Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science
6.002 - Circuits and Electronics
Fall 2001

Statement of Objectives and Outcomes

COURSE OBJECTIVES:

The subject aims to provide the student with:

1) An understanding of basic EE abstractions on which analysis and design of electrical and electronic circuits and systems are based, including lumped circuit, digital and operational amplifier abstractions.
2) The capability to use abstractions to analyze and design simple electronic circuits.
3) The ability to formulate and solve the differential equations describing time behavior of circuits containing energy storage elements.
4) An understanding of how complex devices such as semiconductor diodes and field-effect transistors are modeled and how the models are used in the design and analysis of useful circuits.
5) The capability to design and construct circuits, take measurements of circuit behavior and performance, compare with predicted circuit models and explain discrepancies.

Learning Outcomes:

Students will:

Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors;

Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method;

Appreciate the consequences of linearity, in particular the principle of superposition and Thevenin-Norton equivalent circuits;

Gain an intuitive understanding of the role of power flow and energy storage in electronic circuits;

Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis;

Learn how the primitives of Boolean algebra are used to describe the processing of binary signals and to use electronic components such as MOSFET's as building blocks in electronically implementing binary functions;

Learn how the concept of noise margin is used to provide noise immunity in digital circuits;

Be introduced to the concept of state in a dynamical physical system and learn how to analyze simple first and second order linear circuits containing memory elements;

Be introduced to the concept of singularity functions and learn how to analyze simple circuits containing step and impulse sources;

Be introduced to the concept of sinusoidal-steady-state (SSS) and to use impedance methods to analyze the SSS response of first and second-order systems;

Learn how to calculate frequency response curves and to interpret the salient features in terms of poles and zeros of the system function;

Gain insight into the behavior of a physical system driven near resonance, in particular the relationship to the transient response and the significance of the quality factor Q;

Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation and filtering on electronic signals;

Be introduced to the concepts of both positive and negative feedback in electronic circuits;

Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator;

Acquire experience in building and trouble-shouting simple electronic analog and digital circuits.