PREFACE

The Need for this Book

Since the beginning of my career as a teacher, I have been teaching Basic Electrical Engineering—a core course usually taught in 1st or 2nd semester of B. Tech. common to all disciplines. I observed that the students had difficulty in understanding the available textbooks, and therefore resorted to memorising the statements and formulae of the basic principles. It forced my teacher's conscience to prepare a textbook that presented the important ideas in depth and left many of the details for future learning in further study. So, I authored this book emphasising important principles as the foundation of electrical engineering. The main goal of this book is to:

- explain the basic ideas of electrical engineering in simple language,
- bring easy understanding of circuits, electrical power systems, generators and motors, and
- provide enough number of 'Practice Problems' to enhance the grasp of the basic principles in different ways.

The book is a culmination of various stages such as drafting, testing and feedback on prepared material by students' editorial board.

Prerequisites

This book is meant to be used by students who have just passed 10+2, who lack the knowledge of higher mathematics. It uses derivatives at some places and integrals scantly. Simple algebra, vector algebra, complex-number algebra and matrices are extensively used with detailed explanations. Thus, it will serve the purpose of a textbook to the undergraduate students of all engineering disciplines and diploma students of Electrical Engineering and Electronics Engineering streams.

Pedagogy of the Book

When an engineering subject is considered by a teacher for textbook or class-teaching, he moves from general to specific—first ideas, and then laws, followed by equations, and examples. However, most students seem to learn in the opposite order—first examples, then equations, followed by laws and finally ideas. Some students never go beyond studying the examples, and many believe that only the equations are important. When the teacher probes their understanding of the general principles through a quiz, many students give memorised 'solutions', or protest that this thing was never taught in the class.

The goals and needs of both the teacher and the taught are met in the design and the pedagogy of this book. The principles and applications of the subject are clearly and concisely presented using a step-by-step approach.

Structure of the Book

The book, spanning over 19 chapters, has been structured to cover all important topics required by the syllabus in a single volume. It begins with an introductory chapter, and ends with a chapter on electrical wiring and illumination needed by a practicing engineer. Chapters 2 to 4 explain the basic ideas, principles, circuit analysis techniques and theorems by considering simple dc circuits. Chapters 5 to 7 deal with magnetic circuits. Chapter 8 explains first-order transients in *RC* and *RL* dc circuits. Chapters 9 to 12 are on single-phase and three-phase ac circuits. Chapters 13 to 17 cover electrical machines. Lastly, chapter 18 gives basic information of electrical measuring instruments.

Each chapter ends with 'Summary', Check Your Understanding', 'Review Questions', Multiple Choice Questions', 'Problems', and 'Experimental Exercises'.

AIDS TO LEARNING

This textbook addresses the viewpoints of both students and teachers in a number of ways:

- **Objectives and Summary**   Each chapter begins with the Learning Objectives and ends with Summary giving key Terms and Concepts, and Important Formulae.
- **Causality**   In complicated situations, the cause-effect relationships are given.   Understanding consists largely in knowing the causal connections between various factors in a problem so that the equations are written with a purpose.   Students often have trouble solving problems because they memorise equations without clearly understanding what the variables mean.
- **Major Equations**   Important major equations are boxed with a thick border, with a view to highlight them. This format, however, is sparingly used lest the students think that electrical engineering consists of a set of equations to be memorised.
- **Key and Important Terms**   Key terms are made bold-italic when they are first introduced and defined.   Important terms are italicised wherever they appear.
- **Solved Examples/Problems**   The book has 528 examples/problems, solved step-by-step clearly bringing out the causal-effect relationships.
- **Additional Solved Examples**   More solved problems have been included for difficult concepts and further integrations of subject areas.
- **Check Your Understanding**   Students can check their understanding of the principles studied in a chapter by answering 10 True/False (objective) questions given at the end of each chapter.
- **Review Questions**   These questions allow students to review the key concepts and assess their understanding.
- **MCQs**   There are 646 Multiple Choice Questions, which prepare the students for competitive tests conducted by GRE, UPSC, NTPC, ONGC, Infosys, Accenture, etc.
- **Practice Problems**   The book provides 840 numerical problems for the practice of the students in the category of simple, tricky and challenging. The answers to the problems are also provided to enable students to gain confidence in their attempts. Most of the problems have been taken from examination papers of different universities.
- **Experimental Exercises**   Experimental Exercises aid students to perform experiments in the laboratory in a systematic way.

Rich pool of pedagogy of more than 2000 solved problems and students' practice problems needed by practicing engineers.

Solved Examples/Problems:	**528**	*Review Questions*:	**268**
Multiple Choice Questions:	**244**	*Students' Practice Problems*:	**840**
Experimental Exercises:	**16**	*True/False Questions*:	**180**

ONLINE LEARNING CENTRE

This book is accompanied by a comprehensive website—http://www.mhhe.com/kulshreshtha/bee—designed to provide valuable resources for students, instructors and professionals. Students can access a sample chapter, 402 additional Multiple Choice Questions and link to reference material on the website. Teachers using this book as the main text can request the Publisher for the Solution Manual of numerical problems. Supplementary teaching materials include chapter-wise PowerPoint slides with animations for effective lecture presentations, and an exhaustive test-bank.

SUPPLEMENTARY EXERCISES

For a thorough understanding of electrical principles, one needs to work out an exhaustive number of numerical problems. Supplementary Exercises—in the category of Solved Problems and Students' Practice Problems—is an additional feature

of the book. These sets of exercises are meant to provide a standard methodology of sincerely learning the basic principles of Electrical Engineering. The questions and problems in this set of exercises are categorised into *five* parts :

I. **Part A**—*DC Circuits* : Assemblage of
   Ch. 2 : Ohm's Law; ***Ch. 3*** : Network Analysis; and ***Ch. 4*** : Network Theorems.

II. **Part B**—*Electromagnetic Circuits* : Assemblage of
   Ch. 5 : Electromagnetism; ***Ch. 6*** : Magnetic Circuits; and ***Ch.7*** : Self and Mutual Inductances.

III. **Part C**—*AC Circuits* : Assemblage of
   Ch. 9 : Alternating Voltage and Current; ***Ch. 10*** : AC Circuits; ***Ch. 11*** : Resonance in AC Circuits; and ***Ch. 12*** : Three-Phase Circuits and Systems.

IV. **Part D**—*Electrical Machines* : Assemblage of
   Ch. 13 : Transformers; ***Ch. 14*** : Alternators and Synchronous Motors; ***Ch. 15*** : Induction Motors; ***Ch. 16*** : DC Machines; and ***Ch. 17*** : Fractional Horse Power Motors.

V. **Part E**—*Miscellaneous* : Assemblage of
   Ch. 8 : DC Transients; ***Ch. 18*** : Electrical Measuring Instruments; and ***Ch. 19*** : Electrical Installation and Illumination.

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Despite the best efforts put in by me and my team, it is possible that some unintentional error might have eluded us. I shall acknowledge with gratitude if any of these is pointed out. Any suggestions from the readers for the improvement in future edition of this book are most welcome.

D C Kulshreshtha

Publisher's Note **:**

Tata McGraw Hill Education looks forward to receiving from teachers and students their valuable views, comments and suggestions for improvements, all of which may be sent to tmh.corefeedback@gmail. com**,** mentioning the title and author's name on the subject Line.