



Course Syllabus

ELPT 1325 – National Electrical Code 1

Revision Date: 01/11/2017

Catalog Description: An introductory study of the National Electric Code (NEC) for those employed in fields requiring knowledge of the Code, with emphasis on wiring design, protection, methods and materials, equipment for general use, and basic calculations.

Lecture hours = 3, Lab hours = 0

Prerequisites: None

Semester Credit Hours: 3

Lecture Hours per Week: 3

Lab Hours per Week: 0

Contact Hours per Semester: 48

State Approval Code: 46.0301

Instructional Goals and Purposes: The purpose of this course is to locate and interpret the sections in the NEC pertaining to electrical installations; calculate the size of conductors, boxes, raceways, and overcurrent protective devices for branch circuits supplying electrical equipment, calculate conductor size, overcurrent protection for service equipment as applied to building services and compute the size of branch circuits, feeders and equipment for motors.

Learning Outcomes:

1. Briefly discuss the history of the National Electrical Code (NEC).
2. Understand and apply NEC *Definitions and Terminology*.
3. Select *Boxes and Enclosures* to meet NEC requirements.
4. Regulations regarding *Cable Systems*.
5. Regulations related to *Raceways and Conductors*.
6. *General Provisions* concerning areas inside and outside of a *One-Family Dwelling*.
7. *Specific Provisions* concerning areas inside and outside of a *One-Family Dwelling*.
8. *Load Calculation* for a *One-Family Dwelling* to include the size of services, feeders, branch circuits and application of demand factors.
9. Provisions concerning *Services and Electrical Equipment*, many of which are applicable in all types of occupancies, not only *Single-Family Dwellings*.
10. General Provisions that pertain to a *Commercial Location* and how they differ from the single or multi-family dwelling occupancy.
11. Non-dwelling load calculations.
12. Provisions concerning services, feeders, and equipment in a Commercial location.

Specific Course Objectives (includes SCANS):

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

1. Briefly discuss the history of the National Electrical Code (NEC). SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Identify the catalyst that brought about the National Electrical Code (NEC).
 - b. Discuss how the NEC began and the purpose of the NEC.
 - c. Discuss how changes to the NEC evolve.
 - d. Discuss the type of information found within the NEC (layout).
 - e. Discuss the NEC's concern with equipment and material standards.
 - f. Recognize various trademark logos that denote listed and labeled products.
 - g. Describe the role of nationally recognized testing laboratories (NRTL) and the National Electrical Manufacturers Association (NEMA) as well as the expanded role of the National Fire Protection Association (NEMA).
 - h. Recognize that electrical requirements in addition to the NEC may exist and if so, that compliance is required.
2. Understand National Electrical Code *Definitions and Terminology*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Know the meaning of the term accessible when applied to (1) wiring methods and (2) when applied to equipment.
 - b. Know the four categories of branch circuits and be able to list their differences.
 - c. Know the correct definitions of words and phrases found in Article 100, which are crucial to the installation of a hazard-free electrical system.
 - d. Determine whether a load is continuous or non-continuous.
 - e. Describe the difference between branch-circuit conductors and feeder conductors.
 - f. Know the terminology associated with grounded and grounding.
 - g. Give examples of damp, dry, and wet locations.
 - h. Determine which conductors are neutral conductors.
 - i. Comprehend the electrical vocabulary associated with the word service.
3. Properly select *Boxes and Enclosures* to meet NEC requirements. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Perform box fill calculations.
 - b. Understand additional markings on boxes.
 - c. Describe the general installation requirements for boxes.
 - d. Describe box and luminaire support requirements.
 - e. Size junction and pull boxes.
4. Understand NEC regulations regarding *Cable Systems*. SCANS (1 A-I, 1A-ii, 1A=iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Explain the general installation requirements for cable systems.
 - b. Explain conductor identification and the permissible re-identification of certain conductors.
 - c. Discuss grounded conductors provided at switch locations.
 - d. Discuss grounded conductor provided for the future.
 - e. Discuss underground installations for both direct burial and raceway protected conductors and cables.
 - f. Discuss special application cables.
5. Understand NEC regulations related to *Raceways and Conductors*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Describe general provisions related to raceways.
 - b. List the differences between nonflexible conduit (and tubing) and flexible conduit.
 - c. Determine raceway fill.

- d. Discuss conductors, including ampacity correction factors and conductor temperature limitations.
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- 6. Apply *NEC General Provisions* concerning areas inside and outside of a *one-family dwelling*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Interpret an electrical floor plan (blueprint) for a one-family dwelling.
 - b. Describe branch circuits.
 - c. Know the NEC requirements for receptacles and their placement.
 - d. Know the NEC requirements for receptacles requiring AFCI and GFCI protection.
 - e. Understand lighting and switching requirements.
 - f. Discuss outdoor receptacles and lighting requirements.
 - 7. Apply *NEC Specific Provisions* concerning areas inside and outside of a *one-family dwelling*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Describe provisions related to kitchens, dining rooms, and breakfast rooms.
 - b. Describe provisions related to hallways and stairways.
 - c. Describe provisions related to clothes closets.
 - d. Describe provisions related to bathrooms.
 - e. Describe provisions related to basements and garages.
 - f. Describe provisions related to attics and crawl spaces.
 - 8. Perform a *Load Calculation* for a one-family dwelling. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Compile the information essential to load calculations.
 - b. Perform a load calculation for a one-family dwelling using the standard method.
 - c. Perform a load calculation for a one-family dwelling using the optional method.
 - 9. Understand provisions concerning *Services and Electrical Equipment*, many of which are applicable in all types of occupancies, not only *Single-Family Dwellings*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Describe the various service-entrance wiring methods.
 - b. Be familiar with minimum wiring clearance requirements (vertical, horizontal, etc.) for services and outside wiring.
 - c. Have a good understanding of the amount of three-dimensional working space required around service equipment, panel boards, electrical equipment, etc.
 - d. Know and understand different aspects of service equipment and panel board installations.
 - e. Have an extensive understanding of the grounding system as a whole as well as a detailed understanding of grounding and bonding procedures.
 - f. Know how to calculate conductor sizes in accordance with 310.15(B)(7).
 - 10. Understand the NEC *General Provisions* that pertain to a *Commercial Location* and how they differ from the Single-Family Dwelling occupancy. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Apply General Provisions related to branch circuits in a commercial location.
 - b. Apply General Provisions related to receptacles in a commercial location.
 - c. Apply General Provisions related to lighting in a commercial location.
 - 11. Have an understanding of the elements required to perform a *Commercial Location Load Calculation*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Know that receptacle outlets are counted, unlike in dwelling unit load calculations.
 - b. Understand how to apply Table 220.44 demand factors to receptacle loads in excess of 10 kVA.
 - c. Be able to calculate the receptacle load for banks and office buildings where the actual number of receptacle outlets is unknown.
 - d. Be familiar with volt-ampere loads for different types of occupancies, and even for different areas within certain occupancies.

- e. Know when and how to apply Table 220.42 demand factors.
 - f. Be aware that track lighting is calculated in addition to the general load
 - g. Determine when a load is continuous or not continuous.
 - h. Understand that continuous loads require the inclusion of an additional 25% volt-ampere rating in the load calculation.
12. Understand NEC provisions concerning Services, Feeders, and Equipment in a *Commercial Location*. SCANS (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. Know required minimum vertical wiring clearances for each electrical installation.
 - b. Be aware of minimum working space provisions (600 volts or less) above, below, and in front of electrical equipment.

Course Content:

A general description of lecture/discussion topics included in this course is 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 1: Introduction to the National Electrical Code*
2. *Unit 2: Definitions and Terminology*
3. *Unit 3: Boxes and Enclosures*
4. *Unit 4: Cables*
5. *Unit 5: Raceways and Conductors*
6. *Unit 6: One-Family Dwellings General Provisions*
7. *Unit 7: One-Family Dwellings Specific Provisions*

8. *Unit 8: One-Family Dwellings Load Calculations*
9. *Unit 9: Services and Electrical Equipment*
10. *Unit 12: Commercial Locations General Provisions*
11. *Unit 13: Non-dwelling Load Calculations*
12. *Unit 14: Services, Feeders, and Equipment*

Assessment(s):

1. *Unit 1 Quiz*
2. *Unit 2 Quiz*
3. *Unit 3 Quiz*
4. *Unit 4 Quiz*
5. *Unit 5 Quiz*
6. *Unit 6 Quiz*
7. *Unit 7 Quiz*
8. *Unit 8 Quiz*
9. *Unit 9 Quiz*
10. *Unit 12 Quiz*
11. *Unit 13 Quiz*
12. *Unit 14 Quiz*
13. *Mid Term Exam*
14. *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:

- ***Illustrated Guide to the National Electrical Code***, 6th Edition by Charles R. Miller
ISBN-13: 9781133948629
- Calculator
- Notepad and pen or pencil
- Safety Glasses and PPE as required
Refer to ***School of Energy Safety Contract***

Required Readings:

- ***Illustrated Guide to the National Electrical Code***, 6th Edition by Charles R. Miller
- NFPA 70, National Electrical Code Book

Recommended Readings:

- Electricians Math and Basic Electrical Formulas
Free download from Mike Holt Enterprises, Inc.
www.MikeHolt.com

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 flow charts.
 - 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 time line 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 data bases 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.