

A Manual on Experiments in Physics

(To be done with the IASc Kit)

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1 July 2018

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Preface

Physics education in India today, both at the graduate and post-graduate levels, lacks good training in experimental physics. The curriculum is biased more towards theory than experiment. Even the few experiments that are done in the laboratory use outdated equipment and techniques.

In the year 2000, the Indian Academy of Sciences, Bengaluru, entrusted to one of us (RS), the responsibility of developing good, low-cost experiments in physics, and of conducting Refresher Courses to train teachers in doing these experiments. Dr Priolkar of Goa University was a part of this effort right from the start. Dr Ramesh of the National Aerospace Laboratories, Bengaluru, joined this effort in 2010. The authors of this manual have developed more than fifty experiments covering different aspects of physics. Some of these experiments are at the BSc, and some at the MSc or post-MSc levels. The experiments have all been designed to verify a physical law, or measure a physical property. All the electronic circuits are analog circuits. Our claim is that the circuits work for the purpose for which they have been designed, namely, to carry out reproducible measurements to an accuracy of a few per cent.

In 2010, the Indian Academy of Sciences, Bengaluru, licensed Messrs Ajay Sensors and Instruments in Bengaluru to produce the equipment and circuits developed by us, and sell them at prices fixed by the Academy.

Ninety-five Refresher Courses of two weeks, duration, using 25 of these experiments, have been conducted all over India till the end of January 2018. Eight Refresher Courses in more advanced experiments have been conducted in Bengaluru from 2013. About 2500 teachers and students have been trained to do these experiments. More than 250 standard kits to do some basic experiments have been sold so far. More than 150 institutions, including some IITs, IISERs, Central and State Universities and autonomous institutions are using some of these experiments in their curriculum. Since 2007, this effort has been supported by the Indian Academy of Sciences, Bengaluru, the Indian National Academy of Sciences, New Delhi and the National Academy of Sciences of India, Allahabad.

The Science Education Panel of the Academies suggested that the manual for the experiments may be published as a book. The manual has been revised completely.

We believe that this manual, along with the equipment developed, will be useful for improving the laboratory practice in colleges. It is our hope that the manual will also stimulate teachers to develop new experiments.

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(In the following, the letter A, within brackets, at the end of the title, signifies experiments that can be done in B.Sc classes. Experiments marked B can be done in M.Sc. Experiments marked C require advanced infrastructure, and are being done in the IASc laboratory in Jalahalli, Bengaluru)

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