Lecture 1: ECE110 *Introduction to Electronics*

Electrical

Engineering

Charge

Current

Voltage

Power

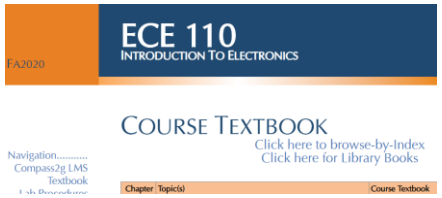
Energy

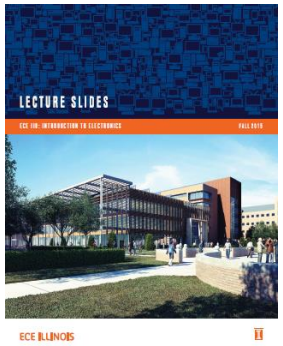
Computer

Required

- ECE 110 Electronics Kit
  - ECE Supply Center
  - Pickup @ECEB (on campus)

- All Online (https://canvas.illinois.edu)
  - ECE110 Textbook
  - ECE110 Lecture Slides
  - ECE110 Lab Procedures

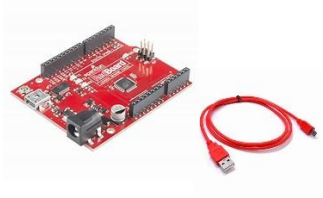




Recommended

– Multipurpose wire stripper- moderately useful to take insulation off wires or trim wires to useful lengths. ≈ $10

– Arduino (or RedBoard) + cable -nice if you want to program and interact with hardware through software. ≈ $25



Laboratory

- **measure** electrical devices
- **analyze** and **model** electrical circuits
- **construct** electrical systems
- **design** a control system for your own autonomous vehicle
- **create** your own "open-ended" project

The laboratory provides a hands-on opportunity to both learn and to showcase your skills!

Weekly prelab assignments and lab write-ups.

Assignments

- Lab
  - Weekly meetings
  - Does not meet on this week, and the week of National Day holiday.
  - Pay attention on the make-ups of the National Day (see the Syllabus on the end page)
  - Prelab assignments due at the beginning of your meeting
  - Lab summary is submitted at the end of each lab period, periodic Unit Reports
- Homework
  - Online via **PrairieLearn, https://www.prairielearn.org/**
  - Due **Saturday at 11:59 pm Asia/Shanghai time**. Get it done early!
  - Multiple opportunities to earn credit on each problem. Everyone should get 100% on homework!
  - Absolutely **no submissions past the credit dates** (start early if you plan to be sick on Fridays ☺)

  - Discuss on **BB**. When posting/replying publicly, **ask for resources** and not detailed solutions.
  - Post hints and links instead of solutions!
  - If you need help on your **detailed** solution, post a **private** question to the instructors.

Grading policies

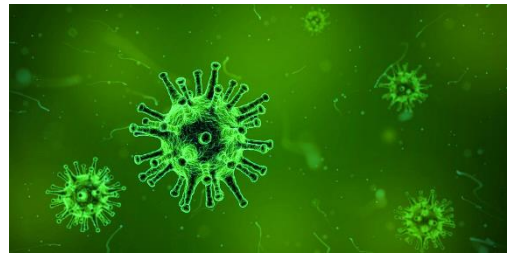
A+	Greater than 97%
A	93-97%
A-	90-93%
B+	87-90%
B	83-87%
B-	80-83%
C+	77-80%
C	73-77%
C-	70-73%
D+	67-70%
D	63-67%
D-	60-63%
F	Less than 60%

Laboratory	**30%** [1]
Lecture Total	**70%** [1]
3 midterms	30%
Final Exam	25% [2]
Homework	10%
Attendance	5 %

[1]You must obtain 50% of the lecture score and 50% of the lab score to avoid failing the course!

[2]The Final Exam can have an effective weight of 35% by replacing the lowest midterm grade.

Feeling Sick? Can't make class?



Policy

- Lab attendance is **mandatory**, each and every week
- **No food/drink in lab room**

Lab: Notify your lab Instructor (not me!) before lab to request an excused absence.

Lecture: Do nothing. Participation in lecture has been shown to improve your grade. Do your best to keep up with attendance and participation.

IEEE Code of Ethics (2020)

IEEE – Institute of Electrical and Electronics Engineers

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members, and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

I. To uphold the highest standards of integrity, responsible behavior, and ethical conduct in professional activities.

II. To treat all persons fairly and with respect, to avoid harassment or discrimination, and to avoid injuring others.

Avoid Dilemmas and Grow Professionally!

Picking Up the Slack…search at Santa Clara University, also in syllabus.

http://www.scu.edu/

- Often called a "hitch-hiker" scenario…

Q: What do you feel Greg should do?

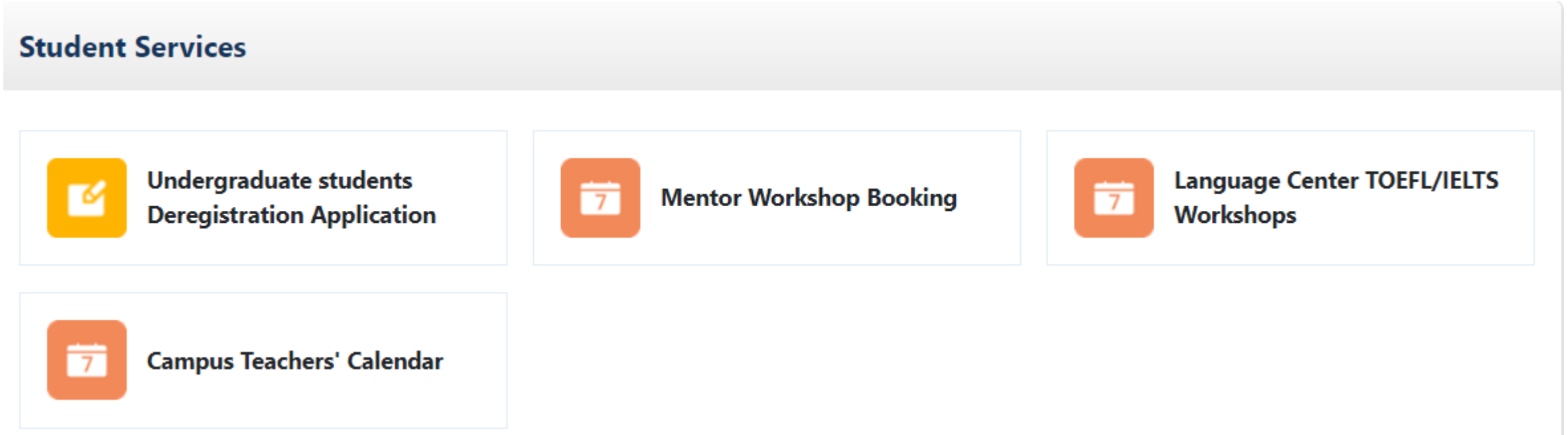
A. Value the relationship, grade Natalie the same as the group.
B. Greg is not a babysitter…give Natalie the grade she earned.
C. Give Natalie a worse grade than the group, but better than she deserved.
D. Talk to Natalie before deciding which grade to give.
E. Talk to the Instructor before deciding which grade to give.

Q: What would you have done differently?

Good Course:
ECE 316
Ethics and Engineering
(also Adv. Composition)

Seeking advice and help?

- **Talk to us!** Instructors, graduate TAs, undergrad course aides want to know you!
- **Student Services: intl.zju.edu.cn/my-zju**



The Field of Study Defined

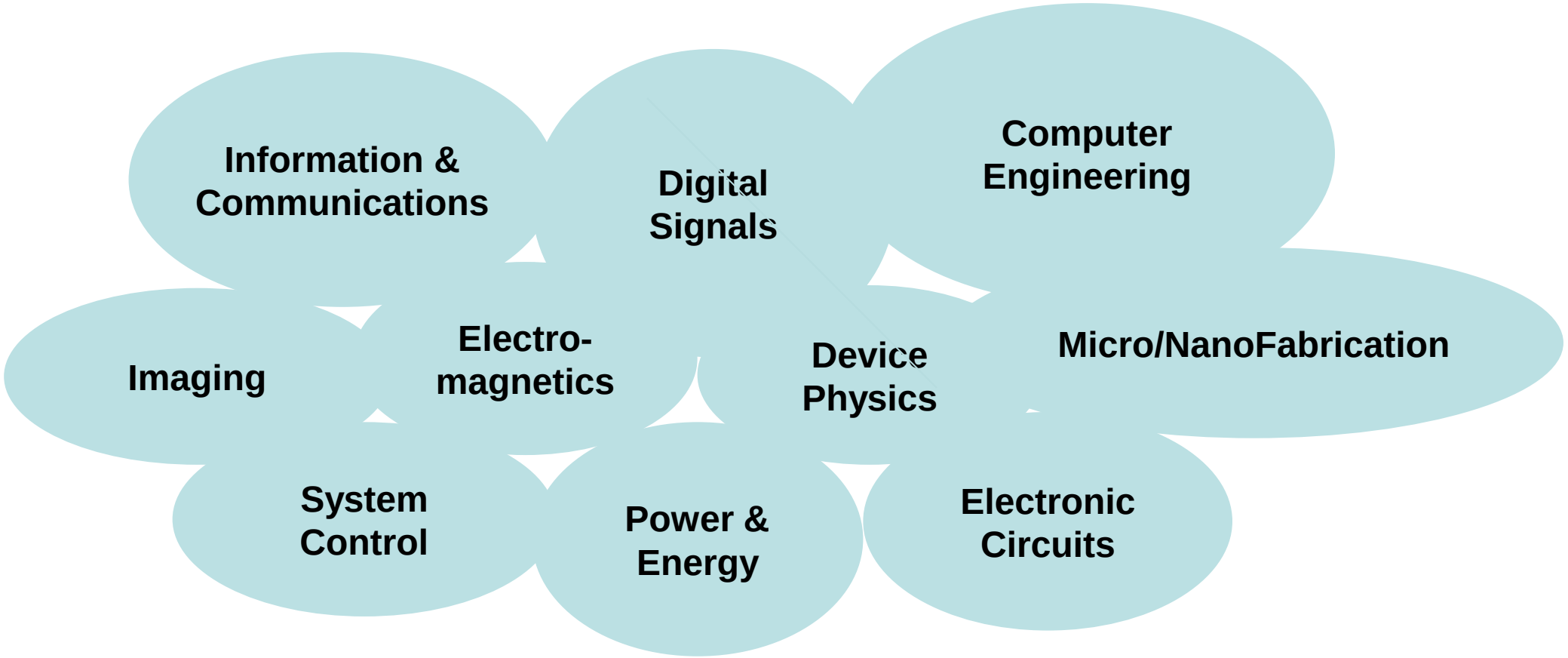
"***Engineers*** use the knowledge of mathematics and natural sciences gained by study, experience, and practice, applied with judgment, to develop ways to economically utilize the materials and forces of nature for the benefit of mankind. "

- ABET (Accreditation Board for Engineering and Technology)

Electrical engineering (EE) is a field of **engineering** that generally deals with the study and application of electricity, electronics, and electromagnetism

- WikiPedia

Electrical Engineering inseparable focus areas



Charge and Current

- an electron is a charged subatomic particle
- the coulomb (C) is a measure of electric charge with

$$\frac{-1.6 \times 10^{-19} C}{electron} \quad (notation) = \quad \frac{-1.6\ \mathrm{e} - 19\ \ C}{electron}$$

- Electric current is the flow of electric charge in time (C/s)

$I = \Delta Q / \Delta t$ the Δ means "the change in"

- The ampere is the unit of electric current

$1\ A = 1\ C/s$

Image is public domain.

Q2 Answers:
A. 0.00000016 A
B. 0.160 A
C. 1 A
D. 1e-9 A
E. 160e-12 A

L1Q1: What is the charge of 1 billion electrons?
L1Q2: A "typical" electronics circuit might have 1 billion electrons pass a cross section of a wire every nanosecond, what is the electric current in amps?

Voltage and Energy

- **Energy** is **the ability to do work**, measured in joules (J), BTUs, calories, kWh, etc.
- **Voltage** is **the work done per unit charge** (eg. J/C) against a static electric field to move charge between two points
- Also, 1 volt ($1\ V$) is the electric potential difference between two points that will impart $1\ J$ of energy per coulomb ($1\ C$) of charge that passes through it.

$$\Delta E = \Delta Q \times V$$

L1Q3: A certain battery imparts 480 pJ to every 1 billion electrons. What is its voltage?
L1Q4: What is the charge moved through 400 V (EV battery) to provide 800 kJ of energy?
L1Q5: What is the average current if the energy in Q4 is provided in five seconds?

Energy and Power

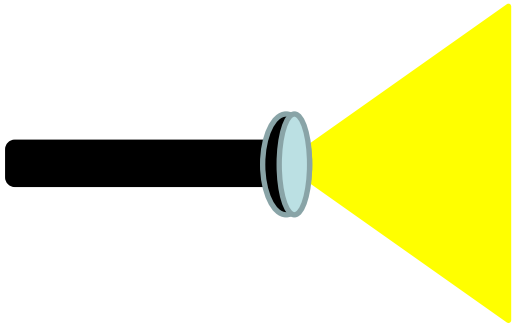
Power is **the rate at which energy is transferred**.

Power is $(rate\ of\ charge\ flow) \times (potential\ difference)$

Power is $current \times voltage$

$$P = \frac{\Delta E}{\Delta t} = \frac{\Delta Q}{\Delta t}\ V = I\ V$$

L1Q6: A flashlight bulb dissipates $6\ W$ at $2\ A$. What is the supplied voltage?



L1 Learning Objectives

a. Describe the goals of an organization's Code of Ethics.
b. Explore a professional dilemma case study and provide active measures that would rectify or avoid the dilemma entirely.
c. (L1c) Compute relationships between charge, time, and current.
d. (L1d) Compute relationships between charge, voltage, and energy.
e. (L1e) Compute relationships between power, current, and voltage.

$$I = \frac{\Delta Q}{\Delta t} \qquad V = \frac{\Delta \mathrm{E}}{\Delta Q}$$

$$\Delta E = \Delta Q \times V \qquad P = \frac{\Delta E}{\Delta t} = \frac{\Delta Q}{\Delta t}\, V = I\, V$$