

**GENERAL LECTURES  
ON ELECTRICAL  
ENGINEERING**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649311590

General lectures on electrical engineering by Charles Proteus Steinmetz & Joseph Le Roy Hayden

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**CHARLES PROTEUS STEINMETZ & JOSEPH LE ROY HAYDEN**

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ON  
ELECTRICAL ENGINEERING

BY

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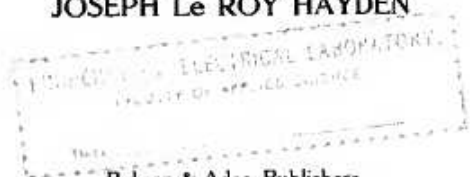
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Second Edition.

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Compiled and Edited by

JOSEPH Le ROY HAYDEN



Robson & Adee, Publishers  
Schenectady, N. Y.

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## Preface

**T**HE following lectures on Electrical Engineering are general in their nature, dealing with the problems of generation, control, transmission, distribution and utilization of electric energy; that is, with the operation of electric systems and apparatus under normal and abnormal conditions, and with the design of such systems; but the design of apparatus is discussed only so far as it is necessary to understand their operation, and so judge of their proper field of application.

Due to the nature of the subject, and the limitations of time and space, the treatment had to be essentially descriptive, and not mathematical. That is, it comprises a discussion of the different methods of application of electric energy, the means and apparatus available, the different methods of carrying out the purpose, and the relative advantages and disadvantages of the different methods and apparatus, which determine their choice.

It must be realized, however, that such a discussion can be general only, and that there are, and always will be, cases in which, in meeting special conditions, conclusions regarding systems and apparatus may be reached, differing from those which good judgment would dictate under general and average conditions. Thus, for instance, while certain transformer connections are unsafe and should in general be avoided, in special cases it may be found that the danger incidental to their use is so remote as to be overbalanced by some advantages which they may offer in the special case, and their use would thus be

## PREFACE

justified in this case. That is, in the application of general conclusions to special cases, judgment must be exerted to determine, whether, and how far, they may have to be modified. Some such considerations are indicated in the lectures, others must be left to the judgment of the engineer.

The lectures have been collected and carefully edited by my assistant, Mr. J. L. R. Hayden, and great thanks are due to the publishers, Messrs. Robson & Adee, for the very creditable and satisfactory form in which they have produced the book.

CHARLES P. STEINMETZ.

Schenectady, N. Y., Sept. 5, 1908.



## FIRST LECTURE