

## **16.201 Introductory Circuit Theory I**

### **COURSE OUTLINE**

#### **Fall 2011 Catalog Data:**

3 credits. Prerequisites: Calculus II (92.132, Grade C- or better),

Co-requisite: Basic Circuits Lab I (16.207).

Terminal characteristics of ideal elements, active and passive. Ohm's law and Kirchhoff's Laws.

Equivalent resistance, voltage division, current division. Introduction to network topology, independent variables, mesh and nodal analysis with matrix methods. Definition and consequences of linearity.

Superposition theorem. Concept of excitation and response. Passive equivalent circuits; active equivalent circuits. Thevenin's and Norton's theorems. Ideal inductance and capacitance, volt-ampere characteristics, energy relations, First-order transients: initial conditions, natural response, and natural frequencies.

Network response to unit step function and unit impulse. Second-order transients: RLC circuits, natural frequencies and the complex-frequency s-plane. Introduction to matrices and their use in circuit analysis.

#### **Instructors:**

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MW 12-1pm; T,Th 12-2pm; Friday, by Appointment  
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**Lectures:** MW 9:00-9:50am

**Recitations:** MW 10-10:50am(Section 201); 11-11:50am(Sec. 202); 2-2:50pm(Sec 203)

**Text:** Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku, **4th Edition**, McGraw-Hill, 2009.

#### **Course Objectives:**

As a result of this course, it is expected that the student will be able to:

1. Understand basic circuit concepts. Understand the importance of electric circuits to the engineering world and the quality of our life
2. Understand the characteristics of basic circuit elements through terminal descriptions, volt-ampere relationships and energy consumption/storage properties
3. Solve simple circuits using ohm's law, Kirchhoff's laws and the properties of the elements. Build up basic problem solving skills through organizing available information and applying circuit laws.
4. Solve circuit problems systematically using nodal analysis and mesh analysis. Build up advanced problem solving skill by systematically formulate a circuit problem into a linear algebra problem.
5. Use circuit theorems to simplify circuit analysis, to develop some insight into the relationship between the inputs and the outputs, and how changing parameters may affect this relationship.
6. Understand the dynamic behavior and transient properties of simple first-order and second-order circuits. Understand how to describe the dynamic behavior of a circuit with differential equations, and how initial conditions, the inputs and the parameters affect the transient response.
7. Build up strong problem solving skills by effectively formulate a circuit problem into a mathematical problem using circuit laws and theorems.

**Grading:** 3 Tests (45%), Quizzes (15%), Final Exam (25%), Homework (10%), Attendance (5%)

#### **Homework Rules:**

1. Late homework is NOT accepted.
2. Homework should be clear, concise, and complete.

**Attendance:** Will be taken every class.

## **Tentative Class schedule** (Fall 2011)

### **Period 1: Chapter 1,2: Basic concepts, Basic laws**

9/7(W): Course overview, (1.2), Charge & Current(1.3), voltage(1.4)  
9/12(M): Power & energy(1.5), circuit elements(1.6), (2.1), Ohm's law (2.2)  
9/14(W): Nodes, branches, loops(2.3), KCL,KVL(2.4)  
9/19(M): Use basic laws to solve circuit problems (2.4)  
9/21(W): Series resistors & voltage division (2.5); Parallel resistors & current division(2.6)  
9/26(M): Equivalent resistance & applications to solving circuit problems  
9/28(W): Period review in lecture, Practice test 1 in recitation  
**10/3(M): Test 1, 8:55-9:55am (No cheat sheet)**

### **Period 2: Chapter 3, Methods of analysis**

10/5(W): Linear algebra review, Nodal analysis (2.2)  
10/12(W): Nodal analysis with voltage sources (2.3)  
10/17(M): Mesh analysis (2.4); Mesh with current sources (2.5)  
10/19(W): More mesh analysis problems in lecture, Period review in recitation  
**10/24(M): Test 2, 8:55-9:55am (No cheat sheet)**

### **Period 3: Chapter 4, Circuit Theorems**

10/26(W): Linearity (4.2), Superposition without dependent source(4.3)  
10/31(M): Superposition with dependent source (4.3), Source transformation (4.4)  
11/2(W): Thevenin's theorem (4.5)  
11/7(M): Norton's theorem (4.6), Maximal power transfer (4.7)  
11/9(W): More problems in lecture, Period review in recitation  
**11/14(M): Test 3, 8:55-9:55am (No cheat sheet)**

### **Period 4: Chapters 6,7,8**

11/16(W): Chapter 6, capacitors and inductors  
11/21(M): More on Ch.6, Source free RC (7.2)  
11/23(W): Source free RL (7.3), Singularity functions (7.4)  
11/28(M): Step resp. of RC (7.5), Step resp. of RL (7.6)  
11/30(W): Solving 2<sup>nd</sup>-order differential equations  
12/5(M): Finding initial values (8.2), Step resp. of a series RLC circuit(8.5), source free RLC as a special case (8.3)  
12/7(W): Step resp. of a series RLC circuit(8.5), Briefly mention other 2<sup>nd</sup>-order circuits (8.6,8.7)  
12/12(M) Period review in lecture, recitation  
**12/15(Th): 8-10am, Final Exam will cover Chapters 7,8**

### **All tests and exam are closed-book, closed-notes.**

Makeup test/exam will only be given in extreme emergency or illness. There will be no bonus problem. Ask for help before the final exam, NOT after!

**Attention: You need to pass Circuit I with grade C- or better to take Circuit II.**