Northwest State Community College  
Course Information Sheet

# Course Information

Title: Industrial Electricity 1B

Course Number: PLC 121

Credit Hours: 1

Pre-requisite: PLC 120

# Description

This is the second course in a sequence of 3 one credit hour courses. These three courses together are equivalent to IND 120 Industrial Electricity. This is an introductory course on the study of basic electrical concepts and circuits. The course will be based on Direct Current (DC) and Alternating Current (AC) concepts, terminology, components, and basic series/parallel circuits. Students will learn how to calculate and measure voltage, current, and resistance in basic series and parallel circuits. Students will learn how to utilize a Digital Multi-meter (DMM) to troubleshoot components in an electrical circuit, and test stand-alone components. The students will be introduced to DC and AC relay circuits, as well as electrical symbols that will be used on electrical prints. The course will have a heavy focus on troubleshooting concepts and techniques when working with electrical circuits.

# Learning Outcomes

Upon completion of this course the students will be able to:

1. Apply capacitors and inductors in electric circuits
2. Apply voltage divider circuits
3. Apply Alternating Current concepts.
4. Apply DC & AC relays, and solenoids

# Required Material

**Text:**

DC Circuit Fundamentals Author: Lab-Volt; - ISBN: 978555000084

AC Circuit Fundamentals Author: Lab-Volt; ISBN: 978000088

**Supplies:**

Calculator

Safety Eyewear

DMM

Wire Strippers

Wiring Kit

# Industrial Electricity 1B Module 1 - Voltage Dividers, Capacitors, and Inductors

This module will introduce the students to voltage divider circuits.  Students will learn how to calculate and measure voltage drops in a series circuit.  Potentiometers and rheostats will be used in these circuits.  Students will also be introduced to capacitors, both from an operational and application aspect.  More focus will be on troubleshooting.

Upon completion of this module the student will be able to:

1. Explain the purpose of a voltage divider in a DC circuit
2. Wire a voltage divider circuit with two resistors
3. Calculate the voltage drop on each resistor in a voltage divider circuit
4. Measure the voltage drop on each resistor in a voltage divider circuit
5. Wire a voltage divider circuit with a resistor and a potentiometer
6. Explain the purpose of capacitors and inductors in a DC circuit
7. Wire a capacitor together with a resistor in a DC circuit
8. Measure the voltage drop on the resistor in a DC circuit

### Module 1 Activities

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 Read DC Circuit Fundamentals, pages 111-116 - Exercise 6 (Solving Series Circuits and Krichhoff's Voltage Law) Text Book

 Watch video: The Purpose of Voltage Divider Circuits (8:51)

<https://www.youtube.com/watch?v=zuG7BLjDYbg>

 Watch video: Basic Voltage Divider Calculations (5:18)

<https://www.youtube.com/watch?v=u8pAGROJ5N4>

 Read DC Circuit Fundamentals, pages 167-180 - Exercise 8 (DC Capacitors)

Text Book

 Read DC Circuit Fundamentals, pages 195-201 - Exercise 9 (Electromagnetism)

Text Book

 Complete Quiz 121-1

See Quiz INT121-1 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 121-1.1, Lab 121-1.2, Lab 121-1.3, and Lab 121-1.4

See Lab Documents

 Schedule and complete Hands-on Lab 121-1.1

See INT121 1.1 Lab Document

 Schedule and complete Hands-on Lab 121-1.2

See INT121 1.2 Lab Document

 Schedule and complete Hands-on Lab 121-1.3

See INT121 1.3 Lab Document

 Schedule and complete Hands-on Lab 121-1.4

See INT121 1.4 Lab Document

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# Industrial Electricty 1B Module 2: Alternating Current Basics

This module will introduce the student to AC current concepts and applications.  Students must learn how to calculate Vpeak, Vpeak-peak and Vrms.  Students will also learn how frequency works and why that will be useful for future courses.  Transformers will be introduced, as well the purpose and application of transformers.

Upon completion of this module the student will be able to:

1. Calculate the Peak voltage from an RMS measurement using a DVM
2. Test the voltage on a 120VAC outlet.
3. Identify the hot, neutral and grounding wire connections on a 120VAC outlet
4. Explain the difference between a short circuit and an overload
5. Wire up an overload condition circuit to demonstrate and explain
6. Explain the continuity between a transformer primary and secondary
7. Measure the AC voltage on the primary/secondary of a transformer
8. Wire a basic transformer circuit with 2 resistive loads on the secondary
9. Explain the relationship between current and voltage on a transformers’ primary and secondary winding

### Module 2 Activities

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 Read AC Circuit Fundamentals, pages 1-10 - Exercise 1 (AC Circuits and AC Capacitors)

Text Book

 Watch video: Reading AC & DC Voltage on a Scopemeter (5:28)

<https://www.youtube.com/watch?v=YVjparEAU3Q>

 Read AC Circuit Fundamentals, pages 51-62 - Exercise 3 (Transformers)

Text Book

 Read DC Circuit Fundamentals, pages 89-105 - Exercise 6 (Electrical Distribution)

Text Book

 Complete Quiz 121-2

See Quiz INT121-2 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 121-2.1, Lab 121-2.2 and Lab 121-2.3

See Lab Documents

 Schedule and complete Hands-on Lab 121-2.1

See INT121 2.1 Lab Document

 Schedule and complete Hands-on Lab 121-2.2

See INT121 2.2 Lab Document

 Schedule and complete Hands-on Lab 121-2.3

See INT121 2.3 Lab Document

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# Industrial Electricty 1C Module 3: DC & AC Relay, Circuits, and Solenoids

This module will overview the operation and application of relays used in an industrial environment. Parts on the relay will be discussed, as well as how to troubleshoot the components on a relay.  The operation of N.O. and N.C. contacts on a relay is critical for this and future courses.

Upon completion of this module the student will be able to:

1. Wire a relay in both an AC and DC circuit
2. Identify and measure the resistance of the coil and contacts of a relay
3. Troubleshoot a relay circuit with a DVM
4. Wire a relay circuit controlling two indicator lights
5. Wire a relay circuit controlling a small DC motor
6. Measure and explain the difference between a N.O and N.C. contacts

### Module 3 Activities

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 Read DC Circuit Fundamentals, pages 217-226 - Exercise 10 (DC Relays)

Text Book

 Read AC Circuit Fundamentals, pages 75-83 - Exercise 4 (AC Relays and Contactors)

Text Book

 Watch video: Relay Basics (11:45)

<https://www.youtube.com/watch?v=q-dZ0Gr7W6c>

 Complete Quiz 121-3

See Quiz INT121-3 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 121-3.1, Lab 121-3.2, and Lab 121-3.3

See Lab Documents

 Schedule and complete Hands-on Lab 121-3.1

See INT121 3.1 Lab Document

 Schedule and complete Hands-on Lab 121-3.2

See INT121 3.2 Lab Document

 Schedule and complete Hands-on Lab 121-3.3

See INT121 3.3 Lab Document

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