Electrical Machines

Electrical machines convert energy existing in one form to another, usable, form. These machines can broadly be divided into three categories: generators, motors and transformers. Generators convert mechanical energy into electrical energy, motors convert electrical energy to mechanical energy, and transformers change the voltage level in ac system and are considered to be the backbone of a power system.

Electrical machines play an important role in domestic appliances, commercial devices and industrial applications. It is important for students of electrical and electronics engineering to learn the basic concepts of transformers, motors, generators and magnetic circuits. This book explains the design of transformers, decoding of generators and performance of electrical motors through descriptive illustrations, solved examples and mathematical derivations. Construction, working principles and applications of various electrical machines are discussed in detail. In addition, it offers an engrossing discussion on special purpose machines, which is useful from an industrial prospective in building customised machines. The text contains hundreds of worked examples and illustrations and more than a thousand self-assessment exercises. It is an ideal textbook for undergraduate students of electrical and electronics engineering.

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This book is dedicated to
my Parents,
wife – Ritu Sahdev,
son – Rohit Sahdev,
daughter-in-law – Robina Sahdev
and
grandsons – Arnav and Adhiraj

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Preface

This book on 'Electrical Machines' has been written for under-graduate students of Electrical Engineering (EE) and Electrical & Electronics Engineering (EEE) belonging to various Indian and Foreign Universities. It will also be useful to candidates appearing for AMIE, IETE, GATE, UPSC Engineering Services and Civil Services Entrance Examinations.

We know that electrical energy has a wide range of applications where electrical machines play a vital role in industrial production and many other areas of science and technology. Accordingly, this book has been designed so that it be useful not only to students pursuing courses in electrical engineering but also for practising engineers and technicians.

'Electrical Machines' is taught at various universities under different titles such as Electrical Machines-I, Electrical Machines-II, DC Machines and Transformers, Electromagnetic Energy Conversion Devices, Special Purpose Machines, etc. All the topics in such courses have been covered in this single unit. As such, the book covers the revised syllabi of all Indian and Foreign Universities.

Generally, students find Electrical Machines to be one of the most difficult subjects to understand, despite the availability of a large number of text books in this field. Keeping this fact in mind, this text has been developed in a systematic manner giving more emphasis on basic concepts.

Each chapter of the book contains much needed text, supported by neat and self-explanatory diagrams to make the subject self-speaking to a great extent. A large number of solved and unsolved examples have been added in various chapters to enable students to attempt different types of questions in examination without any difficulty. Section Practice Problems have been added in all the chapters to maintain regular study and understanding. At the end of each chapter sufficient objective type questions, short-answer questions, test questions and unsolved examples have been added to make the book a complete and comprehensive unit in all respects.

The author lays no claim to original research in preparing the text. Materials available in the research work of eminent authors have been used liberally. But the author claims that he has organised the subject matter in very systematic manner. He also claims that the language of the text is lucid, direct and easy to understand.

Although every care has been taken to eliminate errors, however it is very difficult to claim perfection. I hope this book will be useful to its users (students, teachers and professionals). I shall be very grateful to the readers (students and teachers) and users of this book if they point out any mistake that might have crept in. Suggestions for the improvement of the book will be highly appreciated.

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