

COURSE OUTLINE

BLUEPRINT READING FOR ELECTRICIANS

Course Title

BP116

Dept & Course No.

I. COURSE DESCRIPTION

This course is designed to enable students to learn electrical blueprint reading and at the same time receive exposure to and become familiar with applicable sections of the most recent National Electrical Code (NEC). It covers single and multi-family dwellings; commercial, industrial, specialized and hazardous location.

III. SEMESTER CREDIT: 3

IV. CONTACT HOURS PER WEEK:

<u>3</u>	<u>0</u>	<u>3</u>
Lecture	Lab	Total

V. PREREQUISITE: None

VI. STUDENT LEARNING OUTCOMES:

Upon completion of the course, the students will be able to, with 65% accuracy to:

A. Read and interpret electrical blueprint based on the NEC requirements

B. Calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used.

VII. COURSE CONTENT

A. Static machine and Dynamic machine

1. Print Reading
 - a. Purpose of Prints
 - b. Drafting
 - c. 3. Blueprint
2. Drawing Set
 - a. Plot Plan
 - b. Plan
 - c. Elevations
 - d. Sections
 - e. Details
 - f. Specification
 - g. Perspectives
3. Symbols, Notation and Materials
 - a. Symbols
 - b. Notations
 - c. Devices
 - d. Materials
4. Print reading
 - a. NEC requirements
 - b. Using the NEC
 - c. Applying the NEC
 - d. Print readings

B. Dwelling Units

2. Single family dwelling units
 - a. Service entrance
 - b. Disconnecting means
 - c. Service details
 - d. Service grounding
 - e. Groundings system
 - f. Circuits breakers and Fuse
 - g. Conductor enclosure
 - h. Lighting fixture, lamp holder
 - i. And receptacles

- j. Wall-mount oven and countertop
- k. Ranges
- 3. Multiple family dwelling units
 - a. Conductor
 - b. Apartments-Floor Plan
 - c. Load calculations
 - d. Service Calculations
 - e. Service for multiple occupancy
 - f. Buildings
 - g. Service-lighting and appliance
 - h. Panel board
 - i. Services and Feeders
 - j. Distribution panel board
 - k. Grounding System
 - l. Special purpose outlets
 - m. Voltage Drop

C. Calculate loads for commercial and industrial installations and identify devices and materials used.

C. Commercial/Industrial locations

- 1. Commercial locations
 - a. Excerpts from specification
 - b. Electrical plans
 - c. Floor plans
 - d. Feeder riser diagram
 - e. Switchboard
 - f. Services entrances
 - g. Panel board
 - h. GFCI
 - i. Conductor and Enclosure
 - j. Circuit breaker and Fuse
 - k. Solar Photovoltaic System
- 2. Industrial Locations
 - a. Power installation for industrial plant
 - b. Motor circuits and other circuits
 - c. Power installation for restaurant
 - i. Circuit analysis
 - ii. Service calculation
 - d. Switchboards
 - e. Motors and disconnecting means
 - f. Motor controllers
 - g. Transformer types

D. Identify hazardous locations and determine the methods used to reduce the hazard

D. Hazardous locations

- 1. Classes of Hazardous
- 2. Hazardous (classified) Location
- 3. Commercial garages
- 4. Aircraft hanger
- 5. Gasoline dispensing and Service Station
- 6. Bulk storage plants

E. Design an electrical blueprint using computer assisted software.

E. Designing electrical blueprint using computer assisted software

- 1. Visio 2010
- 2. AutoCAD
- 3. The Constructor 10

VIII. MATERIALS AND EQUIPMENT

- A. Personal computer
- B. Printing materials
- C. Printer
- D. Pencil
- E. Ruler
- F. Triangles

IX. TEXT AND REFERENCES

- A. Required Text
R. T Miller. Printreading based on the ²⁰¹⁷ ~~2011~~ NEC; Homewood, Illinois American Technical Inc, 2011
- B. Supplementary Reference
Mark W. Early NEC 2011 Hand Book; Quincy, Massachusetts , National Fire Protection Association Inc, 2011

X. METHOD OF INSTRUCTION

- A. Lecture-discussion
- B. Demonstration
- C. Laboratory Performance

XI. METHOD OF EVALUATION

- A. Knowledge will be evaluated using the following methods:
 - 1. Written test
 - 2. Graded recitation/Oral presentation
 - 3. Instructor's Interview
- B. Skills will be evaluated using the following criteria:
 - 1. Accuracy
 - 2. Techniques
 - 3. Appearance
 - 4. Time lines/Completion
- C. Final grade is computed and weighted using the following criteria:

Class participation.....	10%
Quizzes/Short Tests.....	30%
Midterm/Final Exams.....	20%
Performance.....	<u>40%</u>
TOTAL	100%

- D. Transmutation of total percent to letter grade:

90-100%.....	A
80-89%.....	B
70-79%.....	C
65-69%.....	D
00-64%.....	F

Palau Community College
 BPI 16 BLUEPRINT READING FOR ELECTRICIANS
 Course Learning Outcomes

During the course experience, the **course learning outcomes** (CLO) will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical rating of 4,3,2 and 1 are not intended to represent the traditional school grading system of A, B, C, D and F. The descriptions associated with each of the numbers focus on the level of student performance for each of the course learning outcome listed below.

- Rating Scale:
- 5. Excellent
 - 4. Above average
 - 3. Average
 - 2. Below Average
 - 1. Unacceptable

CLO 1: Read and interpret electrical blueprint based on the NEC requirements

5	The student is able to read and interpret electrical blueprint based on the NEC requirements without any supervision and instruction
4	The student is able to read and interpret electrical blueprint based on the NEC requirements with limited supervision but no instruction
3	The student is able to read and interpret electrical blueprint based on the NEC requirements with limited supervision and limited instruction
2	The student has difficulty reading and interpreting electrical blueprint based on the NEC requirements and requires considerable supervision and instruction
1	The student is unable to read and interpret electrical blueprint based on the NEC requirements even with supervision and instruction.

CLO 2: Calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used.

5	The student is able to calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used without any supervision and instruction
4	The student is able to calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used with limited supervision but no instruction
3	The student is able to calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used with limited supervision and limited instruction
2	The student has difficulty to calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used and require considerable supervision and instruction
1	The student is unable to calculate the loads for single and multi-family dwelling installations and identify electrical devices and materials used even with supervision and instruction.

CLO 3: Calculate loads for commercial and industrial installations and identify devices and materials used

5	The student is able to calculate loads for commercial and industrial installations and identify devices and materials used without any supervision and instruction
4	The student is able to calculate loads for commercial and industrial installations and identify devices and materials used with limited supervision but no instruction
3	The student is able to calculate loads for commercial and industrial installations and identify devices and materials used with limited supervision and limited instruction
2	The student has difficulty to calculate loads for commercial and industrial installations and identify devices and materials used and require considerable supervision and instruction
1	The student is unable to calculate loads for commercial and industrial installations and identify devices and materials used even with supervision and instruction.

CLO 4: Identify hazardous locations and determine the methods used to reduce the hazard

5	The student is able to identify hazardous locations and determine the methods used to reduce the hazard without any supervision and instruction
4	The student is able to identify hazardous locations and determine the methods used to reduce the hazard with limited supervision but no instruction
3	The student is able to identify hazardous locations and determine the methods used to reduce the hazard with limited supervision and limited instruction
2	The student has difficulty to identify hazardous locations and determine the methods used to reduce the hazard and requires considerable supervision and instruction
1	The student is unable to identify hazardous locations and determine the methods used to reduce the hazard even with supervision and instruction.

CLO 5: Design an electrical blueprint using computer assisted software

5	The student is able to design an electrical blueprint using computer assisted software without any supervision and instruction
4	The student is able to design an electrical blueprint using computer assisted software with limited supervision but no instruction
3	The student is able to design an electrical blueprint using computer assisted software with limited supervision and limited instruction
2	The student has difficulty to design an electrical blueprint using computer assisted software and requires considerable supervision and instruction
1	The student is unable to design an electrical blueprint using computer assisted software.

MARKING SHEET
BP 116 – Blueprint Reading for Electricians

Name of student: _____

Instructor: _____

CRITERIA	ALLOTED POINTS	GAINED POINTS
CLO1 – READ AND INTERPRET ELECTRICAL BLUEPRINT BASED ON THE NEC REQUIREMENTS		
1. Electrical components are recognized through standard electrical symbols drawn in the blueprint.	10	
2. Connections between electrical components are identified through the kind of lines used in the blueprint.	10	
3. Standard electrical symbols are distinguished according to their use.	10	
TOTAL GAINED POINTS		
CLO2 – CALCULATE THE LOADS FOR SINGLE AND MULTI-FAMILY DWELLING INSTALLATIONS AND IDENTIFY ELECTRICAL DEVICES AND MATERIALS USED		
1. Size of small appliance branch circuit conductor is identified by calculating the branch circuit loads according to NEC requirements.	10	
2. Size of general lighting branch circuit conductor is identified by calculating the total lighting circuit loads according to NEC requirements.	10	
3. Size of service entrance conductor is identified using demand factor required by NEC.	10	
4. Size of branch circuit overcurrent protective device is determined according to NEC requirements.	10	
5. Size of main service equipment protective device is determined according to NEC requirements.	10	
6. Sizes of conduit pipes are determined according to NEC requirements.	10	
TOTAL GAINED POINTS		
CLO3 – CALCULATE LOADS FOR COMMERCIAL AND INDUSTRIAL INSTALLATIONS AND IDENTIFY DEVICES AND MATERIALS USED.		
1. Size of branch circuit conductor for a single motor load is identified according to NEC requirements.	10	
2. Size of overcurrent protective device for a single motor load is identified according to NEC requirements.	10	
3. Overload trip setting is identified according to NEC requirements.	10	
4. Size of main feeder conductor for multiple motor loads is identified according to NEC requirements.	10	
5. Size of main feeder overcurrent protective device for multiple motor loads is identified according to NEC requirements.	10	
6. Sizes of conduit pipes are determined according to NEC requirements.	10	
TOTAL GAINED POINTS		
CLO4 – IDENTIFY THE HAZARDS, GIVEN THE TYPE OF INSTALLATION		
1. Given the different types of installations, hazardous locations are identified according to NEC standards.	10	
2. Electrical installation requirement for the identified hazardous location is determined according to NEC requirement.	10	
3. Type of materials appropriate for the given hazardous location is identified according to NEC requirements.	10	
TOTAL GAINED POINTS		
CLO5 – GIVEN THE TYPE OF INSTALLATION AND PLANS, DESIGN USING COMPUTER ASSISTED PROGRAM TO COMPLETE THE DRAWING		
1. Electrical symbols used in the blueprint are in accordance with National	10	

Electrical Code Standards.		
2. Symbols are drawn neatly and precisely.	10	
3. Lines used to connect electrical components are drawn in parallel/90° (when appropriate) with the building envelope according to best practices.	10	
4. Different parts of electrical blueprint are drawn according to NEC standards.	10	
TOTAL GAINED POINTS		

MARKING GUIDE
BP 116 – Blueprint Reading for Electricians

CRITERIA
CLO1 – READ AND INTERPRET ELECTRICAL BLUEPRINT BASED ON THE NEC REQUIREMENTS
1. Electrical components are recognized through standard electrical symbols drawn in the blueprint. <ul style="list-style-type: none"> • 2 points deduction for every electrical symbol not recognize in the blueprint.
2. Connections between electrical components are identified through the kind of lines used in the blueprint. <ul style="list-style-type: none"> • 2 points deduction for every improper use of lines
3. Standard electrical symbols are distinguished according to their use. <ul style="list-style-type: none"> • 2 points deduction for every improper use of lines
CLO2 – CALCULATE THE LOADS FOR SINGLE AND MULTI-FAMILY DWELLING INSTALLATIONS AND IDENTIFY ELECTRICAL DEVICES AND MATERIALS USED
1. Size of small appliance branch circuit conductor is identified by calculating the branch circuit loads according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every improper size of conductor.
2. Size of general lighting branch circuit conductor is identified by calculating the total lighting circuit loads according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every improper size of conductor.
3. Size of service entrance conductor is identified using demand factor required by NEC. <ul style="list-style-type: none"> • 2 points deduction for every improper use of demand factor.
4. Size of branch circuit overcurrent protective device is determined according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every improper selection of branch circuit overcurrent device.
5. Size of main service equipment protective device is determined according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every NEC violation in determining main service equipment protective device.
6. Sizes of conduit pipes are determined according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every improper size of conduit selected.
CLO3 – CALCULATE LOADS FOR COMMERCIAL AND INDUSTRIAL INSTALLATIONS AND IDENTIFY DEVICES AND MATERIALS USED.
1. Size of branch circuit conductor for a single motor load is identified according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every NEC violation in determining size of branch circuit conductor.
2. Size of overcurrent protective device for a single motor load is identified according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every NEC violation in identifying size of overcurrent protective device.
3. Overload trip setting is identified according to NEC requirements. <ul style="list-style-type: none"> • 2 points deductions for every NEC violation in identifying overload trip setting.
4. Size of main feeder conductor for multiple motor loads is identified according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every NEC violation in determining main service equipment protective device.
5. Size of main feeder overcurrent protective device for multiple motor loads is identified according to NEC requirements. <ul style="list-style-type: none"> • 2 points deduction for every NEC violation in determining main service equipment protective device.

6. Sizes of conduit pipes are determined according to NEC requirements.
- 2 point deductions for every NEC violation in determining sizes of conduit pipes.

CLO4 – IDENTIFY THE HAZARDS, GIVEN THE TYPE OF INSTALLATION

1. Given the different types of installations, hazardous locations are identified according to NEC standards.
 - 2 point deductions for every unidentified hazardous location.
2. Electrical installation requirement for the identified hazardous location is determined according to NEC requirement.
 - 2 point deductions for every NEC electrical installation requirement missed.
3. Type of materials appropriate for the given hazardous location is identified according to NEC requirements.
 - 2 point deductions for every inappropriate type of materials selected.

CLO5 – GIVEN THE TYPE OF INSTALLATION AND PLANS, DESIGN USING COMPUTER ASSISTED PROGRAM TO COMPLETE THE DRAWING

1. Electrical symbols used in the blueprint are in accordance with National Electrical Code Standards.
 - 2 point deductions for every electrical symbol used which does not conform to NEC Standards.
2. Symbols are drawn neatly and precisely.
 - 2 point deductions for every NEC symbol untidy and imprecisely drawn
3. Lines used to connect electrical components are drawn in parallel/90o (when appropriate) with the building envelope according to best practices.
 - 2 point deductions for every line drawn unparallel to the building envelops.
4. Different parts of electrical blueprint are drawn according to NEC standards.
 - 2 point deductions for every missed part of electrical blueprint.