**Point Loma Nazarene University**
**EGR 225 Electric Circuits Analysis (3 units)**
**SPRING 2019**

**CREDIT AND CONTACT HOURS:** 3 credit hours.
Class Tue 9:30-10:45 am LA 2

**INSTRUCTOR**: Dr. Tom Carter

**OFFICE HOURS:** Tue 8:00-9:00 am, 1:00-2:00 pm Trailer # 2 / RS282 by 2/14/19

**TEXTBOOK:** *Analysis & Design of Linear Circuits*, Thomas, Rosa & Toussaint, 8th edition

**REFERENCES/SUPPLEMENTS:** *Calculator, Matlab access*

**CATALOG**:
***EGR225 Electric Circuits Analysis (3)***

Theory and analysis of electrical and electronics circuits. Topics include basic circuit elements, laws of circuit analysis, Kirchoff's laws, loop and nodal analysis, differential equations for modeling electronic circuits, AC and DC analysis, transient analysis, complex impedance and steady state analysis, Laplace Transforms, and frequency domain analysis.

**COURSE LEARNING OUTCOMES/EXPECTED PERFORMANCE CRITERIA**:

**PROGRAM OUTCOMES**: This course contributes to meeting the program outcomes by developing student skills in the following areas. Upon completion, students be able to:

1. Explain and apply basic electrical principles to analyze linear DC and AC circuits.
   - explain & apply the voltage-current relationships for resistors, capacitors, & inductors
   - explain and apply Kirchhoff's Voltage Law
   - explain and apply Kirchhoff's Current Law
   - explain and apply circuit equivalency (series, parallel) and source transformations

2. Apply circuit theorems to find voltage, current, and power in linear DC & AC circuits.
   - use voltage division and current division
   - use mesh analysis
   - use nodal analysis
   - use superposition
   - use Thevenin and Norton equivalent circuits

3. Describe basic waveforms.
   - identify and manipulate step, exponential, and sinusoidal waveforms
   - identify and manipulate composite waveforms
   - define and calculate the frequency, period, and phase of periodic waveforms
   - explain and calculate the average and effective (rms) values of periodic waveforms

4. Calculate the transient response of linear RC and RL circuits with switches and DC sources.
   - explain and calculate the time constant of RC and RL circuits
   - calculate the initial and final conditions of RC and RL circuits
   - formulate and graph the transient response of RC and RL circuits
   - model switches using step functions

5. Analyze the sinusoidal steady-state response of linear AC circuits.
   - express sinusoidal waveforms as phasors
   - describe the voltage-current relationships of passive elements by their impedances
   - calculate voltage phasors and current phasors in circuits containing complex impedances
   - express phasors as sinusoidal waveforms
   - describe circuits using Laplace transforms
   - evaluate circuits using frequency domain analysis

## GRADING

| | | |
|---|---|---|
| Homework | 35% | (lowest score for the semester will be dropped) |
| Midterm #1 | 20% | |
| Midterm #2 | 20% | |
| Final | 25% | |

Final grades will be determined as follows:

| | |
|---|---|
| 100-93% | A |
| 90-92.9% | A- |
| 87-89.9% | B+ |
| 83-86.9% | B |
| 80-82.9% | B- |
| 77-79.9% | C+ |
| 73-76.9% | C |
| 70-72.9% | C- |
| 67-69.9% | D+ |
| 63-66.9% | D |
| 60-62.9% | D- |
| 0-59.9% | F |

## COURSE ORGANIZATION

**Lectures:** PowerPoint and interactive discussion will cover the topics below. In class participation may result in extra credit points that will be applied to the next exam. Lectures will be posted on Canvas after the class.

**Homework:** will be assigned weekly at the end of the lecture period (Thursdays) and due before the start of the following Thursday lecture. Homework should be submitted on Canvas as either text or attached file. If delivered late, but by the end of the next day (Friday), the grade will be reduced to a max of 20% of original points. No late homework will be accepted after that. The lowest grade for the semester will be dropped. Some of the homework assignments will involve independent research and have questions and problems with no single "right" answer. Those will be graded based on your clarity,

completeness of source references, and ability to independently research. In some cases, creativity may also be required and evaluated. Copied answers will be given zero credit.

**Midterms:** Two midterms will be given, based on the material covered during that period of the class. Your own personal handwritten notes may be used on these exams.

**Final:** The Final will be comprehensive, covering the material of the entire semester. Your own personal handwritten notes may be used on the Final.

**If you will miss a class or exam for a school function**, you must arrange to make it up **ahead of time**. It is your responsibility to let the professor know of such an absence enough ahead of time to accommodate. Absences due to unexpected emergencies will require documentation from a reliable and verifiable source of the time and reason for such absence.

**UNIVERSITY MISSION:**
Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service becomes an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

**DEPARTMENT MISSION:**
The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

**ATTENDANCE:**
Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day.

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See Attendance Policy in the in the Undergraduate Academic Catalog.

**CLASS ENROLLMENT:**
It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university), not the instructor. Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

**ACADEMIC ACCOMMODATIONS:**
While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

**ACADEMIC HONESTY**
Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See the catalog for definitions of kinds of academic dishonesty and for further policy information.

**FINAL EXAM:**
The final exam will be comprehensive over all the material covered in the class. The Final Exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

**COPYRIGHT PROTECTED MATERIALS:**
Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

**CREDIT HOURS:**
In the interest of providing sufficient time to accomplish the stated course learning outcomes, this class meets the PLNU credit hour policy for a 3 unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

**EXPECTED SCHEDULE BY WEEK**:

| LECTURE | TOPIC | SECTION |
|---|---|---|
| 1 | Introduction; Key Terms | 1-1 to 1-3 |
| 2 | Circuit Elements; Analysis using KCL & KVL | 2-1, 2-2, 2-3 |
| 3 | Equivalent Circuits, Voltage and Current Division | 2-4, 2-5 |
| 4 | Circuit Reduction | 2-6 |
| 5 | Nodal Analysis, Mesh Analysis | 3-1, 3-2, 3-3 |
| 6 | Thevenin & Norton Equivalent, Interface Design | 3-4, 3-5 |
| 7 | Signal Waveforms & Descriptors | 5-1 to 5-6 |
| 8 | Open | |
| 9 | Review | |
| 10 | **FIRST MIDTERM EXAM** | |
| 11 | Capacitors, Inductors; Equivalent C and L | 6-1, 6-2, 6-4 |
| 12 | RC and RL Circuits, First-Order Step Response | 7-1, 7-2 |
| 13 | Initial/Final Conditions, Response to Other Fncs | 7-3, 7-4 |
| 14 | RLC Circuits | 7-5, 7-6 |
| 15 | Sinusoids and Phasors, AC circuit Analysis | 8-1, 8-2 |
| | ***SPRING BREAK*** | |
| 16 | Circuit Theorems with Phasors | 8-3 to 8-5 |
| 17 | Energy and Power | 8-6 |
| 18 | Open | |
| 19 | Review | |
| 20 | **SECOND MIDTERM EXAM** | |
| 21 | Laplace Transforms, Pole-Zero diagrams | 9-1 to 9-3 |
| 22 | Inverse Laplace Transforms | 9-4 |
| 23 | Circuit Frequency Response | 9-5 |
| 24 | Frequency Analysis & Filters | Chpts 12-13 |
| 25 | Frequency Analysis & Filters | Chpts 12-13 |
| 26 | Frequency Analysis & Filters | Chpts 12-13 |
| | ***EASTER BREAK*** | |
| 27 | Open | |
| 28 | Review | |
| | FINAL | |