14:332:221 Principles of EE I

Text: Electric Circuits by James W. Nilsson and Susan A. Riedel, Ninth Edition , Pearson - Prentice Hall.
Syllabus: Chapters 1 to 6, 9 and 10 of the above text.
Comments: There are a number of possible text books. We have been using the above text book and its precious editions for a long time after zigzagging trying to use other text books.
Chapters 1 to 4 emphasize circuit analysis with resistive (static) elements R, as such the resulting circuit equations are algebraic. Chapter 5 introduces operational amplifiers while still using resistive (static) elements. Chapter 6 introduces the dynamic elements inductance L and capacitance C. Chapters 7 and 8 which we skip deal with transient analysis with RLC elements. In these chapters, the resulting circuit equations are obviously differential equations. The way the calculus sequence is taught at Rutgers, students are not yet familiar with differential equations. We postpone doing Chapters 7 and 8 to Principles of EE II. Chapters 9 and 10 are concerned with sinusoidal steady state analysis. Although the book does not emphasize, I usually introduce steady state analysis with constant (DC) inputs as a prelude to steady state analysis with sinusoidal signals. This allows me to discuss the concepts of transient and steady state responces (note that since we are skipping Chapters 7 and 8, a good general understanding of what we skipped is important). Also, before getting into Chapters 9 and 10, I emphasize the algebra of complex numbers since that is what is prevalent throughout Chapters 9 and 10 dealing with phasors and phasor analysis.

Once you get the book and look at the material, we can discuss further. If you want, I can give you my notes (pdf files of circuit problems which are not necessarily from any

332:221 Principles of Electrical Engineering I – Fall 2011

Instructor: Professor P. Sannuti, Office - CoRE 525, Phone # 732-445-3127,
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Office hours: Monday, Wednesday, and Thursday 1:00 PM to 2:30 PM or by appointment.

Course and lab Website: `Sakai site`.

Prerequisite: 01:640:152 Calculus for Mathematical and Physical Sciences
Co-requisite: 01:640:251 Multivariable Calculus

Text: Electric Circuits by James W. Nilsson and Susan A. Riedel, Eighth or Ninth Edition , Pearson – Prentice Hall.

Syllabus: Chapters 1 to 6, 9 and 10 of the above text.

Exams: There will be possibly three hourly exams, and a final exam. All the exams will be closed book and closed notes. **Hourly exams are announced only a week before the exams take place. No make up exams will be given. If you have a medical excuse, consult Dean Bernath.**

Grading: The course grade is based on the hourly exams, final exam, some collected Home-work (see below), and certain number of unannounced quizzes (There are no makeup quizzes). Quizzes are simple and are like 'Assessing Objective' problems in the text book.

Grade distribution: It will be announced some time or other during the course.

Assigned Home-work – Collected: There is assigned Home-work that is collected and graded. Pdf files of assigned HW that is collected and graded will be sent by email as the lectures proceed; they are also placed in course Sakai cite.

Assigned Home-work – Not collected: If you are ambitious, you can do – or set up the equations of – all the problems at the end of each book chapter. However, it is advisable to do at least those problems for which answers (not solutions) are available in Appendix H of both 8th and 9th editions.

PSPICE and MULTISIM: As a part of lab, you need to work with PSPICE and MULTISIM, circuit simulating software.

Data of teaching assistants:
Ms. Shilpa Shivalingaiah, office hour Monday 11-12pm @EE205,
Th 3:20-6:20PM phone:NA yet, shlp8020@gmail.com
TA for Section 1 of lab (M 12:00-3:00PM)

Mr. Wen-chiang Hong, office hour Wensday 10-11am @EE205,
phone: 201 918 0443, wh200@eden.rutgers.edu
TA for Section 2 of lab (T 8:40-11:40AM) and
Section 4 of lab (W 12:00-3:00PM)

Gang Liu, office hour Tuesday 12:40-1:40pm @EE205,
phone: 732 325 8475, gliu82@yahoo.com
TA for Section 3 (T 1:40-4:40PM) and
Section 5 of lab (Th 3:20-6:20PM)

Mr. Jai Mota jaimota@eden.rutgers.edu, Grader. All enquiries regarding grading of HW or exams are to be discussed with him first. If they are not resolved, then only consult the instructor.

ABET COURSE SYLLABUS: This can be found at
`http://www.ece.rutgers.edu/degree/under/ug_course_descriptions`.

Principles of Electrical Engineering is exactly what its name implies. If you learn the basic principles, the rest of Electrical Engineering follows quite easily. The subject builds up sequentially, and thus each lecture builds on the previous lectures. If you are not in synchronism with the course, it takes a much grater effort to catch up with the course. Make every effort to be up to date so that you can get the most out of the lectures. **Seek help when you need it by coming to office hours, do not postpone seeking help**.

Work habits: Attendance in the course is not compulsory if you do not want to take quizzes, and thus lose receiving credit for them. All the exams in the course require comprehensive knowledge of the subject. Unless you attend the class regularly and learn the fundamental concepts and practice them by doing Home-Work, it would be hard to get a good grade.

Practical perspective problems: The text book has several practical perspective problems. Unfortunately, we cannot budget class time to do all such problems. We concentrate in the course to drill on all the basic fundamentals of 'Circuit Analysis'. Some of the students say what they learn in 'Circuit Analysis' is just theory. It is not so. In fact, all the practical perspective problems given in the text book show that practical applications require a thorough understanding of circuit theory. So, the aim of the course is to drill as much as possible understanding circuit theory. Certain assigned Home Work Problems contain design issues that arise in practice.

Nature of Course: Circuit Analysis can be learned only by solving problems and getting to know the basic principles over and over. It is not advisable to remember formulae, except the very basic ones, such as equivalent impedance (resistance) of those impedances (resistances) connected in series or in parallel, voltage division, current division, etc. Remembering formulae does not work out, and it is like remembering sentences to speak a language rather than formulating sentences as it is spoken (one cannot remember all possible sentences for all possible situations).

Goal

The goal of the course is to expose the students to various concepts in Electrical Circuit Analysis. The important concepts are listed below.

1. Voltage, Current, Power, Energy, Conservation of power in a circuit.

2. Ideal voltage and current sources, Independent and dependent sources.

3. Resistance and Ohm's law.

4. Kirchoff's Current Law (KCL) and Kirchoff's Voltage Law (KVL).

5. Analysis of simple circuits using KCL and KVL.

6. Circuit analysis with resistors in series and parallel.

7. Voltage divider and current divider circuits, effect of a load.

8. Voltmeter and Ammeter construction from a galvanometer.

9. Δ-Y transformations.

10. Attenuators.

11. Node voltage Analysis.

12. Mesh current Analysis.

13. Source transformations.

14. Thevenin and Norton equivalents of a circuit between any two given nodes.

15. Superposition theorem in linear circuits.

16. Maximum power transfer from the circuit to a load.

17. Operational Amplifier (Op-Amp); Ideal model of an Op-Amp, Inverting amplifier, Non-inverting amplifier, differential amplifier circuits; effect of a load, Analysis of Op-Amp circuits with a more realistic model of Op-Amp.

18. Capacitance, Inductance and Mutual inductance.

19. Sinusoidal Steady State Analysis, Concepts of a Phasor and an Impedance, Circuit analysis with Phasors and an Impedances.

20. Sinusoidal Steady State Power calculations, RMS or effective value, Average power, Real and Reactive powers, Complex power, Power triangle, Conservation of real and reactive powers, maximum power transfer.

21. Ideal transformer voltage and current relation-ships between primary and secondary windings.

In order to assess how well the students understand the above concepts, examination problems are constructed reflecting most of the important concepts outlined above. During the Fall semester 2004, examination problems included the concepts as outlined below:

Quiz 1: Simple circuit analysis involving the concepts of voltage, current, power, independent and dependent sources, KCL and KVL.

Quiz 2: Series, parallel, and Δ-Y equivalents.

Quiz 3: Construction of Thevenin equivalent circuit, Nodal Analysis, and Mesh current Analysis.

Quiz 4: Ideal analysis of a cascaded Op-Amp circuit.

Quiz 5: Conversion from time domain to phasor domain, Nodal Analysis in phasor domain, and conversion back to time domain.

Quiz 6: Conversion from time domain to phasor domain, Mesh current Analysis in phasor domain, and conversion back to time domain.

Hourly Exam 1, Problem 1: Solving a simple circuit with independent and dependent sources, demonstration of power balance.

Hourly Exam 1, Problem 2: Solving a simple circuit by one of the three possible methods, (1) by simplifying it using series and parallel resistance equivalents, (2) by Nodal Analysis, and (3) by Mesh current Analysis.

Hourly Exam 1, Problem 3: Determination of equivalent resistance between two nodes by utilizing series and parallel resistance equivalents as well as Δ-Y equivalents.

Hourly Exam 1, Problem 4: Construction of a voltmeter and modification of a voltmeter.

Hourly Exam 1, Problem 5: Writing all the independent equations involving node voltages of a complex circuit.

Hourly Exam 1, Problem 6: Writing all the independent equations involving mesh currents of a complex circuit.

Hourly Exam 2, Problem 1a: Determination of open circuit voltage between two nodes of a circuit using mesh current analysis.

Hourly Exam 2, Problem 1b: Determination of short circuit current between two nodes of a circuit using node voltage analysis.

Hourly Exam 2, Problem 1c: Determination of Thevenin resistance between two nodes of a circuit using test voltage and test current method.

Hourly Exam 2, Problem 2: Ideal analysis of a cascaded Op-Amp circuit.

Hourly Exam 2, Problem 3: Non-ideal analysis of an Op-Amp circuit.

Hourly Exam 2, Problem 4a: Behavior of a capacitance under a known periodic input voltage across it.

Hourly Exam 2, Problem 4b: Power calculations with sinusoidal voltage and current.

Hourly Exam 2, Problem 5: Determination of a simple equivalent circuit of a complex circuit.

Final Exam, Problem 1: Solving a simple circuit with independent and dependent sources, demonstration of power balance.

Final Exam, Problem 2: Node Voltage Analysis of a resistive circuit.

Final Exam, Problem 3: Mesh Current Analysis of a resistive circuit.

Final Exam, Problem 4: Non-ideal analysis of an Op-Amp circuit.

Final Exam, Problem 5: DC Steady State Analysis of a circuit.

Final Exam, Problem 6: Mesh Current Analysis of a circuit in phasor domain.

Final Exam, Problem 7: Node Voltage Analysis of a circuit in phasor domain.

Final Exam, Problem 8: Determination of Thevenin impedance between two nodes of a circuit using test voltage and test current method in phasor domain.

Final Exam, Problem 9: Phasor domain Analysis of a circuit and conservation of real and reactive powers.

Final Exam, Problem 10: Writing Mesh Current equations when mutual inductances are present.

Final Exam, Problem 11: Determination of equivalent impedance between two nodes when ideal transformer is present.