IIT JEE PHYSICS
(1978–2016: 39 Years)
Topic-wise Complete Solutions

Volume II
Heat, Electromagnetism and Modern Physics

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We dedicate this book to the hundreds of anonymous professors at IITs who formulated the challenging problems for IIT-JEE. The book is a showcase of their creation.

Foreword

Physics starts with observing the nature. The systematic observation results in simple rules which unlock the doors to the nature's mystery. Having learned a handful of simple rules, we can combine them logically to obtain more complicated rules and gain an insight into the way this world works. The skill, to apply the theoretical knowledge to solve any practical problem, comes with regular practice of solving problems. The aim of the present collection of problems and solutions is to develop this skill.

IIT JEE questions had been a challenge and a center of attraction for a big section of students at intermediate and college level. Independent of their occurrence as an evaluation tool, they have good potential to open up thinking threads in mind. Jitender Singh and Shraddhesh Chaturvedi have used these questions to come up with a teaching material that can benefit students. The explanations accompanying the problems could bring conceptual clarity and develop the skills to approach any unseen problem, step by step. These problems are arranged in a chapter sequence that is used in my book Concepts of Physics. Thus a student using both the books will find it as an additional asset.

Both Jitender Singh and Shraddhesh Chaturvedi have actually been my students at IIT, Kanpur. Jitender Singh has been closely associated with me since long. It gives me immense pleasure to see that my own students are furthering the cause of Physics education. I wish them every success in this work and expect much more contribution from them in future!

Dr. H C Verma
Professor of Physics
IIT Kanpur

Preface

This book provides a comprehensive collection of IIT JEE problems and their solutions. We have tried to keep our explanations simple so that any reader, with basic knowledge of intermediate physics, can understand them on his/her own without any external assistance. It can be, therefore, used for self-study.

To us, every problem in this book, is a valuable resource to unravel a deeper understanding of the underlying physical concepts. The time required to solve a problem is immaterial as far as Physics is concerned. We believe that getting the right answer is often not as important as the process followed to arrive at it. The emphasis in this text remains on the correct understanding of the principles of Physics and on their application to find the solution of the problems. If a student seriously attempts all the problems in this book, he/she will naturally develop the ability to analyze and solve complex problems in a simple and logical manner using a few, well-understood principles.

For the convenience of the students, we have arranged the problems according to the standard intermediate physics textbook. Some problems might be based on the concepts explained in multiple chapters. These questions are placed in a later chapter so that the student can try to solve them by using the concept(s) from multiple chapters. This book can, thus, easily complement your favorite text book as an advanced problem book.

The IIT JEE problems fall into one of the nine categories: (i) MCQ with single correct answer (ii) MCQ with one or more correct answers (iii) Paragraph based (iv) Assertion Reasoning based (v) Matrix matching (vi) True False type (vii) Fill in the blanks (viii) Integer Type, and (ix) Subjective. Each chapter has sections according to these categories. In each section, the questions are arranged in the descending order of year of appearance in IIT JEE.

The solutions are given at the end of each chapter. If you can't solve a problem, you can always look at the solution. However, trying it first will help you identify the critical points in the problems, which in turn, will accelerate the learning process. Furthermore, it is advised that even if you think that you know the answer to a problem, you should turn to its solution and check it out, just to make sure you get all the critical points.

This book has a companion website, `www.concepts-of-physics.com`. The site will host latest version of the errata list and other useful material. We would be glad to hear from you for any suggestions on the improvement of the book. We have tried our best to keep the errors to a minimum. However, they might still remain! So, if you find any conceptual errors or typographical errors, howsoever small and insignificant, please inform us so that it can be corrected in the later editions. We believe, only a

collaborative effort from the students and the authors can make this book absolutely error-free, so please contribute.

Many friends and colleagues have contributed greatly to the quality of this book. First and foremost, we thank Dr. H. C. Verma, who was the inspiring force behind this project. Our close friends and classmates from IIT Kanpur, Deepak Sharma, Chandrashekhar Kumar and Akash Anand stood beside us throughout this work. This work would not have been possible without the constant support of our wives Reena and Nandini and children Akshaj, Viraj and Maitreyi.

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