2.00AJ / 16.00AJ Exploring Sea, Space, & Earth: Fundamentals of Engineering Design
Spring 2009

Basic Circuits

2.00A Lecture

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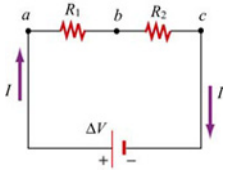
Please see:
http://www.art-sci.udel.edu/ghw/phys245/05S/lab/images/schematics.gif
or http://commons.wikimedia.org/wiki/File:Circuit_elements.png

Electronic Circuits

- **Resistance:** The property of a component to oppose the flow of electrical current through itself.
- **Capacitance:** The property of a component to oppose any change in voltage across its terminals, by storing and releasing energy in an internal electric field.
- **Inductance:** The property of a component to oppose any change in current through itself, by storing and releasing energy in a magnetic field surrounding itself.

Resistance



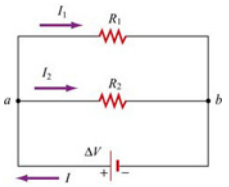
Resistors in series

Resistance in Series:

Current is the same everywhere

$V_T = I*R_T$; $V_1 = I * R_1$; $V_2 = I * R_2$

$V_T = V_1 + V_2 = I * (R_1+R_2)$



Resistors in Parallel

Resistance in Parallel:

Voltage is the same everywhere

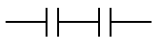
$I_T = V / R_T$; $I_1 = V / R_1$; $I_2 = V / R_2$

$I_T = I_1 + I_2 = V / R_T = V / R_1 + V / R_2$

$R_T = 1 / (1/R_1 + 1/R_2) = R_1R_2/ (R_1+R_2)$

Courtesy John Belcher, Peter Dourmashkin, and Sen-Ben Liao. Used with permission.

Capacitance

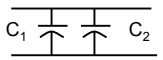


Capacitors in series

Capacitance in Series:

Voltage is the same everywhere

$C_T = 1 / (1/C_1 + 1/C_2) = C_1C_2/ (C_1+C_2)$



Capacitors in Parallel

Capacitance in Parallel:

Current is the same everywhere

$C_T = C_1 + C_2 + \ldots$

RESISTORS

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Please see http://www.art-sci.udel.edu/ghw/phys245/05S/lab/images/penny.jpg and
http://www.art-sci.udel.edu/ghw/phys245/05S/lab/images/dime.jpg
and any table of resistor color codes, such as http://en.wikipedia.org/wiki/Electronic_color_code

Resistor DecoderJava Applet:
http://www.physics.udel.edu/~watson/phys345/decoder/

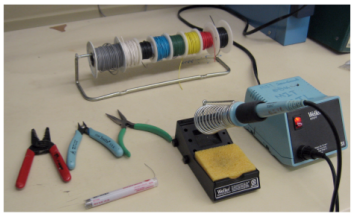

Figure 3: Tools for Building LED Light Bank

Tools

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Please see http://www.art-sci.udel.edu/ghw/phys245/05S/lab/images/leads.gif

LED Light Bank

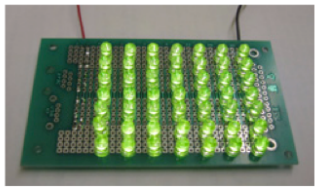

Figure 13: Working LED Light Bank

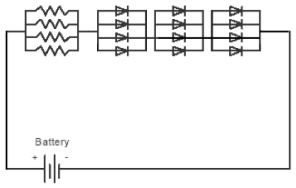

Figure 2: Circuit Diagram for LED Light Bank

Intro to circuit building: http://www.instructables.com/id/Circuit-Building-101/

Light Absorption in the Ocean

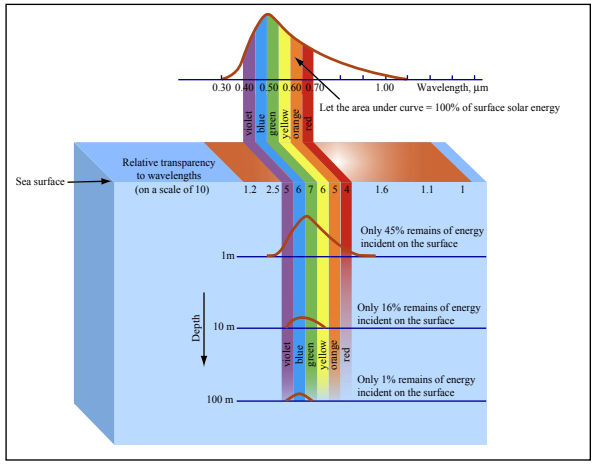

Figure by MIT OpenCourseWare.