



Syllabus for EGR 244
Electrical Engineering Fundamentals I

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Textbooks and Supplies:

Fundamentals of Electric Circuit Analysis, by Clayton Paul, John Wiley & Sons, 2001.

Catalog Description: Basic electrical circuit analysis; DC and sinusoidal steady-state circuits, manual and computer analysis methods, capacitance and inductance.

Course Objectives: (Learning Objectives) Upon successful completion of this course, the student will become proficient in the application of the following skills in the analysis of linear electric circuits:

- (1) Kirchhoff's voltage and current laws and Ohm's law,
- (2) resistors in series and in parallel,
- (3) circuit solution by circuit reduction,
- (4) voltage and current division,
- (5) circuit solution by direct application of KVL, KCL and Ohm's law,
- (6) source transformations,
- (7) analysis of circuits containing controlled sources,
- (8) superposition,
- (9) Thevenin and Norton equivalent circuits
- (10) maximum power transfer,
- (11) node-voltage and mesh-current equations,
- (12) the capacitor and inductor terminal relations and their response to dc sources,
- (13) complex numbers and complex algebra
- (14) phasor analysis of circuits
- (15) average power in phasor circuits
- (16) initial conditions, switching operations and the concept of a transient solution
- (17) first-order RL and RC circuits and time constants
- (18) the Laplace transform and its inverse by partial-fraction expansion
- (19) equivalent circuits of L's and C's in the Laplace domain
- (20) solution of circuits by Laplace transform techniques
- (21) response of second-order circuits to step and impulse sources

Corequisites: MAT 330

Course Content: Analysis of electric circuits. Kirchhoff's voltage and current laws, Ohm's law, independent and controlled voltage and current sources, inductors and capacitors. Basic resistive circuit analysis techniques: resistors in series and parallel, voltage and current division, source transformations, superposition, Thevenin and Norton equivalents, node voltage and mesh current analysis. AC phasor circuits, transient analysis via the Laplace transform.

Grading:

6 examinations	55%
Homework	10%
Recitation Quizzes	10%
Final Exam	25%

(No makeup exams will be administered **unless** you or a representative has contacted me **prior** to the exam and received permission to be absent due to a valid excuse.) **Tests and the Final Exam will be closed book and closed notes. You are not allowed to use any supplemental material on the tests or the final exam.**

Letter grades will be assigned at the end of the course according to:

$$\begin{aligned}90 \pm \varepsilon_1 &< A \leq 100 \\85 \pm \varepsilon_2 &< B^+ \leq 90 \pm \varepsilon_1 \\80 \pm \varepsilon_3 &< B \leq 85 \pm \varepsilon_2 \\75 \pm \varepsilon_4 &< C^+ \leq 80 \pm \varepsilon_3 \\70 \pm \varepsilon_5 &< C \leq 75 \pm \varepsilon_4 \\60 &< D \leq 70 \pm \varepsilon_5 \\F &< 60\end{aligned}$$

The factors $\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4, \varepsilon_5$ will be determined for each person according to:

- (1) class absences,
- (2) on time to class,
- (3) recitation absences,
- (4) on time to recitation,
- (5) cell phones or other electronic devices (other than calculators) turned off at all times in the classroom,
- (6) general decorum in class and in recitation.

Course Standards:

Class Attendance and Participation:

- (a) **I require that you attend class each period as well as each recitation. You are responsible for all business conducted during regularly scheduled class periods and in recitation.** For example, if we change a test date, it will be given in class or recitation and your missing that day will not be a valid excuse for missing the test. If you must miss a class due to a valid reason, the responsible thing to do is to contact me prior to the class (in person, by phone message or by email) and notify me that you will be absent.
- (b) **I require that you be on time for class.** Being late for class is very disruptive and disrespectful to me.

- (c) **I require that all electronic devices (except calculators) be turned off when you enter the classroom.** If a cell phone rings in class or I see you using or looking at a cell phone, blackberry, etc. (I'm not blind) I will remember that when it comes time to determine your particular ε_i to determine your final grade.
- (d) **DO NOT SLEEP IN MY CLASS! If you can't stay awake in class, don't come to it!**
- (e) **General decorum in class and in recitation.** Once the class has started (promptly at the beginning of the hour), I require that you not talk, or giggle or socialize with your other classmates around you. I require that you pay attention and listen to me in class. The purpose of the class or recitation is for me to convey ideas and important skills to you. You should not be talking in class unless (1) I ask a question of you or the class in general, or (2) you raise your hand and ask me a question.

When you leave Mercer and go to work in an industrial company, you will be expected to behave responsibly and if you violate the above such as showing up late or missing important meetings, or clown around in important meetings and don't appear to take the meeting seriously, your manager will form a poor impression of you and downgrade you in promotions and salary raises. So the class environment here is a direct simulation of your industrial life.

All I ask of you is to behave responsibility as you would when you go to work in industry, and show me the respect due me as you would your senior managers in your industrial job.

Homework: Several homework problems will be assigned each period that serve to clarify the main points of that period. These will be due at the beginning of the next class period at which time the detailed solutions to those homework problems will also be given. **No late homework will be accepted unless you have contacted me prior to the time the homework is due and have a valid excuse. This policy will be strictly enforced so don't ask me to violate it UNLESS you have contacted me before it is due with a valid excuse for your absence.** This is just what industry would reasonably expect of you also. These homework problems are critical to your learning of the material and skills. If you conscientiously work these homework problems and study the solutions that I will give out, you will have no problem with the test or final exam questions.

When you turn your homework in (at the beginning of the period and do not work on it in class) it should be in the following form:

- (1) written on one side of the paper,
- (2) stapled,
- (3) folded,
- (4) your name and the time of the class written on the outside,
- (5) your work shown clearly and in logical order so I can follow it, and
- (6) your answer boxed.

Lecture Transparencies: For many years I have given my "lectures" using transparencies that I have prepared ahead of time. These are intended to be a concise summary of the important ideas and skills that I want you to learn. I do this to help you distinguish "the trees from the forest". In those transparencies I will tell you the chapter and section titles and numbers as well as the Example numbers we are discussing so that you can follow along in class with your textbook. These transparencies are exact copies of what is in the textbook: no more and no less. Hence you do not need copies of these transparencies: you can simply follow along in the textbook. However, if you wish (you really don't need to) copies of the lecture transparencies can be obtained at nominal cost from the Mercer Copy Center in the Auxiliary Services Building.

Reading the Text and Doing the Exercise Problems: The following schedule shows the sections of the text that we will be covering each period. We will stick closely to this schedule. Also, there are numerous Exercise Problems in the text at the end of each Example Problem that I expect you to work. The answers to those Exercise Problems are given and all these answers

are correct. These exercise problems are simple and are intended to help you determine whether you have mastered the essential skills of that section. These are not required to be handed in and are solely for your benefit. If you cannot get the correct answer to these Exercise Problems, I expect you to come to my office and ask me for help. I will gladly help you IF you have put in the time to try to work these beforehand. But don't ask me "how to work the problem" without showing me your prior attempt so I can see where you went wrong.

I have written 17 textbooks on Electrical Engineering subjects and have been teaching Electrical Engineering subjects for over 45 years. I have also been teaching Electric Circuit analysis for about 30 years so you can trust me to know the material. I joined the faculty here at Mercer in 1997 after retiring from the University of Kentucky after 27 years on its faculty. I wrote the textbook you will use, and it was specifically designed for the EGR 244 course. Note that there are nice summaries of many of the important circuit analysis skills on the inside flaps of the front and rear covers of the book for your constant reference.

The Recitation: Once a week on Tuesday or Thursday (depending on your section) a recitation will be held from 3:05-5:00. I expect you to attend this and be on time. These will be less formal than our lecture periods but I will still expect a certain amount of responsible behavior. The purpose of this recitation is for you to work problems (which I will give out at the beginning of the recitation) under my guidance. This is a very valuable part of the course so attend and take conscientious advantage of it! The only way you can learn to analyze Electric Circuits is to work lots of problems! The recitation is to help you do that. At the end of each recitation, I will give out one problem for you to work like an exam question. I will take these up and grade them, and they will be counted as a part of your grade.

Cheating: You are expected to abide by the Mercer Honor Code at all times. You may work together with your classmates on homework problems but I expect the work you hand in to be yours. If I see you looking at other student's papers or using unauthorized materials during an exam, I will take up your paper, no questions asked, give you a grade of zero for that test, and report you to the Honor Council.

The Keys to Success: If you will (1) attend class, listen, and behave appropriately when in class as outlined above, (2) conscientiously attend the recitations and work the problems, (3) work (yourself) the homework problems and (4) work the Exercise Problems in the textbook, I can virtually guarantee you that you will make an A for the course.

The Role of Your University Experience: One of the, if not the most, important functions of your university study experience is to act as a simulation of what your industrial experience will be like after graduation. In industry you will have a manager (your "boss") who will assign you various tasks to complete. He/she will then evaluate you (based on his/her judgment) on how well you performed those tasks. Did you complete them in the assigned time limit? How well did you communicate the results to your "boss"? Did you do anything over and above the minimal assigned task or did you just do what you were told to do? Your manager will complete an annual review and evaluation of you that will be the primary basis for your promotion and/or salary raises. Your most important task is to "impress your boss" since he/she will be the primary factor in deciding your career fate. Your university experience is meant to simulate almost exactly your industrial career. In the university setting your instructor (me) will serve as your manager. I will assign you tasks such as homework, laboratories, special reports, and test questions. It is my job to evaluate you (assign grades) based on how well (in my judgment) you complete those tasks exactly like your manager in industry will do. Hence it is your primary task to "impress me". Keep in mind that this course, like your industrial experience, is not a "democracy"!

Important Additional Information:

Students with a documented disability should inform the instructor at the close of the first class meeting. The instructor will refer you to the office of Student Support Services (SSS) for consultation regarding evaluation, documentation of your disability, and recommendations for accommodation, if needed. Students will receive from SSS the *Faculty Accommodation Form*. On this form SSS will identify reasonable accommodations for this class. The form must be given to the course instructor for signature and then returned to SSS.

COURSE OUTLINE / SCHEDULE

Period	Topics	Textbook Sections Covered (Starting Pages)
1	Electric circuit models, charge, and voltage	1.1 (2), 1.2 (3)
2	Current, lumped circuit elements, power	1.3 (7), 1.4 (10)
3	Kirchhoff's current law	1.5 (13)
4	Kirchhoff's voltage law	1.6 (18)
5	Conservation of power, series and parallel connections of elements, redrawing circuits	1.7 (28), 1.8 (30), 1.10 (34)
6	Independent voltage and current sources and the resistor	2.1 (51), 2.2 (55)
7	Single loop circuits, single node pair circuits	2.3 (59)
8	Resistors in series and in parallel	2.4 (67)
	Test #1	
9	Circuit solution by circuit reduction	2.4.1 (73)
10	Voltage and current division	2.5 (77)
11	Solution for circuits containing more than one source	2.6 (85)
12	Source transformations	2.7 (90)
	Test #2	
13	The controlled (dependent) voltage and current sources, Analysis of circuits containing controlled sources	2.8 (94), 2.8.1 (97)
14	Equivalent resistances of circuits containing controlled sources	2.8.2 (100)
15	Superposition	3.1 (135)
16	The Thevenin equivalent circuit	3.2 (142)
17	The Norton equivalent circuit	3.3 (147)
18	Maximum power transfer	3.4 (153)
	Test #3	
19	Node voltage equations	3.5 (154)
20	Circuits containing voltage sources	3.5.1 (160)
21	Mesh current equations	3.6 (164)
22	Circuits containing current sources	3.6.1 (169)
23	The capacitor, Capacitors in series and in parallel, Continuity of capacitor voltages	5.1 (213), 5.1.1 (218), 5.1.2 (220)
24	The inductor, Inductors in series and in parallel, Continuity of inductor currents	5.2 (220), 5.2.1 (224), 5.2.2 (225)
	Test #4	
25	The sinusoidal source, Representation of general waveforms via the Fourier series, Response of circuits to sinusoidal sources	6.1 (261), 6.1.1 (263), 6.1.2 (266)
26	Complex numbers, complex algebra, and Euler's identity	6.2 (267)

- 27 The phasor (frequency-domain) circuit 6.3 (274), 6.3.1 (274), 6.3.2 (277)
- 28 Applications of resistive-circuit analysis techniques in the phasor circuit 6.4 (280)
- 29 (continued)
- 30 Power, power relations for the elements, maximum power transfer
6.6 (292), 6.6.1 (296), 6.6.3 (303)

Test #5

- 31 First-order circuit response, the RL circuit 7.1 (361), 7.1.1 (362)
- 32 The RC circuit 7.1.2 (369)
- 33 The Laplace transform, Important properties of the Laplace transform, Transforms
of important time functions, the Laplace transforms of the R,L,C elements
7.3 (387), 7.3.1 (388), 7.3.2 (389), 7.3.3 (394)
- 34 Determining initial conditions 7.3.4 (401)
- 35 The inverse Laplace transform by partial-fraction expansion, Real and distinct poles,
Real and repeated poles 7.4 (403), 7.4.1 (405), 7.4.2 (407)
- 36 Complex conjugate poles, First-order circuit response, The RL circuit
7.4.3 (409), 7.5 (413) 7.5.1 (413)
- 37 The RC circuit 7.5.2 (417)
- 38 Second-order circuit response 7.6 (424)

Test #6

HOMEWORK ASSIGNMENTS (due the next class period)

Period

1	No Homework
2	1.3-1, 1.4-1, 1.4-3
3	1.5-1, 1.5-2, 1.5-3, 1.5-4, 1.5-5
4	1.6-2, 1.6-3, 1.6-4, 1.6-5, 1.6-6, 1.6-7
5	1.7-1, 1.7-3, 1.7-4, 1.8-1
6	2.1-2, 2.1-3, 2.2-1, 2.2-2, 2.2-7
7	2.3-2, 2.3-3, 2.3-4, 2.3-8, 2.3-9, 2.3-13
8	2.4-1, 2.4-2, 2.4-4
9	2.4-6, 2.4-7, 2.4-8, 2.4-10
10	2.5-1, 2.5-2, 2.5-3, 2.5-5
11	2.6-1, 2.6-3, 2.6-4, 2.6-5
12	2.7-1, 2.7-3, 2.7-4, 2.7-5
13	2.8-2, 2.8-3, 2.8-4, 2.8-9
14	2.8-11, 2.8-12, 2.8-13, 2.8-15
15	3.1-1, 3.1-2, 3.1-3, 3.1-8
16	3.2-1, 3.2-2, 3.2-3, 3.2-10
17	3.3-1, 3.3-2, 3.3-3, 3.3-11
18	3.4-1, 3.4-3, 3.4-6
19	3.5-1, 3.5-2, 3.5-4
20	3.5-5, 3.5-7
21	3.6-1, 3.6-4, 3.6-6
22	3.6-7, 3.6-8
23	5.1-1, 5.1-2, 5.1-3, 5.1-9
24	5.2-1, 5.2-2, 5.2-3, 5.2-9
25	6.1-1(a), 6.1-2(c), 6.1-2(a), 6.1-2(e)
26	6.2-1(a), 6.2-1(b), 6.2-1(c), 6.2-1(d), 6.2-3, 6.2-4
27	6.3-1, 6.3-2, 6.3-3, 6.3-4, 6.3-5
28	6.4-1, 6.4-2, 6.4-3, 6.4-4, 6.4-5
29	6.4-9, 6.4-11, 6.4-13, 6.4-14
30	6.6-1, 6.6-2, 6.6-3, 6.6-5, 6.6-6
31	7.1-2, 7.1-3, 7.1-4
32	7.1-6, 7.1-7, 7.1-8
33	7.3-5
34	7.3-8, 7.3-9
35	7.4-1, 7.4-2, 7.4-4, 7.4-5

36

7.4-3, 7.4-6, 7.5-1, 7.5-2

37

7.5-3, 7.5-4

38

7.6-1, 7.6-2, 7.6-3