



Course Syllabus

ELPT 1370 – Advanced Electricity

Revision Date: 01/11/2017

Catalog Description: Introduction to advanced electrical theory and circuitry including, power factor, induction, capacitance, apparent power, sine wave analysis, complex circuitry and power distribution calculations and circuits.

Lecture hours = 3, Lab hours = 2

Prerequisites: ELPT 1311 – Basic Electrical

Semester Credit Hours: 3

Lecture Hours per Week: 3

Lab Hours per Week: 2

Contact Hours per Semester: 80

State Approval Code: 46.0301

Instructional Goals and Purposes: The purpose of this course is to explain alternating current waveform power generation; explain how properties other than resistance can limit the flow of current; determine the values of AC voltage, current, and impedance for circuits containing resistors, capacitors, and inductors; explain and calculate power factor in circuits; and utilize electrical measuring instruments.

Learning Outcomes:

1. Basics of Alternating Current (AC)
2. Inductance in AC circuits
3. Resistive - Inductive Series Circuits
4. Resistive - Inductive Parallel Circuits
5. AC Circuits Containing Capacitors
6. Capacitance in AC Circuits
7. Resistive - Capacitive Series Circuits
8. Resistive - Capacitive Parallel Circuits
9. Resistive - Inductive - Capacitive Series Circuits
10. Resistive - Inductive - Capacitive Parallel Circuits
11. Filters

Specific Course Objectives (includes SCANS):

After studying all materials and resources presented in the course, the student will be able to:

1. **Alternating Current.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Discuss the differences between DC and AC.
 - b. Compute instantaneous values of voltage and current for a sine wave.

- c. Compute peak, RMS, and average value of voltage and current.
 - d. Discuss the phase relationship of voltage and current in a pure resistive circuit.
2. **Inductance in AC Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Discuss the properties of inductance in an AC circuit.
 - b. Discuss inductive reactance.
 - c. Calculate values of inductive reactance and inductance.
 - d. Discuss the relationship of voltage and current in a pure inductive circuit.
 - e. Calculate values for inductors connected in series or parallel.
 - f. Discuss reactive power (VARs).
 - g. Determine the Q of a coil.
3. **Resistive- Inductive Series Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Discuss the relationship of resistance and inductance in an AC circuit.
 - b. Define power factor.
 - c. Calculate values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an R- L series circuit.
 - d. Calculate the phase angle for current and voltage in an R- L series circuit.
 - e. Connect an R-L series circuit and make measurements using test instruments.
 - f. Discuss vectors and be able to plot electrical quantities using vectors.
4. **Resistive - Inductive Parallel Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Discuss the operation of a parallel circuit containing resistance and inductance.
 - b. Calculate circuit values of an R-L parallel circuit.
 - c. Connect an R-L parallel circuit and measure circuit values with test instruments.
5. **Capacitors.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. List the three factors that determine the capacitance of a capacitor.
 - b. Discuss the electrostatic charge.
 - c. Discuss the differences between non-polarized and polarized capacitors.
 - d. Calculate values for series and parallel connections of capacitors.
 - e. Calculate an RC time constant.
6. **Capacitance in AC Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Explain why current appears to flow through a capacitor when it is connected to an AC circuit.
 - b. Discuss capacitive reactance.
 - c. Calculate the value of capacitance in an AC circuit.
 - d. Discuss the relationship between voltage and current in a pure capacitive circuit.
7. **Resistive - Capacitive Series Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Discuss the relationship between resistance and capacitance in an AC series circuit.
 - b. Calculate values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RC series circuit.
 - c. Calculate the phase angle for current and voltage in an RC series circuit.
 - d. Connect an RC series circuit and make measurements using test instruments.

8. **Resistive - Capacitive Parallel Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Discuss the operation of a parallel circuit containing resistance and capacitance.
 - b. Calculate circuit values of an RC parallel circuit.
 - c. Connect an RC parallel circuit and measure circuit values with test instruments.

9. **Resistive - Inductive - Capacitive Series Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Discuss AC circuits that contain resistance, inductance, and capacitance connected in series.
 - b. Connect an RLC series circuit.
 - c. Calculate values of impedance, inductance, capacitance, power, VARs, reactive power, voltage drop across individual components, power factor, and phase angle of voltage and current.
 - d. Discuss series resonant circuits.

10. **Resistive – Inductive - Capacitive Parallel Circuits.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Discuss parallel circuits that contain resistance, inductance, and capacitance.
 - b. Calculate the values of an RLC parallel circuit.
 - c. Calculate values of impedance, inductance, capacitance, power, reactive power, current flow through individual components, power factor, and phase angle from measurements taken.
 - d. Discuss the operation of a parallel resonant circuit.
 - e. Calculate the power factor correction for an AC motor.

11. **Filters.** SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Discuss the necessity of filter circuits. Discuss the operation of low-pass filters.
 - b. Discuss the operation of high-pass filters. Discuss the operation of bandpass filters.
 - c. Discuss the operation of band-reject filters.

Course Content:

A general description of lecture/discussion topics included in this course are listed in the Learning Objectives / Specific Course Objectives sections of this syllabus.

Students in all sections of this course will be required to do the following:

1. Attend scheduled classes regularly and be on time for every class period. Students can be dropped from a class due to excessive absences. More than **two** (2) unexcused absences are considered to be excessive.
2. Study the assigned materials, complete and submit homework assignments on time, complete quizzes and exams to assess understanding and comprehension of the material presented.
3. Complete any scheduled lab assignments or class projects. Personal Protective Equipment (PPE) is required to be worn in lab.

Methods of Instruction/Course Format/Delivery:

Students will have access to this course in Canvas and will meet regularly for class each week. Classes will consist of lecture and lab exercises as appropriate. Quizzes and exams may be administered by the Instructor or by an approved testing facility.

Students in traditional, hybrid and Internet classes will have access to courses via Canvas. Students in the traditional class will meet regularly for lecture. Students in the Internet class will be required to take quizzes and exams at an approved testing facility or, they may also be administered by the instructor. Students in

hybrid classes will have both in class and online assignments. Hybrid classes are required to read assigned material, take quizzes and exams as assigned by the instructor, and complete assigned homework prior to meeting for the face to face lecture/lab.

The following will be used to calculate the student's final grade:

Attendance and Participation

Students are expected to attend face to face classes and be on time. Students are required to participate in class discussions and work with other students during class exercises.

Attendance is based on the student missing no more than 10% out of the semester without a valid excuse, at which point, the instructor may withdraw the student at their discretion. Any student thirty or more minutes late may be counted absent. Students that leave before class is dismissed will be counted absent. The Instructor reserves the right to dock points on any makeup work resulting from an unexcused absence.

Lab Exercises

Students will complete lab assignments designed to teach them how to apply knowledge gained from the textbook to actual electrical circuits.

Quizzes

Upon completion of each major assignment, students will take online quizzes over the material covered. Quizzes will generally contain true/false, multiple choice, matching or fill In-the-blank questions.

Midterm and Final Exams

There will be two major exams consisting of a Midterm Exam and a Final Exam. The Final Exam will be cumulative.

Grading Notes

Missed quizzes or exams due to legitimate reasons should be taken prior to the reporting of mid-term or final grades as applicable. It is the responsibility of the student to reschedule the makeup with the instructor, who reserves the right to change the test format of any makeup quiz or exam. Instructor is not required to makeup work for an unexcused class absence. The Instructor also reserves the right to give full or partial credit for any makeup work that is allowed and that resulted from an unexcused absence.

Attendance is based on the student missing no more than 10% out of the semester without a valid excuse, at which point, the instructor may withdraw the student at their discretion. Any student thirty or more minutes late may be counted absent. Students that leave before class is dismissed will be counted absent. The Instructor reserves the right to dock points for any missed class without a legitimate excuse.

Scholastic dishonesty is treated with the utmost seriousness by the Instructor and Panola College. Academic dishonesty includes, but is not limited to, the willful attempt to misrepresent one's work, cheat, plagiarize, or impede other students' scholastic progress.

Grading Scale: A=90-100, B=80-89, C=70-79, D=60-69, F=69 and below

Major Assignments / Assessments:

The following items will be assigned and assessed during the semester and used to calculate the student's final grade.

Assignments

1. Unit 16: Alternating Current
2. Unit 17: Inductance in AC Circuits
3. Unit 18: Resistive - Inductive Series Circuits
4. Unit 19: Resistive - Inductive Parallel Circuits
5. Unit 20: Capacitors
6. Unit 21: Capacitance in AC Circuits
7. Unit 22: Resistive - Capacitive Series Circuits
8. Unit 23: Resistive - Capacitive Parallel Circuits
9. Unit 24: Resistive - Inductive - Capacitive Series Circuits
10. Unit 25: Resistive - Inductive - Capacitive Parallel Circuits
11. Filters

Assessment(s):

1. Unit 16 Quiz
2. Unit 17 Quiz
3. Unit 18 Quiz
4. Unit 19 Quiz
5. Unit 20 Quiz
6. Unit 21 Quiz
7. Unit 22 Quiz
8. Unit 23 Quiz
9. Unit 24 Quiz
10. Unit 25 Quiz
11. Unit 26 Quiz
12. Midterm Exam
13. Final Exam

Course Grade:

The grading scale for this course is as follows:

- Attendance – 10%
- Homework – 20%
- Unit Quizzes – 30%
- Exams – 40%

Texts, Materials, and Supplies:

- ***Delmar's Standard Textbook of Electricity***, 6th Edition by Stephen L. Herman
- ***Experiments in Electricity for Use with Lab - Volt EMS Equipment***
- Calculator (***Do not use your phone as a calculator!***)
- Notebook and a pen or pencil
- Safety Glasses and PPE as required for lab

Refer to ***School of Energy Safety Contract***

Required Readings:

- Textbook as assigned by Instructor

Recommended Readings:

- As assigned by Instructor

Other:

- For current texts and materials, use the following link to access bookstore listings:
<http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*:
<http://www.panola.edu/student-success/documents/pathfinder.pdf>

SCANS CRITERIA

- 1) **Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.**
 - a) **Basic Skills:** A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:
 - i) Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
 - ii) Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flowcharts.
 - iii) Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
 - iv) Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
 - v) Speaking: Organize ideas and communicate orally.
 - b) **Thinking Skills:** A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:
 - i) Creative Thinking: generate new ideas.
 - ii) Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
 - iii) Problem Solving: recognize problems and devise and implement plan of action.
 - iv) Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
 - v) Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
 - vi) Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.
 - c) **Personal Qualities:** A worker must display responsibility, self-esteem, sociability, self-management, integrity, and honesty.
 - i) Responsibility: exert a high level of effort and persevere toward goal attainment.
 - ii) Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
 - iii) Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
 - iv) Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
 - v) Integrity and Honesty: choose ethical courses of action.
- 2) **Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.**
 - a) **Resources:** A worker must identify, organize, plan, and allocate resources effectively.
 - i) Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
 - ii) Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
 - iii) Material and Facilities: Acquire, store, allocate, and use materials or space efficiently.
Examples: construct a decision timeline chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.
 - b) **Interpersonal Skills:** A worker must work with others effectively.

- i) Participate as a Member of a Team: contribute to group effort.
- ii) Teach Others New Skills.
- iii) Serve Clients/Customers: work to satisfy customer's expectations.
- iv) Exercise Leadership: communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
- v) Negotiate: work toward agreements involving exchange of resources, resolve divergent interests.
- vi) Work with Diversity: work well with men and women from diverse backgrounds.

Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.

- c) **Information:** A worker must be able to acquire and use information.

- i) Acquire and Evaluate Information.
- ii) Organize and Maintain Information.
- iii) Interpret and Communicate Information.
- iv) Use Computers to Process Information.

Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer databases to research a report; use a computer spreadsheet to develop a budget.

- d) **Systems:** A worker must understand complex interrelationships.

- i) Understand Systems: know how social, organizational, and technological systems work and operate effectively with them.
- ii) Monitor and Correct Performance: distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
- iii) Improve or Design Systems: suggest modifications to existing systems and develop new or alternative systems to improve performance.

Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.

- e) **Technology:** A worker must be able to work with a variety of technologies.

- i) Select Technology: choose procedures, tools or equipment including computers and related technologies.
- ii) Apply Technologies to Task: understand overall intent and proper procedures for setup and operation of equipment.
- iii) Maintain and Troubleshoot Equipment: Prevent, identify, or solve problems with equipment, including computers and other technologies.

Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.