Northwest State Community College  
Course Information Sheet

# Course Information

Title: Industrial Electricity 2A

Course Number: PLC 123

Credit Hours: 1

Pre-requisite: PLC122

# Description

The purpose of PLC 123 is to develop the student’s knowledge and skills in the area of electrical safety, DC/AC machines, and basic control circuits. The electrical safety module will focus on lockout/tagout, arc-flash standards, PPE, electrical panels, and overcurrent protection. The DC/AC machines will focus on the wiring and troubleshooting of DC shunt motors, single phase motors (split-phase, capacitor-start, and permanent capacitor), dual voltage transformers, and three phase motors. The basic control circuits will consist of start/stop/jog, dual start/stop, sequence circuits, and reversing circuits. There will also be a module focused on the installation of a PLC system (based on the Micrologix 1200 PLC). Students will learn how to utilize test equipment and electrical prints to troubleshoot electrical systems.

# Learning Outcomes

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

1. Explain the NFPA Basic Safe Electrical Work Practices
2. Install fuses and circuit breakers in an industrial environment
3. Troubleshoot fuses and circuit breakers in an industrial environment
4. Install DC/AC industrial motors
5. Troubleshoot DC/AC industrial motors

# Required Material

**Text:**

Electrical Motor Controls (For Integrated Systems), 5th Edition, by Gary Rockis & Glen Mazur.   
ISBN: 978-0-8269-1226-8

Ugly’s Electrical References, 2020 Edition.  
ISBN: 978-1284194531

**Supplies:**

Calculator

Safety Eyewear

Wire Strippers

Wiring Kit

# Module 1 - Safety, Arc Flash & Fuseology

Module 1 will overview basic electrical safety concepts of lockout & tagout, as well as arc flash basics for a safe electrical workplace.  Determining what level of Personal Protective Equipment is needed on the job will be discussed.  Students will also learn the basics of fuseology, focusing on testing and replacing fuses and circuit breakers in electrical panels.

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

1. Demonstrate how to lockout an electrical panel
2. Interpret the electrical panel label for shock and arc data
3. Identify various PPE levels and equipment
4. Demonstrate using the PPE equipment at various arc levels
5. Identify the proper electrical test equipment to use for indoor/outdoor work
6. Test a fuse out of circuit
7. Test a fuse in a live circuit
8. Open a dead panel to access the fuses on a disconnect
9. Open a live panel by overriding door latch for troubleshooting
10. Properly replace a blown fuse in a bus plug or electrical panel

### Module 1 Activities

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 Read Electrical Motor Controls, pages 87-111 - Electrical Safety

Text Book

 Read Electrical Motor Controls, pages 74-74 - Test Equipment, Troubleshooting fuses

Text Book

 Review PowerPoint: Electrical Safety

<https://www.osha.gov/sites/default/files/2018-12/fy07_sh-16615-07_electrical_hazards2.ppt>

<https://www.youtube.com/watch?v=wal2KP1bbIY>

 Review PowerPoint: Lock out / Tag out

<https://www.youtube.com/watch?v=is77KiZ16_o> Video in PowerPoint

 Review PowerPoint: Personal Protective Equipment

<https://www.youtube.com/watch?v=NV2cNmfK8_Y>

<https://www.youtube.com/watch?v=nn4HgNjlJtc>

<https://www.osha.gov/personal-protective-equipment>

<https://www.youtube.com/watch?v=FmlMnPOt6Nc>

 Review PowerPoint: Fire Safety

<https://www.pawlingfire.org/content/training/file/Fire_Extinguisher_Training.ppt>

<https://www.youtube.com/watch?v=qPzjwqDpG8g>

 Review PowerPoint: Confined Spaces Safety

<https://www.osha.gov/sites/default/files/2018-12/fy11_sh-22248-11_9_AWARE_Confined_Space.ppt>

 Review handout: ABCs of multimeter safety

<https://assets.tequipment.net/assets/3/7/ABC-meter-safety.PDF>

 Review PowerPoint: Fuses

<https://www.eaton.com/content/dam/eaton/products/electrical-circuit-protection/fuses/solution-center/bus-ele-tech-lib-dual-element-fuses.pdf>

 Complete Quiz 123-1

See Quiz INT123-1 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 123-1.1

See Lab Documents

 Schedule and complete Hands-on Lab 123-1.1

See INT123 1.1 Lab Document

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# Module 2 - DC/AC Machines I (DC Shunt Motors)

Module 2 will introduce the student to basic DC rotating machines, that will be connected as DC Shunt Motors.  Students will learn the basics of magnetism and how it is used to make rotating machines run.  Students will learn the components, the connections and safety of working with the DC motors.  Both the self-excited and separately-excited motors will be used in this module.  Students will also be required to interpret the motor nameplate data and do basic troubleshooting.

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

1. Wire a DC self-excited shunt motor
2. Explain the current/voltage change as a DC motor is mechanically loaded
3. Wire a DC separately-excited shunt motor
4. Explain how to vary the speed of a DC motor
5. Reverse a DC self-excited and separately excited shunt motor
6. Interpret the nameplate information on a DC motor
7. Load a DC motor and explain the meter readings (load vs. current)
8. Interpret the nameplate information on a DC motor
9. Explain how the speed of the motor is varied with armature & field current
10. Troubleshoot a DC shunt motor circuit

### Module 2 Activities

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 Read Electrical Motor Controls, pages 273-282 - DC Motors

Text Book

 Watch video: DC Motor Basics (3:33)

<https://www.youtube.com/watch?v=1AaUK6pT_cE>

 Review website: Electropaedia - Electric Drives - DC Motors

<https://www.mpoweruk.com/motorsdc.htm>

 Review PowerPoint: DC Motors

<https://www.slideshare.net/slideshow/presentation-on-dc-motors/87855540>

 Complete Quiz 123-2

See Quiz INT123-2 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 123-2.1, Lab 123-2.2 and Lab 123-2.3

See Lab Documents

 Schedule and complete Hands-on Lab 123-2.1

See INT123 2.1 Lab Document

 Schedule and complete Hands-on Lab 123-2.2

See INT123 2.2 Lab Document

 Schedule and complete Hands-on Lab 123-2.3

See INT123 2.3 Lab Document

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