
Fundamental of Electrical Engineering

Learning outcome

- To enable students to understand the basic electromagnetic phenomenon, circuit variables and parameters
- To enable students to understand and apply the fundamental and derived circuit laws and theorems to the analysis of dc circuits
- To enable students to understand and apply the fundamental and derived circuit laws and theorems to the analysis of steady state poly-phase ac circuits;

MODULE ONE

REVIEW OF ELECTROMAGNETIC PHENOMENON, VARIABLES AND CIRCUIT PARAMETERS

Electric charge

An Electric charge, denoted by Q is associated with a deficiency or the abundance of a group of electrons and is equal to the product of the number of electrons and the charge on each individual electron.

Electrical charge manifests itself in the form of forces—electrons repel other electrons but attract protons, while protons repel each other but attract electrons.

The unit of electrical charge is the coulomb(C). The **coulomb** is defined as the charge carried by 6.24×10^{18} electrons. Thus, if an electrically neutral (i.e., uncharged) body has 6.24×10^{18} electrons removed, it will be left with a net positive charge of 1 coulomb, i.e., $Q = 1$ C. Conversely, if an uncharged body has 6.24×10^{18} electrons added, it will have a net negative charge of 1 coulomb, i.e., $Q = -1$ C.

We can now determine the charge on one electron. It is $Q_e = 1 / (6.24 \times 10^{18}) = 1.60 \times 10^{-19}$ C.

Example - An initially neutral body has $1.7 \mu\text{C}$ of negative charge removed. Later, 18.7×10^{11} electrons are added. What is the body's final charge?

Solution - Initially the body is neutral, i.e., $Q_{\text{total}} = 0$ C. When $1.7 \mu\text{C}$ of electrons is removed, the body is left with a positive charge of $1.7 \mu\text{C}$. Now, 18.7×10^{11} electrons are added back. This is equivalent to

$$18.7 \times 10^{11} \text{ electrons} \times \frac{1 \text{ coulomb}}{6.24 \times 10^{18} \text{ electrons}} = 0.3 \mu\text{C}$$

of negative charge. The final charge on the body is therefore $Q_f = 1.7 \mu\text{C} - 0.3 \mu\text{C} = 1.4 \mu\text{C}$.

Coulombs law

Fundamental In Electrical Engineering By Vincent Deltro

Shasha Hu



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Table of Contents Fundamental In Electrical Engineering By Vincent Deltro

1. Understanding the eBook Fundamental In Electrical Engineering By Vincent Deltro
 - The Rise of Digital Reading Fundamental In Electrical Engineering By Vincent Deltro
 - Advantages of eBooks Over Traditional Books
2. Identifying Fundamental In Electrical Engineering By Vincent Deltro
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Fundamental In Electrical Engineering By Vincent Deltro
 - User-Friendly Interface
4. Exploring eBook Recommendations from Fundamental In Electrical Engineering By Vincent Deltro
 - Personalized Recommendations
 - Fundamental In Electrical Engineering By Vincent Deltro User Reviews and Ratings
 - Fundamental In Electrical Engineering By Vincent Deltro and Bestseller Lists
5. Accessing Fundamental In Electrical Engineering By Vincent Deltro Free and Paid eBooks

- Fundamental In Electrical Engineering By Vincent Deltro Public Domain eBooks
 - Fundamental In Electrical Engineering By Vincent Deltro eBook Subscription Services
 - Fundamental In Electrical Engineering By Vincent Deltro Budget-Friendly Options
6. Navigating Fundamental In Electrical Engineering By Vincent Deltro eBook Formats
- ePub, PDF, MOBI, and More
 - Fundamental In Electrical Engineering By Vincent Deltro Compatibility with Devices
 - Fundamental In Electrical Engineering By Vincent Deltro Enhanced eBook Features
7. Enhancing Your Reading Experience
- Adjustable Fonts and Text Sizes of Fundamental In Electrical Engineering By Vincent Deltro
 - Highlighting and Note-Taking Fundamental In Electrical Engineering By Vincent Deltro
 - Interactive Elements Fundamental In Electrical Engineering By Vincent Deltro
8. Staying Engaged with Fundamental In Electrical Engineering By Vincent Deltro
- Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Fundamental In Electrical Engineering By Vincent Deltro
9. Balancing eBooks and Physical Books Fundamental In Electrical Engineering By Vincent Deltro
- Benefits of a Digital Library
 - Creating a Diverse Reading Collection Fundamental In Electrical Engineering By Vincent Deltro
10. Overcoming Reading Challenges
- Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Fundamental In Electrical Engineering By Vincent Deltro
- Setting Reading Goals Fundamental In Electrical Engineering By Vincent Deltro
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Fundamental In Electrical Engineering By Vincent Deltro
- Fact-Checking eBook Content of Fundamental In Electrical Engineering By Vincent Deltro
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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