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TRAINING AND RESEARCH IN APPLIED MATHEMATICS

WHILE the role of mathematics as the Queen of the Sciences is easily conceded and very well understood, there is a great deal of confusion in the minds of many workers regarding the role played by applied mathematics in science and engineering. Applied mathematics is fast emerging as a separate discipline, with its own characteristic approach to various problems, quite distinct from the methods of pure mathematics. It is high time that courses of study are offered in our Universities, at least at the post-graduate level, where some directed study may be made of the applied aspect of mathematics in physical, technical and biological sciences. An obvious corollary to this is the need for establishing one or more computatorial centres, where modern high speed calculating machines would be developed and could be utilised by workers in applied mathematics. In this connection the following memorandum prepared by Prof. B. R. Seth and circulated amongst the members who attended the South Asian Conference on Mathematical Education held in Bombay recently deserves careful study.

Mathematics is applied if conceived in a spirit of ready co-operation with other sciences in the great endeavour of comprehending our environment, and of bringing order and scientific basis into this study. It should be original and imaginative in the invention and use of its concepts. Unlike pure mathematics it shows in its conceptual activity a deep interest in the world of outer experience and enriches mathematics with structures closely related to or suggested by experience and observation. In this respect Indian Mathematics has so far failed to make a signal contribution.

The following developments have revolutionized the concept of applied mathematics: (*i*) Axiomatic approach; (*ii*) Uncertainty principle as illustrated in statistical mechanics, quantum mechanics and modern bio- and sociological phenomena; (*iii*) Industrial competition and military rivalry; (*iv*) High speed electronic computors. The next ten years will see

intensive mathematisation of fundamental scientific and engineering research, managerial functions, conduct of military operations, planning of economic affairs and even human thought. These years will also decide whether applied mathematics will remain an effective component in the great mathematical community, or will emerge as an independent scientific enterprise.

In U.S.A. there are at present seven mathematical institutes and two University departments specifically dedicated to the cultivation of applied mathematics. In India the Calcutta University has a full-fledged department of applied mathematics, but otherwise those taking interest in some branch of applied mathematics are not many. This is in striking contrast to what is happening in the United States of America, where mathematics is playing a very vital role in all spheres of human activity. The reasons for such a state of affairs are :

(*i*) The courses in mathematics are heavy and have not been integrated with other scientific subjects to make them attractive and beneficial to the students in the long run. (*ii*) The avenues open to mathematicians have not been fully explored and publicized. (*iii*) The curriculum in graduate education seldom leads students to take an interest in higher work. (*iv*) Industry and national research laboratories have not been made fully aware of the important role which mathematics is to play in their development. (*v*) No practical bias is given to graduate education to enable a number of students to find suitable employment in business and industry.

Thus there is lack of qualified students, qualified teachers and suitable publicity.

At present mathematics is taught indifferently in technical institutions. This has proved very harmful to the development of the subject, and it is to be feared that national planning for higher grade technical training may not be successful unless mathematics plays its fundamental role.

With this end in view a joint symposium of the Sections of Mathematics, Statistics and Engineering at the Forty-Second Meeting of the Indian Science Congress at Baroda set up a Committee under the Chairmanship of Prof. B. R. Seth, consisting of three engineers, two mathematicians and two statisticians to make recommendations on the teaching of mathematics in engineering institutions. Its report was discussed at the Forty-Third Meeting of the Indian Science Congress held at Agra and the final report is under preparation.

The following recommendations, if adopted, may help to improve the present state of affairs :

(*i*) Establishment of a National Committee on Applied Mathematics. This will facilitate co-operation between Institutes and Universities, will call attention to new areas in which mathematics can be profitably used and will do a periodical survey of problems concerned with training and research in the subject.

(*ii*) Establishment of graduate schools.

(*iii*) Provision of an increasing number of optional papers in applied mathematics for the B.A. (Hons.) and M.A. Examinations in our Universities.

(*iv*) Encouragement to students to take courses in other sciences with a significant mathematical content.

(*v*) Invitations to mathematicians from industries and Government to teach at Universities and take part in their research activities on a temporary basis.

(*vi*) Provision for employing mathematicians on the staff of industries and national laboratories to help them in their problems of production and research.

ELECTRONIC COMPUTERS IN SCIENTIFIC RESEARCH

THE importance attached to the use of modern electronic computers in molecular quantum mechanics has been stressed in an International Conference held in Texas during December last. A resolution was passed unanimously, directing attention to the impressive results already obtained by high speed computers in the calculation of molecular and crystal properties, and claiming that these properties are of extreme importance in chemistry, physics and biology. The resolution goes on to note that "progress of this work is greatly hampered by the fact that, due to their great cost, high speed computers are unavailable to most scientists in this field"; and therefore it "recommends that governments, industries, foundations and private philanthropists give special attention to the problem of providing more high speed computing facilities for use in molecular problems". Copies of the complete document