

is professedly rigorous. The area under a curve has no being apart from its definition as an integral, for, in Mathematics all being is of a logical character and hence area as a geometric intuition cannot be taken for granted. It would have been of great value to the student if a short introduction to the theory of integral had been appended, and also the distinction between primitive and integral (Cauchy or Riemann) dealt with more exhaustively. Again Ex. 3 on p. 83 should not have found a place in the book; it is characteristic of loosely written text-books which pay no attention to rigour.

These blemishes apart, we have no hesitation in recommending this book as an excellent introduction to elementary analysis.

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Wave-Mechanics. (Sukraj Rai Readership Lectures, 1939-40.) By V. V. Narlikar, (Patna University), 1942. Pp. vii + 160.

This account of wave-mechanics is based on a series of eight lectures delivered by the author, and presents a birds'-eye-view of the development of the subject and its broad principles. The topics treated are as follows:—classical mechanics, theories of Einstein and Bohr, Schrödinger's theory, transformation theory of Dirac, relativistic theory of the electron, theory of radiation and nuclear forces. The first seven chapters are of an expository nature while the remaining two chapters constitute a sort of report on the topics dealt with under them. The earlier expository part is in the historical order of development, viz., classical mechanics, old quantum theory and the new quantum mechanics, and such a development has its own advantages as well as disadvantages. A historical treatment would perhaps have been inevitable in the earlier days of quantum mechanics when the theory itself was in a flux, but now that we have a sort of a satisfactory finished product it would be hard to justify such a treatment. In the three chapters on Waves and Particles, Matrices and Waves, and States and Observables, there is a repetition of ideas which has the danger of hiding the essential principles of wave mechanics under the mass of a number of alternative but equivalent mathematical representations. The distinction between non-relativistic and relativistic quantum mechanics is nowhere presented clearly in the book. Thus the postulates of the Dirac theory of the electron as given on p. 104 are definitely defective. Also the mention of the positron on p. 61 in company with a number of other collision problems which can be treated non-relativistically serves to give the wrong notion that the theory of the positron is also non-relativistic.

As the author himself admits the treatment in many places is "too sketchy and scrappy". As examples we might mention the following:—

(i) The treatment of group theory and group representations on pp. 148-52 appears superfluous inasmuch as no attempt is made to apply it even to a single problem. After giving this account of four pages in a book on Wave Mechanics it appears like an anti-climax to say at the end that "one of the most important applications of groups is in the study of crystallography".

(ii) The conclusion that the highest atomic number is 92 from the bare remark (p. 115) that "out of 136 possible rotations only 91 left the interaction term of two electrons unchanged" savours of Eddington's epistemological considerations, and can hardly be considered a proof.

(iii) The remarks (p. 123) on the nature of light are rather loosely worded. To the question "What is light, waves or particles?" the author returns the answer that it is neither. The correct answer, however, is that it is both since, according to the principle of complementarity, a complete description of natural phenomena may require the use of two points of view mutually contradictory. As regards the definition of light the author remarks (p. 124), "Those who know the mathematical theory can do without the definition which is not precise enough. Those who do not understand the theory will not be enlightened by the definition, because it is too technical". This looks like unnecessary mystification, and gives an altogether wrong idea of the quantum theory of radiation.

(iv) The phrase "inside the electron" appears in many places in the book. This is perhaps a picturesque way of describing the neighbourhood of the nucleus, but it is rather loose terminology since it suggests that the electron is not necessarily a fundamental particle.

At the end of each chapter is found a list of references for further study, and this is bound to be of much value. But, surprisingly enough, we nowhere find a reference to Pauli's article on Wave Mechanics in the *Handbuch der Physik* which and Dirac's book are commonly considered to be the two best expositions of the general principles of quantum mechanics. We also notice "Yukawa" spelt as "Ukawa".

In spite of such imperfections we must confess we have enjoyed reading this book. In the earlier expository part, the author has successfully diagnosed the difficulties of beginners in quantum mechanics, and given full and clear expositions of these topics. The several summaries interspersed here and there in the book are bound to be of value to many students. The examples chosen to illustrate the theory are taken from out of a wide field and serve a very useful purpose. The book is written in a racy style abounding in analogies, and illustrations which serve to make difficult mathematical topics more easily understood.