emphasis."

In Chapter IV on methods of solution of first order equations we find prominence given to approximate methods, including numerical and graphical integration and the use of series. The applications (Chapters VI) include dissipation of heat in a wire, flow of heat in a sphere, curve of constant curvature, trajectories, freely falling body under the newtonian law, bending of a beam, deflection of structural columns, vibrating string, vibrating drum head, surface of revolution having minimum area, the brachistochrone, geodesics on a curved surface, the problem of Dido, and a problem in probability.

The latter part of the book is devoted to the discussion of linear equations and applications to various electrical phenomena. The method of treatment is original and should prove very valuable to the workers in this particular branch of engineering.

In a book of this type it is not to be expected that the treatment would be always rigorous. The author has maintained a nice balance between mathe-