Chapter One

INTRODUCTION

The National Curriculum Framework (NCF) – 2005 initiated a new phase of curriculum revision. First, new syllabi for Science and Mathematics for all stages of school education were developed. Based on these syllabi, new textbooks were developed. As a part of this effort, Physics textbooks for Classes XI and XII were published in 2006 and 2007, respectively.

One of the major concerns expressed in NCF–2005 is regarding *Examination Reform*.

> According to NCF–2005, "A good evaluation and examination system can become an integral part of the learning process and benefit both the learners themselves and the educational system by giving credible feedback".
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> It further notes that,
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> "Education is concerned with preparing citizens for a meaningful and productive life, and evaluation should be a way of providing credible feedback on the extent to which we have been successful in imparting such an education. Seen from this perspective, current processes of evaluation, which measure and assess a very limited range of faculties, are highly inadequate and do not provide a complete picture of an individual's abilitiy or progress towards fulfilling the aims of education".

The purpose of assessment is to determine the extent to which learning has taken, on the one hand and to improve the teaching-learning process and instructional materials, on the other. It should inter alia be able to review the objectives that have been identified for different school stages by gauging the extent to which the capabilities of learners have been developed. Tests should be so designed that we must be able to gauge what children have learnt, and their ability to use this knowledge for problem-solving and application in the real world. In addition, they must also be able to test the processes of thinking to gauge if the learner has also learnt where to find information, how to use new information, and to analyse and evaluate the same. The types of questions that are set for assessment need to go beyond what is given in the book. Often children's learning is restricted as teachers do not accept their answers if they are different from what is presented in the guidebooks. Designing good test items and questions is an art, and teachers should spend time thinking about and devising such questions.

Observing on the current practices of the different boards of school education in the country, the National Focus Group paper on *Examination Reform* says:

> "...Because the quality of question papers is low, they usually call for rote memorisation and fail to test higher-order skills like reasoning and analysis, let alone lateral thinking, creativity and judgement".

It further advocates the inclusion of Multiple Choice Questions (MCQ)-a type of question that has great untapped potential. It also notes the limitation of testing through MCQ's only. "While MCQ can more deeply probe the level of conceptual understanding of students and gauge a student's mastery of subtleties, it cannot be the only kind of question in any examination. MCQs work best in conjunction with some open-ended essay questions in the second part of the paper, which tests expression and the ability to formulate an argument using relevant facts."

In order to address to the problem, the Department of Education in Science and Mathematics undertook a programme, *Development of Exemplar Problems in Physics* for Class XI during 2007-08. Problems based on different chapters in textbook of Physics for Class XI published by the NCERT has been developed. Problems have been classified broadly into five categories:

1. Multiple Choice Questions I (MCQ I): only one correct answer.
2. Multiple Choice Questions II (MCQII): may have one or more than one correct answer.
3. Very Short Answer Questions (VSA): may be answered in one/two sentences.
4. Short Answer Questions (SA): require some analytical/numerical work.
5. Long Answer Questions (LA): require detailed analytical/numerical solution.

Though most of the questions given in a particular chapter are based on concepts covered in that chapter, some questions have been developed which are based on concepts covered in more than one chapter.

One of the major objectives of involving learners in solving problems in teaching-learning process is to promote a more active learning environment, improve student learning and also support young teachers in their professional development during their early formative teaching experiences. For this to be achieved, problem-solving based on good question should form an integral part of teaching-learning process. Good questions engage students in progressively deeper levels of thinking and reasoning. It is envisaged that the questions presented through this book would motivate teachers to design good questions. What makes a question good? According to Robyn L. Miller et al.[1]

Some characteristics of a good question are:

- stimulates students' interest and curiosity.
- helps students monitor their understanding.
- offers students frequent opportunities to make conjectures and argue about their validity.
- draws on students' prior knowledge, understanding, and/or misunderstanding.
- provides teachers a tool for frequent formative assessments of what their students are learning.
- supports teachers' efforts to foster an active learning environment.

A Note to Students

A good number of problems have been provided in this book. Some are easy, some are of average difficult level, some difficult and some problems will challenge even the best amongst you. It is advised that you first master the concepts covered in your textbook, solve the examples and exercises provided in your textbook and then attempt to solve the problems given in this book. There is no single prescription which can help you in solving each and every problem in physics but still researches in physics education show that most of the problems can be attempted if you follow certain steps in a sequence. The following prescription due to Dan Styer[2] presents one such set of steps :

1. Strategy design
   (a) Classify the problem by its method of solution.
   (b) Summarise the situation with a diagram.
   (c) Keep the goal in sight (perhaps by writing it down).
2. Execution tactics
   (a) Work with symbols.
   (b) Keep packets of related variables together.

[1] http://www. math.cornell.edu/~ maria/mathfest_education preprint.pdf
[2] http://www.oberlin.edu/physics/dstyer/SolvingProblems.html

(c) Be neat and organised.
(d) Keep it simple.

3. Answer checking

(a) Dimensionally consistent?
(b) Numerically reasonable (including sign)?
(c) Algebraically possible? (Example: no imaginary or infinite answers)
(d) Functionally reasonable? (Example: greater range with greater initial speed)
(e) Check special cases and symmetry.
(f) Report numbers with units specified and with reasonable significant figures.

We would like to emphasise that the problems in this book should be used to improve the quality of teaching-learning process of physics. Some can be directly adopted for evaluation purpose but most of them should be suitably adapted according to the time/marks assigned. Most of the problems included under SA and LA can be used to generate more problems of VSA or SA categories, respectively.