16.201 Introductory Circuit Theory I

COURSE OUTLINE

Fall 2014 Catalog Data:

3 credits. Prerequisite: 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.

Instructor:

Tingshu Hu

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Lectures: MW 10:00-10.50am
Recitation Instructors: John F. Palma, Kanti Prasad, Frank Tredeau
Text: Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku, **5th Edition**, McGraw-Hill, 2011.
Course materials: http://faculty.uml.edu/thu/16.201/material.htm
(homework assignment/solution, sample tests/solutions)
Lecture notes: http://faculty.uml.edu/thu/16.201/lecture_note.htm

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 (54%), Quizzes (15%), Final Exam (20%), Homework +Attendance (11%)

Homework Rules:

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

Attendance: Will be taken every class.

Circuit Theory I Tentative Class schedule (Fall 2014)

Period 1: Chapter 1,2: Basic concepts, Basic laws
9/3(W): Course overview, (1.2), Charge & Current(1.3), reference direction of current
9/8(M): ref. dir of current; voltage(1.4), power & energy(1.5), circuit elements(1.6)
9/10(W): Ohm's law (2.2);Nodes, branches, loops(2.3), KCL, KVL(2.4)
9/15(M): Use basic laws to solve circuit problems (2.4)
9/17(W): Ways of connection; Series resistors & voltage division (2.5)
Parallel resistors & current division(2.6),
9/22(M): Solving circuit problems using basic laws and tools
9/24(W): More practice problems
9/29(M): Test 1 (no cheat sheet)

Period 2: Chapter 3, Methods of analysis
10/1(W): linear algebra review, Nodal analysis (2.2)
10/6(M): Nodal analysis with voltage sources (2.3)
10/8(W): Mesh analysis (2.4); Mesh with current sources (2.5)
10/15(W): More mesh analysis problems in lecture
10/20(M): Test 2 (no cheat sheet)

Period 3: Chapter 4, Circuit Theorems
10/22(W): Linearity (4.2), Superposition without dependent source(4.3)
10/27(M): Superposition with dependent source (4.3), Source transformation (4.4)
10/29(W): Thevenin's theorem (4.5)
11/3(M): Norton's theorem (4.6), Maximal power transfer (4.7)
11/10(M): Test 3 (no cheat sheet)

Period 4: Chapters 6,7,8
11/5(W): Chapter 6, capacitors and inductors
11/12(W): More on Ch.6, Source free RC (7.2)
11/17(M): Source free RL (7.3), Singularity functions (7.4)
11/19(W): Step resp. of RC (7.5), Step resp. of RL (7.6)
11/24(M): Solving 2nd-order differential equations
12/1(M): Finding initial values (8.2), Step resp. of a series RLC circuit(8.5), source free RLC as a special case (8.3)
12/3(W): Step resp. of a series RLC circuit(8.5), Briefly mention other 2nd-order circuits (8.6,8.7)
12/8(M): Review
12/10(W): Office hours

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 (Evidence required). There will be no bonus problem for makeup test/exam.
- No extra work to raise your grade after final exam! All requests will be ignored.

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