



**IN THE NAME OF ALLAH
MOST GRACIOUS, MOST MERCIFUL**



Fundamentals of Electrical Power Engineering

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Academic Publishing and Press, King Saud University
P.O. Box 68953, Riyadh 11537, Saudi Arabia

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First edition, 2007

Second edition, 2012

King Fahd National Library Cataloging-in-Publication Data

Al-Arainy, Abdulrhman Ali

Fundamentals of electrical power engineering./ Abdulrahman Ali Al-Arainy; Nazar Hussain Malik; Saad Mubarak Al-Ghuwainem - 2. - Riyadh, 2011

429 p., 17 x 24 cm

ISBN: 978-9960-55-925-1

1-Electrical engineering 2-Electrical power production
I-Nazar Hussain Malik (co. author) II-Saad Mubarak Al-Ghuwainem
(co-author) III-Title

621.3121 dc

1432/10368

L. D. No. 1432/10368

ISBN: 978-9960-55-925-1

This book has been refereed by a specialized committee appointed by the Academic Council of the University. After the reports of the referees, the Council authorized its publication in its 2nd session of the academic year A.H. 1432/1433, which was convened on 27-10-1432 H. (25-9-2011)



Academic Publishing & Press, 2012

PREFACE

Traditionally, electric power engineering related courses form a main component of any electrical engineering curriculum. However, with the rapid growth in other fields such as electronics, communication, computers and control system, undergraduate electrical engineering students have to be exposed to a multitude of courses in these areas as well. As a result, time available for teaching traditional courses has decreased significantly. Therefore, there was a need to condense the basic essential material into a single, self-contained textbook for one semester course dealing with the core concepts of electrical power engineering.

Although several books are available on advanced topics of electric power systems, these books do not cover the basic power engineering concepts in a simple and easily understandable manner and often lack the desired spectrum of topics. Before this book was written, the authors were forced to assign different chapters from several books in order to give the students a well balanced one-semester introductory course on electrical power engineering. Therefore, a strong need was felt for a textbook that can cover the basic topics of power engineering in a clear and concise manner.

Fundamentals of Electrical Power Engineering was an attempt to address this need. It is written for the undergraduate electrical engineering students to introduce them to the basics of electrical power engineering. It covers the essential topics in power system including power system components, their basic construction, principles of operation and modeling of various components for analysis. The material is arranged in a systematic manner and the book has served as a textbook for students of electrical engineering at King Saud University and several other universities.

Most of the material in this book is the outcome of lecturing in universities and industry. The book briefly introduces the electric power generation, power system layout and modeling and per unit method of calculations. The transmission line and cable parameters are discussed in detail, while a concise description is given for the various types of overhead line insulators and their applications. The important topic of distribution systems as well as power system grounding concepts are introduced as well. Power engineering course will not be faithfully covered without the inclusion of over-voltages, over-currents and the related protection methods. The book is illustrated with plenty of solved examples to clarify the basic

Preface

concepts and contains many questions, problem exercises, and multiple choice questions for the reader to check his/her understanding of the subject matter. It is believed that the book will enable the reader to understand power engineering better and apply that knowledge more effectively.

Since its publication, the book has been used by many colleagues who have found it useful. We have revised the material and have corrected the errors in the first edition. We are thankful to all the instructors for their feedback. We hope the second edition of the book will be more useful for the students and faculty. We welcome any constructive suggestions from users of this book.

A.A. Al-Arainy
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ABBREVIATIONS

AAAC	All Aluminum Alloy Conductor
AAC	All Aluminum Conductor
AC	Alternating Current
ACAR	Aluminum Conductor Aluminum Reinforced
ACSR	Aluminum Conductor Steel-Reinforced
AGC	Automatic Gain Control
DC	Direct Current
DF	Demand Factor
ECC	Energy Control Center
EHV	Extra High Voltage
EPR	Ethylene Propylene Rubber
GCC	Gulf Cooperation Council
GMR	Geometric Mean Radius
HV	High Voltage
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPP	Independent Power Producer
LF	Load Factor
LV	Low Voltage
MOA	Metal Oxide Arrester
MV	Medium High Voltage
PD	Partial Discharge
PE	Polyethylene
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition System
SEC	Saudi Electricity Company
SIL	Surge Impedance Loading
TL	Transmission Line
UHV	Ultra High Voltage
VLF	Very Low Frequency
XLPE	Cross Linked Polyethylene