Class 1: Course Overview and Introduction

Activity 1 – SI Units, Prefixes, and Electrical Quantities

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Intro to ECSE
Intro to ECSE Instructor

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M. Hameed

31 August 2020
## Teaching Staff

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<thead>
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<th>Help sessions</th>
<th>Location</th>
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Use WebEx Teams “ECSE 1010 Intro to ECSE Fall 2020” and the appropriate spaces to interact with the teaching staff at the times listed in the table above.

M. Hameed

ECSE 1010

31 August 2020
Agenda

- Laboratory class – did you buy the equipment?
- Online tools and software
- Class website walk-through
- Syllabus
- More about the course
- ECSE templates
- Prerequisites flowchart
- Discussion about Introduction to Circuits
- Activity 1: SI Units, Prefixes, and Electrical Quantities
Equipment required for the class

- ADALM1000 (M1K board)  
  [Wiki link](#)
ADALP2000 parts kit (description link)
Online Tools and Software

- **Class Website**: http://intro-ece.org

- **Piazza**:  
  - primary platform for class related communication and discussion  
  - activate your account (if you haven’t already)  
  - post questions for quick answers from students or teaching staff

- **Gradescope**:  
  - submission and grading platform for activities and quizzes  
  - useful guides attached on piazza under “resources”
Online Tools and Software (contd.)

- **Blackboard**
  - LMS will be used for Problem Sets (auto-graded)
  - Think of problem sets as homework.

- **WebEx Meetings**
  - lectures, instructor office hours

- **WebEx Teams**
  - spaces will be used to work on activities in smaller groups
  - TA/UG-SA help sessions
Online Tools and Software (contd.)

- Software for M1K board
  - PixelPulse2 (download from Github repository)
  - ALICE (detailed installation procedure later)
- LTspice – numerical circuit simulations
- Matlab – powerful tool for numerical analysis
  - calculator on steroids
- Excel
Course Objective

- The overall goal of this course is to help students build a broad analysis skill set so that through experimentation, simulation and the application of science, mathematics and engineering fundamentals, they can develop useful systems models that enable engineered solutions addressing a broad array of societal needs.
Class Website

- Brief walk-through
- You should plan to browse this page and get familiar
- Bookmark it!
- The webpage will be continuously updated so REFRESH
Syllabus

- You should read this as early as possible and get familiar with the course rules, guidelines, and expectations.
More about the Course

- At RPI, we offer two related degrees built on the basic phenomena of Electricity/Electronics, Computation and Information: **Electrical Engineering & Computer and Systems Engineering**.

- To prepare first year students for successful undergraduate programs in these two degrees, this course provides an introduction to engineering analysis and engineering thinking in four general areas:
More about the Course (contd.)

- Basic Circuits and Electronics (experimentation, simulation, circuits and electronics fundamentals, tinkering);
- Programming (Matlab, Embedded Systems);
- Mathematics (Linear Algebra and the Mathematics of Computation);
- Engineering Systems (Electrical, Electro-Mechanical, Electro-Optical ...).
ECSE templates

- Class of 2023 (revised)
- Electrical Engineering Curriculum Checklist
- Computer and Systems Engineering Curriculum Checklist
- Computer and Systems Engineering and Computer Science Dual Major
Prerequisites flowchart
10 minute break…
Electric Charge (or just charge)

- Charge is the intrinsic property of matter responsible for electric phenomenon.
- Quantity of charge can be expressed in terms of the charge on one electron, $-1.602 \times 10^{-19}$ coulombs.
- Consequently, $-1$ C is the charge on $6.24 \times 10^{18}$ electrons.
- Notation: $q$
- Units: coulomb (C)
Electric Current

- Current is the time rate of flow of electric charge past a given point.

\[ i = \frac{dq}{dt} = \frac{\text{change in charge}}{\text{time for change}} \]

- Notation: I, \(i(t)\), I

- Units: amperes (A), an ampere is 1 C per second

- Will there be current if there is charge?

- How do we measure it?
Voltage or Electric Potential

- The voltage across an element is the work (energy) required to move a unit charge across it.

- \[ v = \frac{dw}{dq} = \frac{\text{work done}}{\text{by charge } q} \]

- A charge of 1 C delivers an energy of 1 joule as it moves through a voltage of 1 volt.

- Notation: \( V, v(t), v \)

- Units: volts (V) or joules/coulomb (J/C)
Electric Power

- Power is the time rate of expending or absorbing energy

\[ p = \frac{dw}{dt} = \frac{\text{work done}}{\text{time taken}} \]

\[ p = \frac{dw}{dt} = \frac{dw}{dq} \cdot \frac{dq}{dt} = v \cdot i \]

- Power absorbed = - power supplied

M. Hameed

ECSE 1010

31 August 2020
## SI Base Units

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Name</th>
<th>Symbol</th>
</tr>
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<tbody>
<tr>
<td>Length</td>
<td>meter</td>
<td>m</td>
</tr>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>Electric Current</td>
<td>ampere</td>
<td>A</td>
</tr>
<tr>
<td>Thermodynamic Temperature</td>
<td>kelvin</td>
<td>K</td>
</tr>
<tr>
<td>Amount of Substance</td>
<td>mole</td>
<td>mol</td>
</tr>
<tr>
<td>Luminous Intensity</td>
<td>candela</td>
<td>cd</td>
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# SI Derived Units

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Unit Name</th>
<th>Formula</th>
<th>Symbol</th>
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</thead>
<tbody>
<tr>
<td>Acceleration - linear</td>
<td>meter per second per second</td>
<td>m/s²</td>
<td></td>
</tr>
<tr>
<td>Velocity - linear</td>
<td>meter per second</td>
<td>m/s</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>hertz</td>
<td>s⁻¹</td>
<td>Hz</td>
</tr>
<tr>
<td>Force</td>
<td>newton</td>
<td>kg.m/s²</td>
<td>N</td>
</tr>
<tr>
<td>Pressure or Stress</td>
<td>pascal</td>
<td>N/m²</td>
<td>Pa</td>
</tr>
<tr>
<td>Density</td>
<td>kilogram per cubic meter</td>
<td>kg/m³</td>
<td></td>
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<tr>
<td>Energy or Work</td>
<td>joule</td>
<td>N.m</td>
<td>J</td>
</tr>
<tr>
<td>Power</td>
<td>watt</td>
<td>J/s</td>
<td>W</td>
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<tr>
<td>Electric Charge</td>
<td>coulomb</td>
<td>A.s</td>
<td>C</td>
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<tr>
<td>Electric Potential</td>
<td>volt</td>
<td>W/A</td>
<td>V</td>
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<tr>
<td>Electric Resistance</td>
<td>ohm</td>
<td>V/A</td>
<td>Ω</td>
</tr>
<tr>
<td>Electric Conductance</td>
<td>siemens</td>
<td>A/V</td>
<td>S</td>
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<tr>
<td>Electric Capacitance</td>
<td>farad</td>
<td>C/V</td>
<td>F</td>
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<tr>
<td>Magnetic Flux</td>
<td>weber</td>
<td>V.s</td>
<td>Wb</td>
</tr>
<tr>
<td>Inductance</td>
<td>henry</td>
<td>Wb/A</td>
<td>H</td>
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**SI Prefixes**

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<thead>
<tr>
<th>Multiple</th>
<th>Prefix</th>
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<tr>
<td>$10^{12}$</td>
<td>tera</td>
<td>T</td>
</tr>
<tr>
<td>$10^9$</td>
<td>giga</td>
<td>G</td>
</tr>
<tr>
<td>$10^6$</td>
<td>mega</td>
<td>M</td>
</tr>
<tr>
<td>$10^3$</td>
<td>kilo</td>
<td>k</td>
</tr>
<tr>
<td>$10^{-2}$</td>
<td>centi</td>
<td>c</td>
</tr>
<tr>
<td>$10^{-3}$</td>
<td>milli</td>
<td>m</td>
</tr>
<tr>
<td>$10^{-6}$</td>
<td>micro</td>
<td>$\mu$</td>
</tr>
<tr>
<td>$10^{-9}$</td>
<td>nano</td>
<td>n</td>
</tr>
<tr>
<td>$10^{-12}$</td>
<td>pico</td>
<td>p</td>
</tr>
<tr>
<td>$10^{-15}$</td>
<td>femto</td>
<td>f</td>
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Activity 1: SI Units, Prefixes, and Electrical Quantities

- Go to the class website
- Look under class 1
- Find activity 1
- Do the activity
  - Individual submission for activity 1
  - Encouraged to discuss with others in the class
- Answer the activity using template (attached class 1)
- When complete – upload to Gradescope
  - Due Tuesday, September 8th at 11:59 pm
  - Use guides to learn how to upload documents