Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.002 – Circuits and Electronics
Spring 2009

6.002 Objectives and Outcomes

Course Objectives

After successfully studying 6.002, students will be able to:

1. Understand the **basic electrical engineering principles and abstractions** on which the design of electronic systems is based. These include lumped circuit models, digital circuits, and operational amplifiers.
2. Use these engineering abstractions to **analyze and design simple electronic circuits**.
3. Formulate and solve **differential equations describing the time behavior of circuits** containing energy storage elements.
4. Use intuition to describe the approximate time and frequency behavior of circuits containing energy storage elements.
5. Understand the concepts of employing simple models to represent **non-linear and active elements—such as the MOSFET**—in circuits.
6. **Build** circuits and **take measurements** of circuit variables using tools such as oscilloscopes, multimeters, and signal generators. Compare the measurements with the behavior predicted by mathematic models and **explain the discrepancies**.
7. Understand the relationship between the **mathematical representation** of circuit behavior and **corresponding real-life effects**.
8. Appreciate the **practical significance of the systems** developed in the course.

Learning Outcomes

1. Employ simple lumped circuit models for resistors, sources, inductors, capacitors, and transistors in circuits.
2. Analyze circuits made up of linear lumped elements. Specifically, **analyze circuits containing resistors and independent sources** using techniques such as the **node method**, **superposition** and the **Thevenin method**.
3. Check **static discipline constraints** in circuits. For example, determine if the circuit representing a gate provides adequate noise margins.

4. Determine the output produced by a circuit for a given set of inputs using **the switch-resistor model of a MOSFET**.
5. Perform a **small-signal analysis of an amplifier** using small signal models for the circuit elements.
6. Calculate the **time behavior of** first order and second order **circuits containing resistors, capacitors and inductors**.
7. Calculate the **frequency response of circuits containing resistors, capacitors and inductors**.
8. **Construct simple gates, amplifiers, or filters** in the laboratory.
9. Determine in the laboratory the time-domain and frequency-domain behavior of an RLC circuit.
10. Use operational amplifier models in circuits which employ **negative feedback**.
11. Use complex impedances to determine the **frequency response** of circuits.
12. Determine the power dissipation in digital gates and employ CMOS technology to reduce static power losses.
13. **Predict** how a given circuit will affect **an audio signal** in the laboratory given the frequency response of the circuit.
14. **Design, build and test** a multi-stage system which includes both analog and digital sub-systems.