CLASSICAL MECHANICS*

OF late the feeling has been steadily growing among several critics that the present-day importance of classical mechanics as an essential part of the curriculum for students of advanced physics is undeservedly overpraised. Inasmuch as it neither introduces any new physical concept nor leads the student directly into current physical research, the post-graduate student is likely to regard it as redundant. Its aid in solving his problems on practical mechanics which may arise in the course of his laboratory work is insignificant.

Closer scrutiny, however, reveals that in the first place classical mechanics serves as the spring-board for the various branches of modern physics. Observe, for instance, that the technique of action-angle variables is very much needed in the older quantum mechanics while the Hamilton-Jacobi equation and the principle of least action transport you smoothly into the realms of wave mechanics; a proper formulation of the newer quantum mechanics is rendered easier by the use of Poisson brackets and canonical transformations. It enables the student to equip himself with many of the mathematical techniques needed for quantum mechanics while still working in terms of the familiar concepts of classical physics

To bring out these aspects sharply, it is obvious that there ought to be a thorough overhaul of the traditional method of presenting the subject. In developing his course of lectures delivered at the Harvard University into the present book, Prof. Goldstein appears to have kept this aim constantly in mind and has succeeded admirably. The accent has throughout been on those formulations which are deemed important from the standpoint of modern physics; increased elegance and compactness have been frequently achieved by the introduction of special techniques normally associated with quantum mechanics.

The discussion of motion under a central force has been broadened to include the kinematics of scattering and the classical solution of scattering problems. Canonical transformations, Poisson bracket formulations, Hamilton-Jacobi theory, and action-angle variables have all been discussed in detail. A somewhat brief introduction has been provided to the variational principle formulation of continuous systems and fields.

One example of the application of new mathematical techniques may be seen in the discussion of the rigid body rotations from the standpoint of matrix transformations. As a result, the familiar Euler's theorem on the motion of a rigid body may now be presented in terms of the eigen-value problem for an orthogonal matrix. Such diverse topics as the inertia tensor, Lorentz transformation in Minkowski space, and resonant frequencies for small oscillations all become now capable of a unified mathematical treatment. Another advantage claimed by the matrix methods is that 'spinors' can be introduced in connection with the properties of Cayley-Klein parameters.

Quite often in the past, special relativity has received no connected development except as part of a highly specialised course which also covers general relativity. On account of its vital importance in modern physics, Prof. Goldstein has considered it an advantage to the student if he is introduced to this topic at a fairly early stage.

While the development of classical mechanics historically has mostly been with the emphasis on static forces dependent on position only (such as gravitational forces) we have on the other hand, in modern physics especially, to deal frequently with velocity-dependent electro-magnetic forces. Potentials dependent on velocity have therefore been incorporated in the structure of mechanics from the beginning and consistently developed throughout.

There is today a real dearth of a connected account of the classical foundations of the variational principle formulation of continuous systems, despite its growing importance in the field theory of elementary particles. The theory of fields can be developed considerably both in extent and complexity before one finds the necessity to introduce quantisation. An adequate discussion of topics such as the stress energy tensor, momentum space representations, etc., all entirely within the frontiers of classical physics would normally need a scholarship much beyond what could be expected of the average student using this book. Chapter 11 is therefore limited to an elementary description of the Lagrangian and Hamiltonian formulation of fields.

Prof Goldstein's excellent book is useful both for the inadequately prepared student and the ambitious senior frequently desirous of omitting the intermediate step. While a certain amount of discipline in advanced calculus and the elements of vector analysis is assumed on

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* *Classical Mechanics.* By Herbert Goldstein. Addison-Wesley Press, Inc., Cambridge 42, Mass. 1950. Pp. xi + 399, Price 6·50 dollars.

the part of the student, more complicated mathematical tools are developed as and when their need is felt. A proper understanding of the sections dealing with electromagnetic forces necessarily presupposes an acquaintance with Maxwell's field equations and the simple results flowing from them.

The exercises appended to each chapter are more in the nature of extensions of the main text illustrating some special point or proving a variant theorem. At the end of each chapter we find references for elaboration of the material treated.

It is, altogether, an exhilarating experience to read through the book and find that classical mechanics is still going strong.

P. S. R.

BUILDING RESEARCH CONGRESS, 1951

A COMPREHENSIVE Congress on Building Research has been planned to take place in September 1951, in London and will be to review the progress made in research in relation to architecture, building and the associated branches of civil engineering, and it has been arranged because of the widespread interest shown in the subjects in many countries since the end of war. There have been rapid developments in all branches of building science and papers presented at the Congress will review these developments and will consider their significance and their effect on future trends. Many of the papers will be contributed by authors from overseas, and it is expected that the Congress will attract many members from all over the world from amongst the ranks of architects, engineers, builders and contractors and from many branches of Science.

For the purpose of the technical sessions, the Congress has been planned in three divisions holding concurrent meetings.

DIVISION 1, which is concerned with the engineering and structural aspects of building, will cover the influence of mechanisation and prefabrication on techniques and cost of building; the influence of modern research on structural design; and the influence of modern soil studies on the design and construction of foundations.

DIVISION 2, which is concerned with building materials, will cover individual materials such as burnt clay products, cement and concrete, building stones, lime, paints, plaster and timber, and there will be in addition a wide survey of research on weathering and durability of building materials.

DIVISION 3 will be concerned generally with the various factors which influence the comfort and efficiency of the people using the buildings. The matters to be discussed include the acoustics of auditoria and broadcasting studies; the heating and ventilating of buildings in relation to summer and winter conditions; the lighting of buildings. In addition three specific types of buildings—hospitals, factories and schools—will be considered in the light of all the requirements they must meet if they are to fulfil their purpose.

Since the Congress has been arranged during the Festival of Britain, it is expected that hotel bookings in the London area will be very heavy and in their own interests members are advised to lose no time in reserving accommodation.

The centre of the Congress will be the Institution of Civil Engineers. For the time being arrangements are being handled from the Building Research Station, D.S.I.R., and enquiries should be addressed to Organising Secretary, Building Research Station, Bucknalls Lane, Garston, Nr. Watford, Herts, England.

BUILDING RESEARCH INSTITUTE

DR. J. N. MUKHERJEE, till recently Director, Indian Agriculture Research Institute, has been appointed Head of the Division of Chemistry and Director of the Building Research Institute, it is learnt.

Dr. Mukherjee has had a long career of research in soil sciences which have an intimate bearing on problems relating to building research. It is hoped that with his appointment the Building Research Institute, which is one in the chain of national laboratories being established under the auspices of the Council of Scientific and Industrial Research, and where a good deal of work has already been done on "low-cost houses and soil stabilisation", will be able to expedite the research programme undertaken by the Council.
