EE 220 Circuits I (3-1), SDSM&T, Spring 2018

Lecture Room & Time: EP 252 MWF from 2-2:50 pm

Laboratory Room & Times: EP 336 Th from 1-2:50 pm (-51), & 3-4:50 pm (-52)

Instructor: Dr. Thomas Montoya, EP 325, Tel: 394-2459, e-mail: Thomas.Montoya@sdsmt.edu

Office Hours: 3-4 pm MWF, or when available (open door policy).

WWW: See link from http://montoya.sdsmt.edu. The course web page will be heavily utilized for posting **assignments**, examples, solutions, ... E-mail will be utilized to notify students of course-related information and events (**check daily**). Your first.last@Mines.sdsmt.edu address will be used.

Catalog Description: This course is designed to provide the electrical engineering student with an understanding of the basic concepts of the profession. Topics covered include resistive circuits, transient circuits, and sinusoidal analysis. Students also investigate essential principles by conducting laboratory experiments related to the topics studied in the classroom. P-spice is used to analyze electrical circuits using personal computers.

EE 220 Prerequisite: MATH 125 (Calculus I) completed with a grade of "C".

EE 220 Corequisite: MATH 321 (Differential Equations).

Text: *Fundamentals of Electric Circuits*, Sixth Edition, Charles K. Alexander and Matthew N.O. Sadiku, McGraw-Hill, 2018, ISBN 978-0-07-802822-9.

Course Policies:

- Course instruction will be delivered in lectures. Attendance is required. Notify instructor in advance (when possible) if you will be absent from class.
- **Laboratory-** You must register for one of the EE 220L sections. Laboratory assignments and completion dates will be announced and distributed as they occur. Further laboratory information and policies will be given during the initial laboratory meeting.
- Except when otherwise specified, all coursework is to be individually completed. See the *Cheating Academic Integrity Policy* and *Community Standards* links under the *Policies/Definitions* link of the catalog (http://ecatalog.sdsmt.edu/). Note that according to the *Cheating Academic Integrity Policy*, "The South Dakota Board of Regents has clearly defined those acts that constitute violations of academic integrity (BOR Policy 2:33 - Student Academic Misconduct and BOR Policy 3:4 - Student Code of Conduct). These acts include, but are not limited to cheating and plagiarism; full definitions are found in BOR 2:33 and BOR 3:4. These acts of dishonesty violate the ethical values the university works to instill in all members of the campus community. The instructor of record for each course is responsible for clarifying the academic integrity standards for that course within the course syllabus."
- Students are encouraged to discuss homework/laboratories with classmates in general terms. However, copying, plagiarism … is not acceptable and will be penalized (e.g., grade of zero).
- Homework (HW) is due at the beginning of class on the specified days (up to 20% penalty for being late w/out doctor's note …). If you know that you will be missing a class, it may be turned in early. HW will **not** be accepted or graded after solutions are posted on the course web page.
- Bring **notes, text, and calculator** (capable of linear algebra, polynomial root solving, & complex number operations) to **every** class. Most quizzes will be unannounced and require a calculator. Occasionally a quiz may be open book/notes (no borrowing). Warning: The TI-83 & TI-84 series are not good choices (complex number operations are awkward). It is the responsibility of each individual to know and/or learn how to operate their calculator (get started now).

- Missed quizzes will **not** be made up. If you know that you will be missing a class for a school-related activity (athletic travel, academic conf., etc.), you may stop by the day before and ask to take a quiz early (if available). Missed exams may be made up for a school-related activity w/ **prior notice.**
- If 2/3 of quizzes **and** 2/3 of HW are completed at a **passing** level, the lowest HW grade and lowest two quiz grades will be dropped (no questions asked). If not, **all** quizzes and HW will count (no drops). The drops are meant to cover all absences, including those due to illness, interviews, trips…
- **All** laboratories must be completed by **every individual** at a passing level to pass the class.
- To facilitate grading, homework shall meet the following specifications (see HW example on course web page):
  (a) Use the front side only (i.e., single-sided) of 8.5" × 11" engineering graph paper or plain white paper (NO pages torn from spiral notebooks) for assignments.
  (b) At the top of **every** page put the date, course number, HW #, problem number(s) **per text** (if applicable), your name, and the page numbering (i.e., page *x* of *y* or *x*/*y* formats in the upper right hand corner). Ensure problems & pages are in order.
  (c) All work exceeding one page should be stapled - no paper clips, folded corners, or folders.
  (d) Copy, paraphrase, or cut-n-paste problem descriptions, figures, and/or circuits and **show all** work so it can be understood without the text. No work/"magic" answer → no credit.
  (e) **Reference** equations derived in the text (e.g., equation number and/or page number). Fundamental equations (e.g., Maxwell's equations, Ohm's Law ...) are excluded from this requirement.
  (f) Writing/figures/graphs must be legible & large enough to read → illegible = no credit.
  (g) Where applicable, use conventional engineering units & prefixes (i.e., MKS) as given in class and text. For example, 1.2 mW and 100 MHz ***not*** 0.0012 W and 10^5 kHz. Answers with missing or incorrect units are incomplete/incorrect.
  (h) Answers should be boxed/double underlined, in **decimal** format if a number (no fractions) with variables, values & units (if any) included. Also, use lead zeros for fractional answers. For example, "$V_x = 0.4$ V" ***not*** "$V_x = .4$" or "$V_x = 2/5$ V".
  (i) Work problems sequentially in a **single** vertical column with subparts clearly labeled, e.g., a), b) ... Leave space (e.g., 1/2") between consecutive parts of a problem, and draw a line across the page at the end of each problem if there is more than one. **No more than two problems on any page.**

Course Goals: The objective of this course is to provide students with the working knowledge of the fundamentals of electrical engineering. A particular emphasis is made on DC, transient, and AC steady-state circuit analysis.

Student Learning Outcomes:

Upon completion of this course, students should demonstrate the ability to:

1. Understand, apply, and use the definitions of and the SI units for charge, current, voltage, energy, and power.
2. Apply Ohm's Law to calculate voltages, currents, and impedances/resistances for AC and DC circuits.
3. Understand and calculate equivalent capacitances, inductances, resistances, and impedances for series, parallel, Wye, and Delta connected resistors, capacitors, and inductors.
4. Understand and apply the voltage and current division rules to AC and DC circuits.
5. Understand and apply Kirchoff's Laws, including Nodal and Mesh analysis, to AC and DC circuits.
6. Understand and apply the principles of linearity and superposition to AC and DC circuits.

7. Understand and calculate the Thevenin and Norton equivalents for AC and DC circuits.
8. Analyze and design simple operational amplifier circuits.
9. Understand the properties of capacitors and inductors and apply the current-voltage relationships of capacitors and inductors.
10. Analyze natural and step response of first order circuits (series RC and RL)
11. Analyze natural and step response of second order circuits (series and parallel RLC)
12. Understand, apply, and use phasors for sinusoidal steady-state AC circuit analysis.
13. Understand and calculate apparent, complex, instantaneous, and average power, effective or RMS voltages and currents, power factor, and power factor correction for AC circuits.
14. Use PSpice to model/simulate simple DC, transient, and AC circuits.
15. Use Matlab to assist with problem solutions and preparing plots.
16. Use basic laboratory measurement equipment including the power supplies, digital multimeters, function generators, and oscilloscopes to conduct experiments.
17. Understand and use a laboratory notebook for documenting experiments and writing technical reports.

Evaluation:

4 Hour Exams @ 10%/each	40%
Quizzes*	10%
Homework*	10%
Laboratory (e.g., logbook, report(s), practical exam ...)*	25%
Final Exam (required)	15%
**Total ..... **	**100%**

* see course policies

Grading scale: 100 > A > 90, 89 > B > 80, 79 > C > 70, 69 > D > 60, F < 60.

ADA: Students with special needs or requiring special accommodations should contact the instructor, (Dr, Montoya at 394-2459) and/or the Director of Counseling and Disability Services, Ms. Megan Reder-Schopp, at megan.reder-schopp@sdsmt.edu or 394-6988 at the earliest opportunity.

Freedom in learning: Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the Provost and Vice President for Academic Affairs to initiate a review of the evaluation.

Electronic Devices Policy: Please mute/turn off your cell phone before class starts. No text messaging in class. No headphones. You may use a laptop/tablet in this class for purposes of note taking. No other use of any other electronic/computer media, **other than calculators**, is allowed during class time.

Topics/Course Schedule: Chapters 1-11, see attached schedule (subject to revision).

Tentative Course Schedule

Class	Date(s)	Topics	Text Sections
1	1/8	**Basic Concepts-** Intro, units, charge, current, voltage, power, energy, circuit elements	1.1-1.3
2	1/10		1.4-1.9
3	1/12	**Basic Laws-** Intro, Ohm's Law, nodes, branches, loops	2.1-2.3
1/15		**Holiday**	
4	1/17	Kirchoff's Laws, series resistors, voltage division, parallel resistors, current division, wye-delta transforms, applications	2.4-2.6
5	1/19		2.6-2.8
6	1/22	**Methods of Analysis-** Intro, nodal analysis, mesh analysis, applications- DC transistor circuits	3.1-3.2
7	1/24		3.2-3.4
8	1/26		3.4-3.5
9	1/29		3.7, 3.9
10	1/31	**Circuit Theorems-** Intro, linearity, superposition	4.1-4.3
11	**2/2**	**Exam #1** (Chapters 1 - 3 material)	
12	2/5	Thevenin's Theorem, Norton's Theorem, source transformation, maximum power transfer	4.5-4.6
13	2/7		4.6, 4.4, 4.8
14	2/9	**Operational Amplifiers-** Intro, equivalent circuit model, ideal op-amp, inverting amplifier, non-inverting amplifier, summing amplifier, difference amplifier, cascaded op-amps	5.1-5.2
15	2/12		5.3-5.6
16	2/14		5.7
17	2/16		5.8
2/19		**Holiday**	
18	2/21	**Capacitors & Inductors-** Intro, capacitors, parallel/series capacitors, inductors, parallel/series inductors, energy storage	6.1-6.2
19	2/23		6.2-6.4
20	2/26		6.4-6.5
21	**2/28**	**Exam #2** (Chapters 4 - 5 material)	
22	3/2	**First-Order Circuits-** Intro, source-free RC & RL circuits	7.1-7.3
3/5 – 3/9		**Spring Break**	
23	3/12	source-free RC & RL circuits cont., singularity functions step response of RC & RL circuits	7.3-7.4
24	3/14		7.5-7.6
25	3/16		7.6-7.7
26	3/19	**Second-Order Circuits-** Intro, initial & final values, source-free series & parallel RLC circuits, step response of series & parallel RLC circuits, general second-order circuits	8.1-8.3
27	3/21		8.3-8.4
28	3/23		8.4-8.5
29	3/26		8.6-8.7
30	3/28	**Sinusoids & Phasors-** Intro, sinusoids, effective/RMS value	9.1-9.2, 11.4
	3/30	**Holiday**	
31	**4/2**	**Exam #3** (covers Chapters 6 – 8 material)	
32	4/4	phasors, complex numbers, impedance, admittance, Kirchoff's Laws in frequency domain, impedance combinations	9.3-9.5
33	4/6		9.5-9.7
34	4/9	**Sinusoidal Steady-State Analysis-** Intro, nodal & mesh analysis superposition, source transforms, Thevenin and Norton equivalent circuits	10.1-10.3
35	4/11		10.4-10.5
36	4/13		10.6
37	4/16	**AC Power Analysis-** Intro, instantaneous & ave. power, max. power transfer, effective/RMS value, apparent power, power factor (pf)	11.1-11.2
38	4/18		11.3-11.5
39	**4/20**	**Exam #4** (covers Chapters 9 – 10 material)	
40	4/23	complex power, conservation of power, pf correction	11.6
41	4/25		11.7-11.8
42	4/27	**Make-up/review day**	
EE 220 Final Exam: TBD, TBD, TBD, 2018, EP252			