ECE 2200/10 Lecture 1 Introduction to Electrical Engineering for non-majors

2200 = 1/2 semester (Mining, Mat. Sci.)
ECE 2200 Without the Physics is hard, Plan on it!
2200, Decide today when you want to take the final: Bad option: In your last lab session, Start labs Today
                                                2nd option: With 2210 exam 2 on 10/17. Start labs next week.
If you don’t take the later final you will have to start labs THIS WEEK.

2210 = Full semester (Mechanical, Chemical, etc.)
Labs start FRIDAY of the first week
2210 Final Monday, Dec 9, 8:00 Subject to change to 2:00 or 3:30, listen in class
Make sure you are registered for the right class (2200 or 2210) and that you have the right syllabus.

BOTH
Bring a lab notebook and a U-card with $20 to 1st lab.
Homeworks are due by 5:00 pm in locker ________ (see map for location of lockers)
WARNING: HWs are often due on non-class days.

How to survive
1. Easiest way to get through school is to actually learn and retain what you are asked to learn.
   Even if you’re too busy, don’t lose your good study practices.
   What you “just get by” on today will cost you later.
   Don’t fall for the “I’ll never need to know this” trap. Sure, much of what you learn you may not use, but
   you will need some of it, some day, either in the current class, future classes, or maybe sometime in
   your career. Don’t waste time second-guessing the curriculum, It’ll still be easier to just do your best to
   learn and retain what is covered.

2. Don’t fall for the “traps”.
   Homework answers, Problem session solutions, Posted solutions, Lecture notes.

3. KEEP UP! Use calendar.

4. Make “permanent notes” after you’ve finished a subject or section and feel that you know it.

Lecture

<table>
<thead>
<tr>
<th>Basic electrical quantities</th>
<th>Letter used</th>
<th>Units</th>
<th>Fluid Analogy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge, actually moves</td>
<td>Q</td>
<td>Coulomb (C)</td>
<td></td>
</tr>
<tr>
<td>Current, like fluid flow</td>
<td>I = ( \frac{Q}{sec} )</td>
<td>Amp (A, mA, µA,...)</td>
<td>( \frac{m^3}{sec} )</td>
</tr>
<tr>
<td>Voltage, like pressure</td>
<td>V or E</td>
<td>volt (V, mV, kV,...)</td>
<td>Pa = 1 ( \frac{N}{m^2} )</td>
</tr>
<tr>
<td>Resistance</td>
<td>R = ( \frac{V}{I} )</td>
<td>Ohm (Ω, kΩ, MΩ,...)</td>
<td></td>
</tr>
<tr>
<td>Conductance</td>
<td>G = ( \frac{I}{R} )</td>
<td>Siemens (S, also mho, old unit)</td>
<td></td>
</tr>
<tr>
<td>Power = energy/time</td>
<td>P = V( \cdot I )</td>
<td>Watt (W, mW, kW, MW,...)</td>
<td>W</td>
</tr>
</tbody>
</table>

Symbols (ideal)

- **Node**: All points connected by wire
- **Ideal wire**: R = 0
- **Resistors**: Connected
- **Battery**: Connected
- **Variable potentiometer**: Connected

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KCL, Kirchhoff's Current Law
\[ I_{\text{in}} = I_{\text{out}} \] of any point, part, or section

\[ \frac{\text{in}}{2 \text{m}^3/\text{s}} \quad \text{metal wire} \quad \frac{\text{out}}{2 \text{C/s}} = 2 \text{A} \]

\[ \frac{\text{in}}{2 \text{m}^3/\text{s}} \quad \frac{\text{out}}{3 \text{m}^3/\text{s}} \]

OK for fluids in pipes
NOT for charges in wires

Battery also obeys KCL
No accumulation of charge anywhere, so it must circulate around.
Leads to the concept of a "Circuit"

Voltage is like pressure
KVL, Kirchhoff's Voltage Law
\[ V_{\text{gains}} = V_{\text{drops}} \] around any loop

Conductors
- Massless fluid in our analogy
- No gravity effects
- Reasonable because:
  - Electron mass is \( 9.11 \times 10^{-31} \text{kg} \)
  - Election charge is \( -1.6 \times 10^{-16} \text{C} \)
- Negative charge flows in negative direction

Nonconductors
- No Bernoulli effects

Battery also obeys KCL
No accumulation of charge anywhere, so it must circulate around.
Leads to the concept of a "Circuit"