Course Information Document / Syllabus

EL 111 DC Fundamentals

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University of Hartford, Ward College of Technology
Prepared and Taught by the Department of Electronic Engineering Technology
In Academic Year 1999 – 2000 Spring Semester, 2000
This Course is Normally Taken in First Year, Spring Semester

EL 111 DC Fundamentals [4] Study of resistive, capacitive and inductive circuits with direct current applied. Includes study of series, parallel, series-parallel and complex circuits with use of network theorems. Lab included to teach use of equipment, measurement techniques, and effective report writing. Three lecture hours, three-hour lab. Prerequisite: MTH 112 (or concurrent). Laboratory fee.

Credits: 4 Credits (3 for lecture, 1 for laboratory)

Course Hours: Lecture, 3 hours/week for 14 weeks = 42 contact hours,
Laboratory, 3 hours/week for 14 weeks = 42 contact hours,
Total Hours = 84 contact hours.
Many students spend 2 to 3 hours outside of class for each contact hour.

Required Text: Floyd, Thomas L.; ***Principles of Electric Circuits***, 6th ed., Prentice Hall, © 2000

Supplemental Materials: Scientific calculator (TI-86 is recommended), standard laboratory tools.

Course Coordinator
and Prepared By: Prof. Walter Banzhaf, P.E. _____

Approved By: Department Chair _____

Notes:

1. The topics listed below are guidelines; what is actually covered in the course may vary slightly. Students will be notified in writing of any variances from what is printed below.
2. Students are responsible for reading this document. Questions should be referred to the course instructor.
3. This document should be retained by the student for future need (e.g. transfer credits), as the course is revised periodically, and it may be difficult or impossible to obtain a copy.

Goals:

This is the first in-depth technical course in the student's major. It provides the foundation of device and network fundamentals which is the basis of all technical courses that follow. The student will be able to calculate and measure currents, voltages, resistances and power dissipations in series, parallel and series-parallel combinations of resistive, capacitive and inductive circuits with DC current and/or voltage sources applied; use theorems and techniques to solve complex circuits; analyze effects upon circuit parameters when component values are changed. The laboratory part of this course will provide the exposure to laboratory instruments which will serve the student throughout his/her career.

Students are encouraged to devote as much time as is needed to master the material in this course. Most students will need to spend two to three hours outside of class for each hour of lecture.

Students are expected to do regular written homework assignments, and to respond in prose to questions on quizzes and examinations. While most of the work is inherently mathematical, questions on quizzes, tests and homework assignments will be require written responses. For each laboratory experiment/ project, a written laboratory report will be required. Student research, using libraries and the WWW, is an expected part of laboratory reports.

Assessment:

Consistent with the Formal Assessment Plan of the Department of Electronic Engineering Technology, approved May 6, 1997, a final laboratory project in the last weeks of the course is the primary means of assessing a student's growth and achievement in the course. This project will supplement the traditional means of assessment, including written and oral reports and presentations in both lecture and laboratory, homework, quizzes and examinations.

This project will be "documented with a written report detailing all aspects of the project, and will be evaluated by the faculty member teaching the technical course." The graded reports from all projects will be kept by the student as a portfolio of progress. In addition, the Department will maintain a file containing a written evaluation of each project for each student, which shall remain the property of Ward College.

Prerequisites by Topic: MTH 112 (or concurrent) Algebra, scientific notation, simultaneous linear equations, logarithmic and exponential equations, graphing.

Grading Criteria:

Course Average Determined by: 3 Tests @ 15% = 45%; Quiz/Homework Avg. 15%; Final Exam = 15%; In-Lab Performance & Laboratory Reports = 25%.

Course Grade As Follows: 100-93 = A; 92-90 = A-; 89-88 = B+; 87-83 = B; 82-80 = B-; 79-78 = C+; 77-73 = C; 72-70 = C-; 69-68 = D+; 67-63 = D; 62-60 = D-; under 60 = F.

Credit By Exam:

Credit for this course may be earned using the University "Credit By Exam" method, ***if*** the student's transcript does not show that this course was taken in the last five years. Students who elect this option should have substantial knowledge in the subject area, both theoretical and applied, and should expect a comprehensive written exam of two to three hours duration, and a practical exam in the laboratory. The practical exam will consist of completing a laboratory experiment from the list that follows.

Course Topics:

Lecture Topics (3 hours per week):

Components, Quantities, and Units (Chapter 1)	2 hours
Voltage, Current and Resistance (Chapter 2)	3 hours
Ohm's Law (Chapter 3)	2.5 hours
Energy and Power (Chapter 4)	2.5 hours
Series Circuits (Chapter 5)	4 hours
Parallel Circuits (Chapter 6)	4 hours
Series-Parallel Circuits (Chapter 7)	3 hours
Circuit Theorems and Conversions (Chapter 8)	3 hours
Branch, Mesh and Node analysis (Chapter 9)	4 hours
Capacitors (Chapter 13)	4 hours
Magnetism and electromagnetism (Chapter 10)	3 hours
Inductors (Chapter 14)	3 hours
Review for final exam	1 hour
Examinations in class	3 hours

Total lecture contact time = 42 hours

Tests: Three, each occupying one class hour, with the two-hour final exam given during Final Exam Week.

Course Topic Summaries

1. **Components, Quantities and Units** - Electrical components, measuring instruments, electrical and magnetic units, scientific and engineering notation, metric prefixes, metric unit conversions (how fast can you run in furlongs per femto-fortnight?)
2. **Voltage, Current and Resistance** - atomic structure, charge, voltage, current, resistance, resistor color code, the electrical circuit, basic circuit measurements
3. **Ohm's law -** calculating I, V and R, relationships of current, voltage, resistance; this could all be summed up as "**let's find out which electrical things can kill us, and which can't kill us**',
4. **Energy and Power -** power in electric circuits, resistor power ratings, power supplies
5. **Series circuits** - rules for current, voltage and total resistance, voltage sources in series, Kirchhoff's voltage law, voltage divider rule, power in series circuits, circuit ground and measuring voltages WRT ground, troubleshooting (which of the 20 lamps on the Christmas tree lights is burned out?)
6. **Parallel circuits -** rules for current, voltage and total resistance, Kirchhoff's current law, current sources in parallel, current divider rule, power in parallel circuits, troubleshooting
7. **Series-parallel circuits** - identifying series and parallel circuits, combinations of series and parallel circuits, analysis, voltage dividers, voltmeter loading effects, ladder networks, circuits that are neither series nor parallel but look like they are anyway and fool you if you're not really careful which brings us to the..., Wheatstone bridge, troubleshooting
8. **Source conversions and network theorems -** voltage source - what is this mythical device?, current source - what is *this* truly mythical device?, converting circuits with voltage sources to circuits with current sources and vice-versa, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem
9. **Mesh and Nodal Analysis -** BRIEFLY branch analysis, leading quickly to mesh current analysis, Cramer's rule, determinants, node voltage (nodal) analysis
10. **Capacitance -** how capacitors store charge and energy, types of capacitors, factors affecting size and dielectric strength, series and parallel capacitors, capacitors in DC circuits, transients in capacitive circuits - time constant, instantaneous current and voltage, exponential equations for I and V versus time, use of network theorems for capacitors in complex resistive circuits
11. **Magnetism and electromagnetism, magnetic circuits -** magnetic fields, flux, flux density, right-hand rule, permeability, reluctance, MMF and the flux equation, electromagnetic devices, hysteresis, B-H curve, electromagnetic induction, Faraday's law
12. **Inductors and Inductance -** Lenz's law, energy storage, induced voltage, electromagnetic induction, right-hand rule *(again),* inductors in series, inductors in parallel, inductors in DC circuits, transients in inductive circuits, time constant, instantaneous current and voltage, exponential equations for I and V versus time, use of network theorems for inductors in complex resistive circuits

Computer Usage:

1. Students use the WWW and appropriate search engines to research topics in the course.
2. Students will use PSpice and SNAP to analyze DC circuits. Assignments will be given requiring analysis, by hand, of challenging circuits; then, students will use computer analysis tools to solve the same circuits. These assignments will be graded.

Laboratory Projects (including major items of equipment and instrumentation used):

1. Resistor color code and measurement
2. Ohm's law relationships
3. Series circuits
4. Effect of temperature on resistance
5. Voltage divider rule for series circuits
6. Parallel circuits
7. Volt-ampere characteristics
8. Series-parallel circuits
9. Kirchhoff's voltage loop law
10. Superposition
11. Thevenin's theorem
12. Norton's theorem

Course Project

13. Maximum power transfer theorem
14. Time Constants - Series RC circuit with DC applied

For all laboratory experiments, students will use DC power supply, digital multimeter (voltage, current, resistance), digital or analog ammeter.

Oral and Written Communication Requirements: Students write comprehensive laboratory reports for every laboratory project. These are done individually. Oral communication is done in lecture and laboratory, using a Socratic technique, in which students must ask questions and respond to questions using professional vocabulary and proper English. Students are expected to do regular written homework assignments, and to respond in prose to questions on quizzes and examinations. While most of the work is inherently mathematical, questions on quizzes, tests and homework assignments will require written responses.

Calculus Usage: Calculus is taught to students in semesters 3 and 4; since this is a second-semester course, no calculus is used.

Library Usage: Students are told how to use the University library to obtain technical information, and are taught how to use the world-wide web to obtain supplemental information, with my blessing, encouragement and assistance. This supplemental information is used by the better students to augment their laboratory reports. The requirement of including supplemental material in laboratory reports is not done until DC Fundamentals (EL 111), in second semester.