

Introduction to Circuit Theory

EGR 220

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Course URL:

<http://www.science.smith.edu/~jcardell/Courses/EGR220>

Overview

- Basic concepts
 - Electrical energy, energy storage & frequency response
 - Defining electrical circuits
 - Chapter 1: Charge & Ohm's Law
- Course admin
 - Problem solving and homework
 - Labs
 - Course webpage & syllabus
www.science.smith.edu/~jcardell/Courses/EGR220

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Basic Concepts

- What is charge?

- What is current?

- What is the relationship (mathematical) between charge and current?

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Basic Concepts

- What is energy?

- What is voltage?
 - (*Always* a potential *difference*)
- How does a *voltage drop* relate to energy and work?

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Basic Concepts

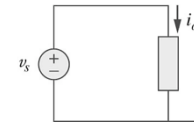
- What is power?
 - Expression for power: $P = W/t$; $P = V \cdot I \rightarrow$ units
 - Power is either generated or absorbed by an element.
 - If 'absorbed' it can be either dissipated as heat energy or stored in electric or magnetic fields

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First Basic Law: Ohm's Law

- Data measurements are shown for a simple circuit
- What is the relationship between V and I?
- Ohm's Law \rightarrow **Resistance**

Voltage (V)	-10	-5	0	5	10
Current (mA)	-2	-1	0	1	2



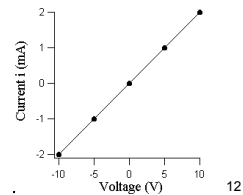
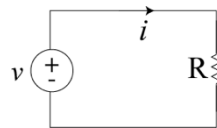
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Ohm's Law

Ohm's Law: $V = \underline{\hspace{2cm}}$

- Experiment: Current, i , is measured as a function of the voltage, v , across resistor R .
- The measurements are plotted.
- What is the value of R ?

$$R = \frac{v}{i} = \frac{10V}{2 \cdot 10^{-3}A} = 5000\Omega$$



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Summary of Terminology

➤ Basic terminology

<u>Term</u>	<u>Expression</u>	<u>Units</u>
◦ Charge	Q	Coulomb, C
◦ Current	$I = dQ/dt$	Ampere, A
◦ Voltage	$V = \text{Work}/Q$ $V = IR$ (Ohm's Law)	Volts, $V = J/C$
◦ Resistance	R	Ohm, Ω
◦ Power	$P = VI$	Watt, $W = (J/C)(C/s) = J/s$

➤ **Units – always know and use the units**

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Chapter 1 Summary

- Basic concepts for circuit theory
- Review basic terminology in text
 - Charge
 - Current
 - Voltage
 - Resistance
 - Energy (work)
 - Power
- Review in chapter 1
 - *Passive sign convention*
- *Units – always know and use the units*

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Chapter 2 – Next Class

- Read for nodes and branches
- Kirchoff's circuit laws
 - Current law
 - Voltage law
- Combining with Ohm's Law

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Course Objectives

- Course webpage & syllabus
www.science.smith.edu/~jcardell/Courses/EGR220

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Learning Methods

- Practicing your skills as you learn them
 - Music?
 - Sports?
 - Art?
 - Crafts?...
 - Homework, labs, in-class problems, office hours
 - Do examples and practice problems in text
- Work / learning outside of class is necessary
- Course starts a little easier ⇨ Picks up speed!

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Homework Grading

- HW 1 due next Tuesday
- Typically 10 problems each week
- Each problem graded from 1 to 10 points
 - 10 = Complete and correct. *Complete* requires working from (and clearly stating) the fundamental law(s) and or theorem(s) used
 - 9 = Complete attempt but incorrect
 - 6 = Incomplete attempt
 - 2 = Problem statement written
 - 0 = No attempt

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Laboratories

- First lab this coming Monday – 1 to 4pm in room FH 143
- You must complete the pre-lab *before* lab time
- Lab memo guidelines are posted
- Additional lab instructor: Sue Froehlich
- You must complete all labs to pass the course
- Class divided in half for most labs

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Other admin

- Text book – 3rd or 4th edition
- No late assignments (1 hour grace, total)
- Mini-quizzes some weeks
- Exams during lab period
- Honor code – copying or providing work will result in zero credit
- **** Office hours ****
 - Thursday afternoon
 - Friday late morning

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