Lesson Plan

Course Title: Architectural Design

Session Title: The Electrical Plan

Performance Objective:
After completing this lesson the students will be able to describe and identify the features of an electrical plan, identify typical electrical symbols found on the plan, establish data for specific circuits and then sketch and draw the electrical plan for their house by meeting the guidelines that must be met in the textbook – Architecture – Residential Drawing and Design by Clois E. Kicklighter and local/state/national codes.

Specific Objectives:
Using the criteria for the various areas of their home found in previous lessons, the students will be able to:

- Determine where the service entrance is located and the capacity
- Determine where the service meter and distribution is located
- Identify where switches and plugs are located
- Establish the various types of fixtures used in the electrical schedule
- Justify their plan by explaining why fixtures are located where and the circuits used for them
- Dimension and label the drawing
- Define the various terms used in the construction industry used to identify the various parts of the electrical plan

Preparation

TEKS Correlations:
This lesson, as published, correlates to the following TEKS. Any changes/alterations to the activities may result in the elimination of any or all of the TEKS listed.

Architectural Design:

- 130.46 (c)(3)(A)(B)(C)
  ...demonstrate knowledge of architectural design principles;
  ...determine building code and zoning requirements for building types in a selected area;
  ...demonstrate knowledge of the various grades and types of construction materials.

- 130.46 (c)(4)(A)(B)(C)
  ...safely use the tools, materials, and equipment commonly employed in the field of architectural computer-aided drafting;
  ...properly handle and dispose of environmentally hazardous materials;
  ...demonstrate knowledge of new and emerging technologies that may affect the field of architecture.

...use problem-solving skills to analyze a situation to identify a problem to be solved;
...break a complex problem into component parts that can be analyzed and solved separately;
...strive for accuracy and precision;
...work independently;
...work collaboratively;
...research an architectural project;
...design and present an effective architectural product;
...present a final architectural product for critique;
...develop preliminary sketches of a commercial or residential architectural design;
...develop building designs to ensure compatibility between interior and exterior to enhance overall appearance;
...develop details of floor and wall sections as required;
...demonstrate knowledge of the Americans with Disabilities Act; and
...assemble an architectural design in three dimensions.

  ...identify the nature of energy;
  ...relate potential energy, kinetic energy, and heat energy to conservation;
  ...create an energy model;
  ...evaluate different methods of energy transfer;
  ...recognize sustainable design as it relates to architectural design;
  ...define green architecture as related to the field of architecture.

**Interdisciplinary Correlations:**

**English:**

- **110.42 (b)(6)(A)(B)**
  …expand vocabulary through wide reading, listening, and discussing;
  …rely on context to determine meanings of words and phrases such as figurative language, idioms, multiple meaning words, and technical vocabulary;

- **110.42 (b)(7)(A)(I)(J)**
  …establish a purpose for reading such as to discover, interpret, and enjoy;
  …use study strategies such as skimming and scanning, note taking, outlining, and using study-guide questions to better understand texts;
  …read silently with comprehension for a sustained period of time;

**Teacher Preparation:**
Teacher should have on hand several complete sets of residential blueprints for the students to view. It is also very beneficial to have several scale models of the various homes for the students to view. This will help them understand and visualize spatial relationships as used in the construction trades.

**References:**
National Electrical Code (NEC)

Instructional Aids:
1. CADD program
2. Various illustrations of floor plans found in magazines, books, and professional journals
3. Residential blueprints
4. Scale models of homes
5. PowerPoints provided with this lesson and found in the teacher editions of many textbooks

Materials Needed:
1. Paper and pencil (pens are not acceptable for drafting and sketching)
2. Sketch pad (optional)
3. Notebook/folder to keep sketches, drawings, examples, hand-outs, and other class related materials
4. Architect’s Scale

Equipment Needed:
1. Computer with appropriate CADD software
2. Computer projection unit if available

Learner Preparation:
Have a working understanding of what the “Electrical Plan” is and why it is one of the most important portions of a set of blueprints.

Introduction

Introduction (LSI Quadrant I):
- **SAY:** Today we are going to discuss how to design and draw the electrical plan of your home.
- **ASK:** What specific electrical features would you like in your home?
- **ASK:** Why do you want …….in your home?
- **SHOW:** I have some examples of electrical plans for you to see today
- **ASK:** What appears to work and what doesn’t work?

Outline

Outline (LSI Quadrant II):
Instructors can use the PowerPoint presentation, slides, handouts, and note pages in conjunction with the following outline.
<table>
<thead>
<tr>
<th>MI</th>
<th>Outline</th>
<th>Notes to Instructor</th>
</tr>
</thead>
</table>
| I. | Residential Electrical Plan  
A. What is an electrical plan  
B. Describe and identify the features of an electrical plan  
1. Service entrance location and capacity  
2. Service meter and distribution panel location  
3. Placement and type of switches and plugs  
4. Location and type of lighting fixtures, special electrical equipment  
5. Number and types of circuits  
6. Electrical fixture schedule  
C. Identify typical electrical symbols found on the plan  
1. Ceiling outlet  
2. Thermostat  
3. 110v outlet  
4. 220v outlet  
5. All types of switches  
6. Flush mounted panel box  
D. Define the various terms used in the construction industry used to identify the various parts of the electrical plan | Teacher will begin PowerPoint presentation and discuss the features, symbols used, data for specific circuits, and terms.  
The teacher will show examples of electrical plans, blueprints, and scale models of homes to introduce the residential electrical plan lesson.  
Students can refer to textbook and PowerPoint slides for examples of electrical plans and standard symbols used.  
Teacher will distribute the handout “Terms used with the Electrical Plan”. |
| II. | Determine the style and the shape of your house.  
A. Consider the geographical location of the property it will be located on  
B. Consider your personal likes | Based on the illustrations from magazines, textbook, and discussion about reasons why certain styles are acceptable in certain areas of the country and not in others, students can determine the appropriate style.  
PowerPoint slides from this lesson and from textbook can be used to help with understanding. |
### III. Determine the total number of circuits in the house.  
- A. Determine where and why 220V circuits are located  
- B. Why you need numerous circuits  
- C. Establish data for specific circuits i.e., how many plugs, switches, outlets, fixtures etc. are on each circuit. Also the size of wire and the length of run.

Teacher shows blueprints and PowerPoint slides and discusses number of circuits needed, where they are located, and why numerous ones are needed. 
Teacher will discuss establishing data for specific circuits.

### IV. Students will make several sketches of the electrical plan in the house they want to build, identifying and locating the following:  
- A. Switches  
- B. Plugs  
- C. Lighting fixtures  
- D. Specialty equipment

As the students sketch, the teacher will say: Explain why certain electrical features are located where they are and are based on the guidelines listed in the textbook and local/state/national codes.

As the students sketch, the teacher will say: Explain why certain circuits are located where they are based on the guidelines listed in the textbook and local/state/national codes.

Teacher will use PowerPoint slides to show the steps for sketching the electrical plan.

Students will use pencil and paper to make sketches and refine their work into detailed sketch as the teacher will be checking with each to question aspects of the design.

### V. Students will use CADD program to draw the electrical plan they sketched and will  
- A. Dimension the drawing  
- B. Label the drawing  
- C. Establish the various types of fixtures used in the electrical schedule

Teacher will refer to PowerPoint for steps to draw the electrical plan.

Students take the final sketch and use CADD program to dimension and label drawing.

A Notebook or folder is maintained to keep sketches, drawings, examples, and handouts.
VI. Justify the plan
   A. Explain why parts of the electrical plan are located where they are based on the guidelines listed in the textbook and local/state/national codes.
   B. Explain why certain circuits are located where they are based on the guidelines listed in the textbook and local/state/national codes.

Teacher has students refer to textbook and then justify their plan through discussion.

VII. Students will review in one of the following ways:
   A. Taking the Electrical Plan Pop Quiz
   B. Answering questions at the end of the textbook chapter on “The Electrical Plan”

The teacher may choose which method for informal review to use.

Application

Guided Practice (LSI Quadrant III):
The students are to make a rough sketch of the house they want to build using pencil and paper. As the student is doing the sketch, the teacher will be checking with each to question the various aspects of design. This is a very good place where critical thinking comes in to play. The “WHY” is discussed and examined to make sure that all aspects of the drawing/design are functional.

Teacher will say: Explain why certain electrical features are located where they are and are based on the guidelines listed in the textbook and local/state/national codes.

Teacher will say: Explain why certain circuits are located where they are based on the guidelines listed in the textbook and local/state/national codes.

Independent Practice (LSI Quadrant III):
The student is to refine work into a detailed sketch showing the location of major fixtures and appliances (freezers, cook stoves, heaters, etc). Several trial and error drawings may be needed before one has a completed acceptable design. Next the student will use CADD program to draw the electrical plan they have sketched, dimension, and label the drawing.

Summary
Review (LSI Quadrants I and IV):  
The students will review by answering the questions at the end of the chapter on “The Electrical Plan” from the textbook.

**Evaluation**

**Informal Assessment (LSI Quadrant III):**  
The students will be given a pop quiz on the elements that constitute an “Electrical Plan”

**Pop Quiz:**
1. What is an Electrical Plan?  
2. List what information is necessary to have on an Electrical Plan.  
3. Why is it important to show where permanent appliances are to be located?  
4. Sketch the symbols for the following: ceiling outlet, thermostat, 110v outlet, 220v outlet, all types of switches, flush mounted panel box.

**Formal Assessment (LSI Quadrant III, IV):**  
The students will complete the “Electrical Plan” of the house they have been working on showing the locations of major appliances and other fixtures (switches, plugs, etc.) of the house by meeting the guidelines in their textbook and local/state/national codes; and the rubric provided with this lesson.

**Extension**

**Extension/Enrichment (LSI Quadrant IV):**
A. Have contractors/architects come and visit your class to explain and answer questions the students might have about floor plans and construction in general. This is a good place for you to introduce your students to the construction trades as a profession.  
B. Field trips to construction sites are invaluable when it comes to actually showing real life applications for this area of employment.  
C. Once all guidelines are met and the plan is complete, the student can use this plan to take to any architect or contractor who will be able to use their electrical plan to build a home from their set of blueprints. They can go to the various contractors and receive bids as to what the cost of their home should be, all based on their plan.
Terms used with the Electrical Plan

Define the various terms used in the construction industry to identify the various parts of the electrical plan.

A. Switches – The instruments used to turn on/off lighting and appliances.

B. Plugs – The same as outlets.

C. 110v outlet – The place where 110V electricity is available for service.

D. 220v outlet – The place where 220V electricity is available for service.

E. Ceiling outlet fixtures – Lighting units that are mounted on the ceiling.

F. Television jacks – The place, usually on a wall, where television service is connected and you plug into your television.

G. Service entrance – Where electricity enters the house.

H. Service meter – The instrument placed on a location used to measure the amount of electricity used.

I. Distribution panel – The panel from which all connections for wiring originate.

J. Thermostat – The instrument used to control the temperature.
Electrical Plan Pop Quiz

1. What is an Electrical Plan?

2. Why is it important to show where permanent appliances are to be located?

3. Sketch the symbols for the following:
   A. Ceiling outlet
   B. Thermostat
   C. 110v outlet
   D. 220v outlet
   E. Flush mounted panel box
   F. Single-pole switch
   G. Double-pole switch
   H. Three-way switch
   I. Four-way switch
J. Weatherproof switch

K. Low-voltage switch

L. Dimmer switch

M. Special switch
Electrical Plan Pop Quiz Answers

1. What is an Electrical Plan? This is the plan that shows where all things relating to wiring of the house are shown...i.e., plugs, switches, TV, computers, etc.

2. Why is it important to show where permanent appliances are to be located? Because this is an area in which a dedicated circuit is placed for that specific appliance and it usually requires special wiring.

3. Sketch the symbols for the following: (See page 2 for correct symbols.)
   
   A. Ceiling outlet
   B. Thermostat
   C. 110v outlet
   D. 220v outlet
   E. Flush mounted panel box
   F. Single-pole switch
   G. Double-pole switch
   H. Three-way switch
   I. Four-way switch
   J. Weatherproof switch
   K. Low-voltage switch
   L. Dimmer switch
   M. Special switch
# The Electrical Plan Rubric

**Task Statement:** Design and draw a residential electrical plan for a house you choose.

**Task Assignment:** Show the features and typical electrical symbols used; establish data for specific circuits; and meet guidelines that must be met.

### Concepts/Skills to be Assessed:

<table>
<thead>
<tr>
<th><strong>Criteria Categories</strong> (Novice to Exemplary)</th>
<th><strong>Novice 1</strong></th>
<th><strong>Developing 2</strong></th>
<th><strong>Accomplished 3</strong></th>
<th><strong>Exemplary 4</strong></th>
<th><strong>Points Earned</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Considering the guidelines that must be met in textbook and local/state/national codes</td>
<td>Little regard has been given to the guidelines that must be met in textbook and local/state/national codes (1-5 points)</td>
<td>50% consideration has been given to the guidelines that must be met in textbook and local/state/national codes (5-10 points)</td>
<td>100% consideration has been given to the guidelines that must be met in textbook and local/state/national codes (10-15 points)</td>
<td>Electrical plan meets all guidelines that must be met in textbook and local/state/national codes and enhances the property aesthetically (15-20 points)</td>
<td></td>
</tr>
<tr>
<td>Determining the location and capacity of the features, and establishing data for specific circuits used in your electrical plan, meeting guidelines that must be met</td>
<td>70% determination has been made for location and capacity of the features and data for specific circuits; with little consideration given to guidelines (1-5 points)</td>
<td>80% determination has been made for location and capacity of the features, and data for specific circuits; meeting most guidelines (5-10 points)</td>
<td>90% determination has been made for location and capacity of the features, and data for specific circuits; meeting all guidelines (10-15 points)</td>
<td>100% determination has been made for location and capacity of the features, and data for specific circuits; meeting all guidelines (15-20 points)</td>
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<tr>
<td>Using proper techniques to draw the correct symbols for the features used in your electrical plan</td>
<td>Evidence that some of the correct symbols for features in the electrical plan have been used (1-5 points)</td>
<td>Consideration for using correct symbols for features in the electrical plan is seen (5-10 points)</td>
<td>Effective use of correct symbols for features in the electrical plan is seen (10-15 points)</td>
<td>Excellent use of all correct symbols for features in the electrical plan is seen (15-20 points)</td>
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<tr>
<td>Dimensioning and labeling the drawing</td>
<td>Evidence of understanding of dimensioning is present with some labeling of features present (1-5 points)</td>
<td>Some dimensioning is evident and a few features are labeled (5-10 points)</td>
<td>Drawing has effective dimensioning with most features labeled correctly (10-15 points)</td>
<td>Drawing has accurate dimensioning with all features labeled correctly (15-20 points)</td>
<td></td>
</tr>
<tr>
<td>Justifying electrical plan</td>
<td>Little to no evidence shown for the ability to justify aspects of the plan (1-5 points)</td>
<td>Emerging ability to justify why fixtures are located where and circuits used for them (5-10 points)</td>
<td>Ability to justify why fixtures are located where and circuits used for them (10-15 points)</td>
<td>Excellent ability to justify why fixtures are located where and circuits used for them (15-20 points)</td>
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</tr>
</tbody>
</table>

A = 75-100 Points; B = 50-75 Points; C = 25-50 Points; D = 5-25 Points

**Total Points:**

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