ENGG1000

Electrical Stream 2018

Lecture – Electronics 1

Never Stand Still | Faculty of Engineering | School of Electrical Engineering and Telecommunications

Electrical Technical Stream

Aims:

- Introduce different kinds of electrical devices and their functions
- Give some equations governing the behaviour of these devices
- Provide some simple circuits containing these devices and explain their functions
- Show some examples of how to analyse the circuits
- Basics assessed in circuit design principles test

What you will not find out:

- How to solve your problem
- In-depth understanding of circuit analysis

More detailed notes on Moodle

Electrical Technical Stream

- Goals of this Technical Stream in ENGG1000:

- 1. Give you a (hopefully fun) introduction to Electronics
- 2. Some practical exposure to some electrical circuits that might help you in your project
  - Motors and Control
  - Power Supplies and Regulators
  - Interfacing between components
  - Infra-red emission and detection
  - Signal Detection and Processing
  - Arduinos and Bluetooth

Electrical - Lectures

- There will be four hours of lectures
- Two per week, 2pm in Civil Eng 101, 3pm in OMB229
- Intended as Problem Solving Classes

Week 3 (Thu 15th Mar)	2-3pm	Civil Eng 101	Introduction to Electronics
	3-4pm	OMB229	Introduction to Electronics
Week 4 (Thu 22nd Mar)	2-3pm	Civil Eng 101	Sensing Circuits
	3-4pm	OMB229	Power Sources and Regulators
Week 5 (Thu 29th Mar)	2-3pm	Civil Eng 101	Op-Amps and Filters
	3-4pm	OMB229	Motors and Drive Circuits
Week 6 (Thu 12th Apr)	2-3pm	Civil Eng 101	Interfacing and Microprocessors
	3-4pm	OMB229	Digital Logic and Control

Recorded Lectures

- 7 hours of pre-recorded lectures are available on Moodle
  - Presented by A/Prof. J. Epps
- Good overall introduction to Electronics
- Presented lectures will aim to compliment this
  - Class time is limited
  - Preference is given to lab time
  - Work through circuit design examples
- Examinable material for the circuit quiz
  - Consists of presented lectures and pre-recorded lectures

Electrical Lab Program

- On the website there are the Lab Experiments, containing a large range of Lab Exercises
- The Labs are optional
  - They are exercises to help you get started on developing systems for your project
  - Circuits that might help you get started in your design project
  - Treat it as almost an electronics reference manual
  - You are not required/expected to complete them all
- You may choose to complete all the Checkpoints in one Lab marked off
  - This would be 10% of your grade
  - Only for Labs 2, 3, or 4
  - Lab 1 is intended as an Introduction, if needed

Electrical Lab Program

The Labs will be open every week at the following times:

- Monday 2-6pm (EE G14) & 2-5pm (EE 214)
- Thursday 2-6pm (EE G14) & 2-5pm (EE214)
- Open labs – no attendance, come as often as you need

The Labs will be staffed by experienced tutors, there to help you develop circuits for your project

- Tutors are you most valuable resource – ask them for help/advice/ideas!!!

Assessment

- There are three optional assessments worth 10% of your course mark each
  - recall you need to take 20% worth of assessment from these technical streams

1. Lab Skills Test
   - 30 minute experimental test
   - You'll need to construct a simple circuit and demonstrate you can use the lab equipment (CROs, Signal Generators)
   - Held Thursday 26th April, 2-5pm (Week 8)
   - Must enrol on Moodle one week in advance to be eligible

Assessment

2. Circuit Principles Quiz

- 30 minute M/C Quiz on Moodle (20 questions)
- Material based on lecture content (including recorded)
- Held on Thursday 19th April, 2-5pm (Week 7)
- Must enrol on Moodle one week in advance to be eligible

3. Lab Book Assessment

- You can complete Lab 2, 3 or 4 and submit it for assessment
- Complete the 6 checkpoints and get them marked by a tutor as you go along
- Submit your lab book with your circuit designs for assessment
- Must be submitted before 5pm Fri 4th May

OH&S

- Prior to being admitted to the Electronics Labs you are required to complete an Occupational Health and Safety Course
- This course is available on Moodle
- Enrol in this course
  - Course Name: ELEC OH&S
  - Enrolment key: elecmood
- Watch the video, read the document, and pass the quiz
- No assessment in the Electrical Stream will count until this is completed

Electronics

- What is Electronics?
- How we make electrical signals and electrical energy do useful stuff.

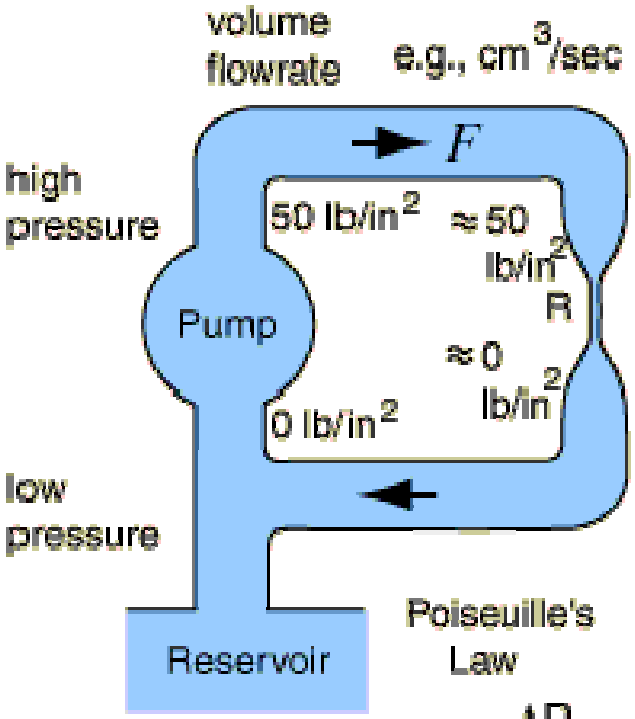
Uses of Electronics

- Detect Events
- Control Devices
- Power Devices
- Switch Stuff
- Communicate

Electrical Energy

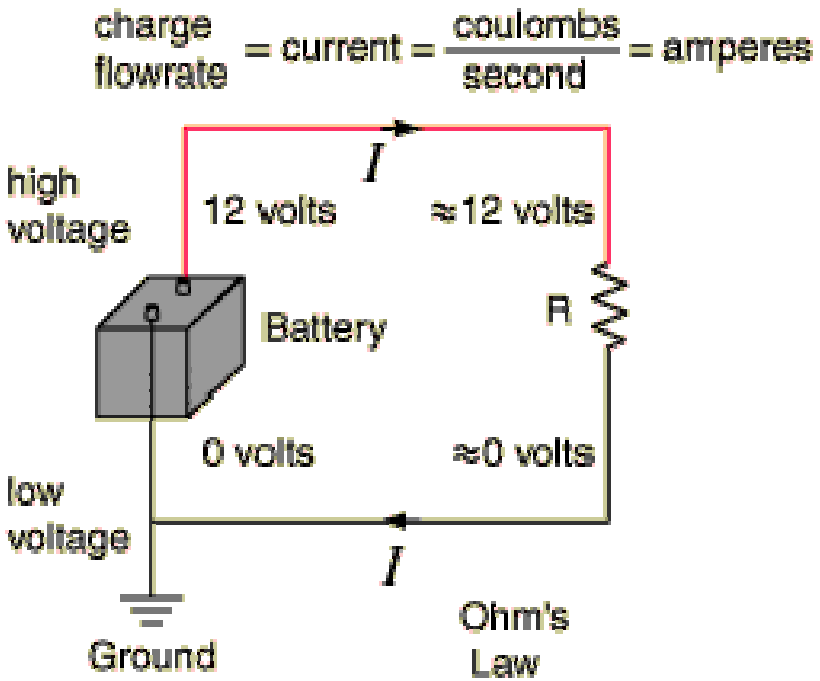
- Electronics uses Electrical Energy to do useful work
  - Appears in the form of voltage (12V DC, 240V AC)
  - Represents potential energy ‘hill’ given to charges
- Charges move and deposit their energy
  - Moving charge is a current
  - Conductance of material determines how much current will flow due to applied voltage

An analogy



Poiseuille's Law

$$F = \frac{\Delta P}{R}$$



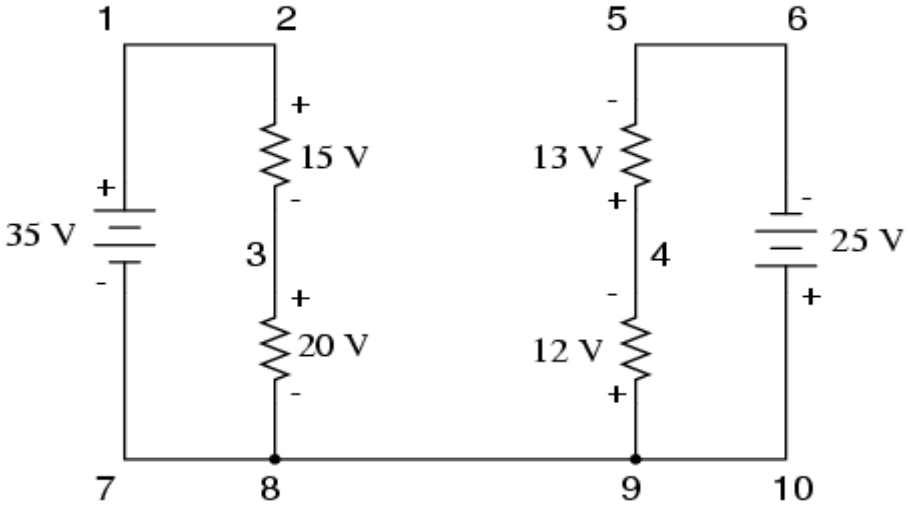
Ohm's Law

$$I = \frac{\Delta V}{R}$$

Fundamental Laws - KVL

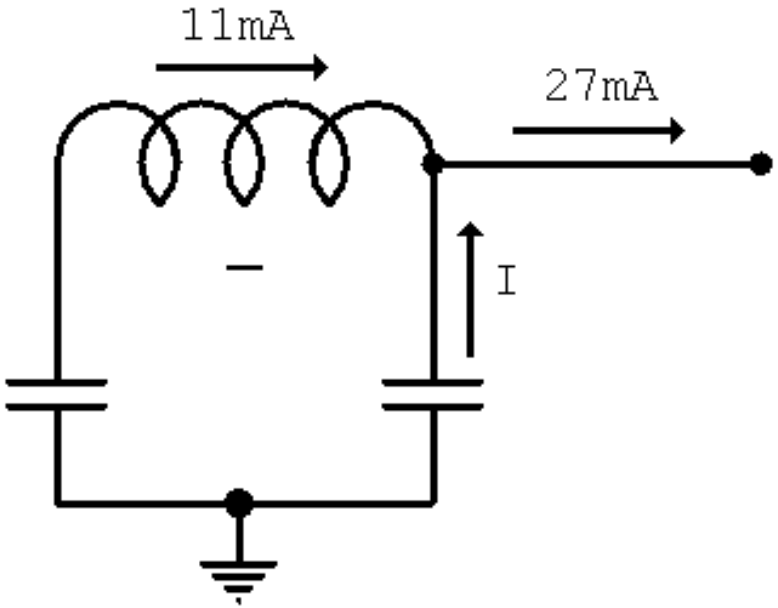
- Conservation of energy
- The sum of voltages around any closed loop in a circuit must be zero

$$V_1 + V_2 + V_3 + \ldots = 0$$



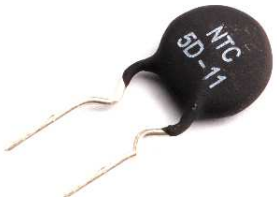
Fundamental Laws - KCL

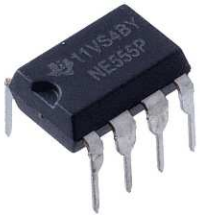
- Conservation of Electrical charge
- The net current flowing into any junction is always equal to the net current flowing out



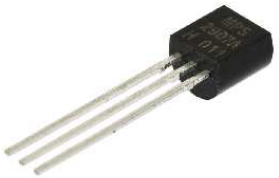
$$I_1 + I_2 + I_3 + \ldots = 0$$

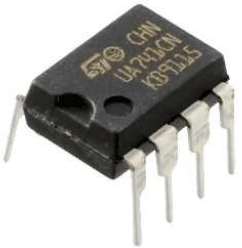
Useful Devices





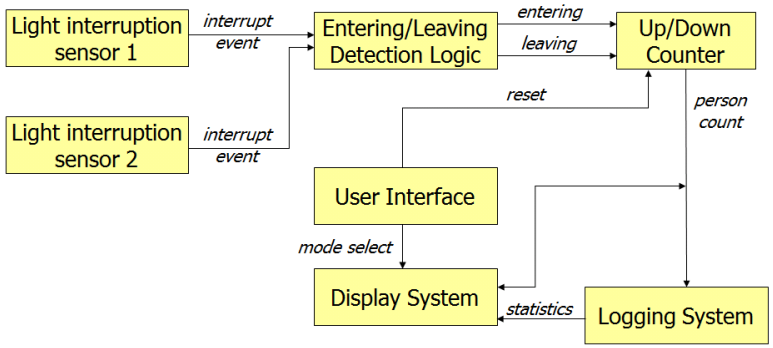
- Diodes
- Transistors
- LEDs
- Photodiodes/Phototransistors
- Thermistors
- Op Amps
- 555 Timer
- Integrated Circuit (IC) chips
- Microprocessors





Electronics Design Process

- Stage 1: System Functional Analysis
  - Block diagram representation

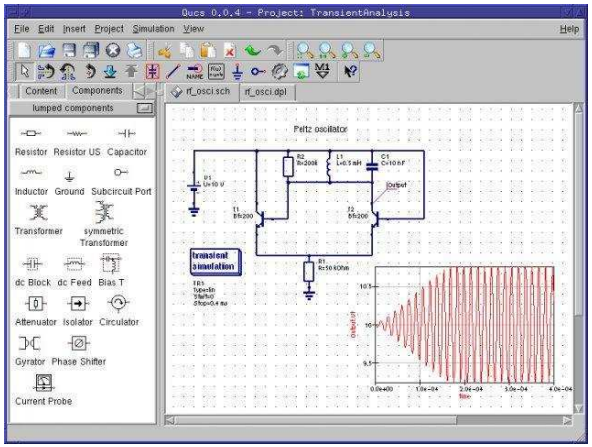


- Stage 2: Theoretical Modelling/Estimation
  - How complex/feasible are the subsystems going to be?

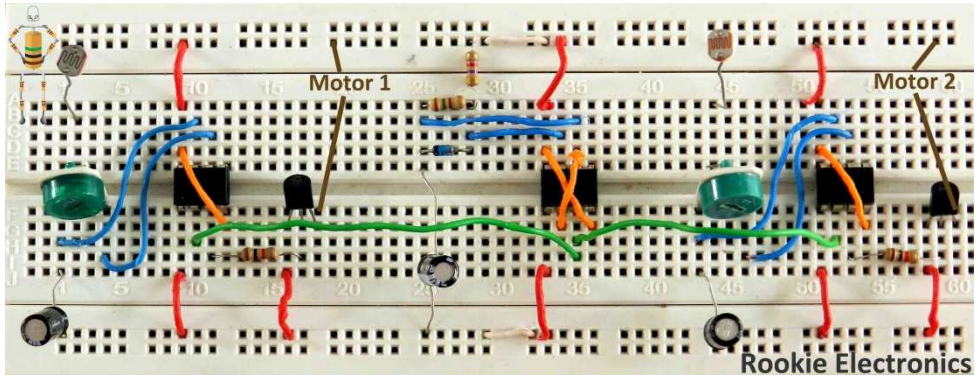
Electronics Design Process

- Stage 3: Simulations

OrCAD PSpice®

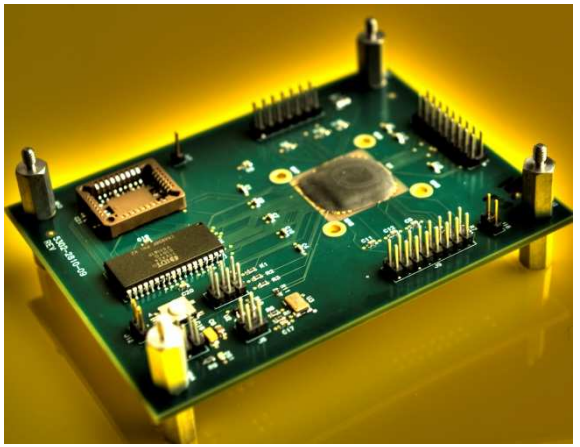


- Stage 4: Early Prototyping



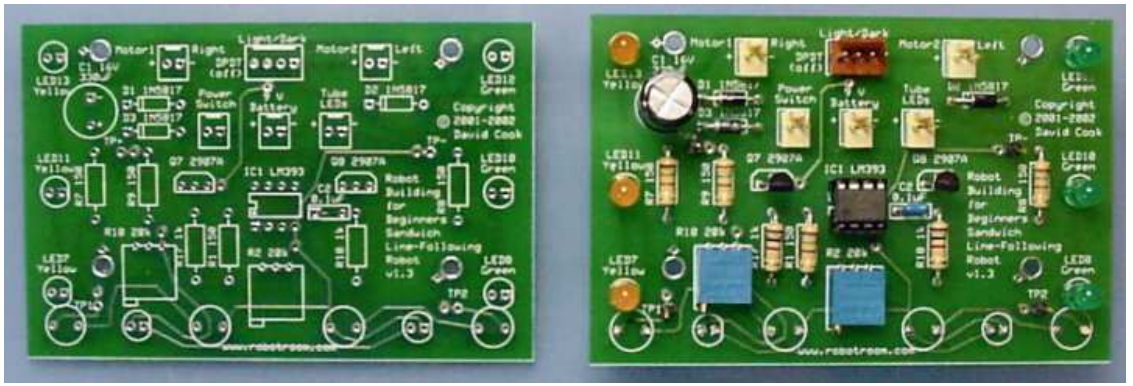
Electronics Design Process

- Stage 5: Concept Feasibility



- Stage 6: PCB Design/Test/Manufacture

Altium Designer



Announcements

- Labs begin Monday
  - 2pm in EE G14 and EE 214
  - Attendance is optional
  - Work through the Lab Exercises or on your own designs
  - See the lab demonstrators for assistance
- Lab times in general
  - Mondays 2-6pm (EE G14) and 2-5pm (EE 214)
  - Thursday 2-6pm (EE G14) and 2-5pm (EE 214)
  - May extend hours later in the session

EDP Peer Assessment 1

- Mentor Session – Week 4
  - Based on the Problem Statement lecture from Monday
- Preparation:
  - Read the Guide for the Generation of the Problem Statement on the Engineering Design Process tab on Moodle
  - Bring an Electronic device to Week 4 mentor session, that allows you to access Moodle
  - Bring a printed copy of your individual problem statement. You'll hand this to your mentor

EDP Peer Assessment 1

- During the session:
  - Hand your individual Problem Statement to your mentor
  - Take note of the runsheet – when you are presenting and who you are marking
  - Log in to Moodle and open EDP – Problem Statement Assessment task
  - If you are the first team, line at ready to present in order

EDP Peer Assessment 1

- During Presentations
  - You have 2 minutes to present. Mentor will keep time
  - Remain at the front with your team until the whole team has presented
  - You will then mark all students in the class that are not in your team
  - The assessment sheets will appear in Moodle for you
  - Fill in the marking criteria as they present
  - Mark fairly and consistently. They will be reviewed and potentially moderated afterwards
  - Marks may be reduced if you are late or fail to assess your assigned students