EE2CI5: Introduction to Electrical Engineering

Lecture 1

Tim Davidson

McMaster University

Fall 2011

So why are we here?

- What is electricity? (Physics)
- How can we use it? (Engineering)
- Fundamental analysis and design techniques for electrical and electromagnetic circuits
- Core skill set for 4 courses
  - EE2CJ4, EE2EI5
  - EE3EJ4, EE3PI4
- Development of structured problem solving skills
- Intuition developed here will be used throughout the rest of the program
- This intuition is often a key to creative applications of electricity

Applications

- Wireless & space communications; radio; TV; Cable/ADSL/powerline modems
- Integrated circuit design
- Biomedical instruments: MRI/CAT/PET machines; microsurgery
- Aerospace: flight control; autopilot; radar; CanadaArm;
- Robotics and automated manufacturing
- Audio amplifiers; hearing aids
- Electric vehicles; environmental monitoring
- Power generation; power distribution (smart grid);
- Analysis and prediction of the stock market

Outline of Topics

- Assumed knowledge: Phys 1E03, Complex arithmetic
- Complementary material: Math 2Z03
- Topics
  - Current and voltage
  - Ohm's Law, power and energy
  - Series circuits
  - Parallel circuits
  - Thevenin and Norton equivalent circuits
  - Capacitance and inductance
  - Review of complex numbers
  - Phasors
  - Response of circuits to sinusoidal signals
  - Impedance, admittance and power
- See course web site for more details, incl. time line *www.ece.mcmaster.ca/∼davidson/EE2CI5*

Engineering Problem Solving

- A key objective for this course is to help you develop an ability to analyze circuits that you have not seen before
- The idea is to develop skills that will assist you in developing creative applications of electricity
- To work toward this objective, it is suggested that you **understand and practice** the structured analysis methods we will discuss in class
- Do not make up your own “rules” or “short cuts” based on the answers to one or two problems

- How will I assess your progress towards the goal?
- On the test and exam, expect to see problems that you have never seen before

Structured problem solving

1. Break down each complicated problem into small simple parts or steps. (Like a “free body diagram”)
2. Write down a simple equation which describes each part
3. Collect the equations together, and then use straightforward (linear) algebra to solve them

This needs practice!

Some additional resources (see course web site):

- Online companion to text book: worked solutions, practice exams, problem solving videos
- Additional practice problems, e.g., Schaum’s Outline

Some Friendly Advice

- Make sure that you **understand** what is taught.
- Actively participate in lectures
  The slides posted on the web will be **incomplete**
- Actively participate in tutorials
- Actively participate in labs
- Read the text
- Practice problem solving

Exam Preparation

- Do at least half of your problems under exam conditions
- If you need a worked example, check the exercises in the book, or the worked examples on the companion web site
- Think about the principles of what you are doing:
  - Do not waste time memorizing formulae, or solutions to particular circuits
  - Spend your time practising your problem solving skills
- It is not enough to be able to follow someone else's solution to a problem that you have seen before.
  You must be able to independently solve problems that you have not seen before.

Exam Technique

- Spend a couple of minutes deciding how much time to spend on each question.
  Once you have decided stick to it!
- Explain the logic behind your solution method.
  - This is best done by inserting a phrase or sentence between every few lines of your mathematical derivation. Just like in the text book.
  - Demonstrating that you have a viable solution method is the key to obtaining “part marks”
- Make sure that your answer makes engineering sense. If it does not, let me know, otherwise you might get zero just for getting a minus sign wrong.

Useful Mathematical Skills

- Algebraic solution of simultaneous (linear) equations
- Complex arithmetic
- Logarithms and Exponentials
- Sketching a function and writing a mathematical description from a sketch

By exam time you should be **fluent** in these areas.

Contact Details

- Tim Davidson
  ITB-A310
  Ext: 27352
  davidson@mcmaster.ca with subject line EE2CI5
- Course Web Site:
  www.ece.mcmaster.ca/∼davidson/EE2CI5

Class Details

- Lectures:
  - Monday, Wednesday, Thursday: 5:30pm, BSB 147
- Tutorial:
  - Wednesday: 10:30, JHE 264
  - Note: a component of the assessment will occur during some of the tutorials.
- Labs:
  - According to Registrar's schedule:
    Mon-Fri 2:30-5:30, ITB A114.
  - Key card access to lab is available at other times

Marking Scheme

- To get a positive mark you must meet the following qualifying criteria:
  - You must personally complete all the laboratories, and you must provide a satisfactory report.
  - Let x denote your midterm mark (in percent) and y your final exam mark. Your marks must satisfy

    $$18x/100 + 50y/100 \geq 34.$$

    That is, you must pass a weighted sum of the midterm and final
- If you meet the qualifying criteria, your mark will be calculated as follows:
  - Laboratory reports: 20%
  - Four quizzes: 12%
  - Mid-term test: 18%
  - Final examination: 50%
- If you do not meet the qualifying criteria, you will be assigned a mark of zero.

Important Notices

- Statistical adjustments (e.g., “bell curving”) will not normally be used
- Missed tests, quizzes and labs will be assigned a mark of zero, unless accommodation requested through MSAF: *http://www.mcmaster.ca/msaf/*
- The instructor reserves the right to conduct any formally deferred test or examination orally
- EE2CI5 is a prerequisite for some third-year courses

Assessment Schedule

- See outline, labs, and announcements pages of course web site for more details
- Midterm test:
  - Tuesday 1 November, 7:00pm - 8:30pm
- Quizzes: In tutorial,
  - 28 Sep, 13 Oct, 26 Oct, 16 Nov
- Labs:
  - Prelab to be completed prior to entering the lab
  - Report due 2 business days after the lab
  - See also the labs page of the course web site