

Industrial Equipment Mechanisms/Industrial Electricity

Course Outcome Summary

Course Information

Organization	Madison Area Technical College
Developers	Paul Harrison
Development Date	1/7/2002
Course Number	32-462-303
Instructional Level	Two-Year Technical Diploma
Potential Hours of Instruction	180
Total Credits	5

Description

This course involves the study of the basic principles of physics specific to electro-mechanical systems. Emphasis is on measurement, lubrication, energy, power, machines, and fluid and chemical properties. Installation, timing and synchronization of machine drive components are also identified. Disassembly and assembly of industrial components with hands-on application are conducted. AC power distribution and control topics are enhanced with the study of motors, transformers and various electro-mechanical devices. The programmable logic controller is introduced in the on/off mod

Types of Instruction

Instruction Type	Contact Hours	Credits
Classroom Presentation	90	5
On-Campus Lab	90	

Textbooks

George V. Hart. *Ugly's Electrical References*. United Printing Arts. 1978. **Unit Price:** 10.00. **ISBN:** 0-9623229-2-X. **Source:** Book Store.

Gary Rockis. *Electrical Motor Controls*. ATP. 2001. **ISBN:** 0-8269-1675-9. **Source:** Book Store.

Gary Rockis. *Electrical Motor Controls Workbook*. ATP. 2001. **ISBN:** 08269-1676-7. **Source:** Book Store.

Stephen Herman. *Delmar's Standard Textbook of Electricity*. Delmar Publisher Inc.. 1999. **ISBN:** 0-8273-8550-1.

Learner Supplies

Safety glasses. **Manufacturer:** ---. **Quantity:** 1.

Calculator. **Manufacturer:** ---. **Quantity:** 1.

3 ring binder. **Manufacturer:** ---.

Prerequisites

Second semester standing or Instructors consent.

Exit Learning Outcomes

Core Abilities

- A. Demonstrate critical thinking
- B. Use science and technology

Standards

Adapt

Apply NEC coded to

Competencies

A. Demonstrate Power Quality fundamentals

Competence will be demonstrated:

- 1. through written exam
- 2. through lab performance

Criteria - Performance will be satisfactory when:

- 1. learner distinguishes power quality issues
- 2. learner applies power quality analysis to industrial applications
- 3. learner demonstrates use of power quality instrumentation - voltage analysis
- 4. learner demonstrates use of power quality instrumentation - Harmonics
- 5. learner demonstrates use of power quality instrumentation - load balance
- 6. learner demonstrates use of power quality instrumentation - Power factor

B. Appraise industrial measurement

Competence will be demonstrated:

- 1. by completing measurement hand-outs

Criteria - Performance will be satisfactory when:

- 1. learner calculates measurements using micrometer
- 2. learner calculates measurements using vernier caliper.
- 3. learner calculates measurements using tape-measure.

C. Ascertain types of simple machine

Competence will be demonstrated:

- 1. through written exam
- 2. through lab performance

Criteria - Performance will be satisfactory when:

- 1. learner calculate mechanical advantage
- 2. learner distinguishes 3 classes of levers
- 3. learner identifies incline plane

D. Interpret relay logic diagrams.

Competence will be demonstrated:

- 1. quiz on ladder logic
- 2. 3 functional diagrams done on Construct
- 3. trouble shoot machine using ladder logic

Criteria - Performance will be satisfactory when:

1. learner will draw ladder diagram to meet specified logic parameters
2. learner will interpret output given ladder diagram
3. learner utilizes ladder logic to find bug placed in machine

E. Apply electrical fundamentals

Competence will be demonstrated:

1. quiz on electrical fundamentals
2. electrical fundamentals lab

Criteria - Performance will be satisfactory when:

1. learner demonstrate ohms law
2. learner calculates voltage
3. learner calculates current
4. learner calculates resistance

F. Identify industrial motors/motor controls.

Competence will be demonstrated:

1. motor controls quiz
2. motor controls labs

Criteria - Performance will be satisfactory when:

1. learner properly wire up and reverse three phase induction motor
2. learner properly wire up and reverse single phase split phase motor
3. learner properly wire up and reverse capacitive start induction motor
4. learner properly wire up and reverse capacitive start capacitive run induction motor.
5. learner utilizes drum switch for directional control
6. learner utilizes drum switch for wye/delta control
7. learner utilizes reversing contactor for motor control

G. Identify industrial transformers.

Competence will be demonstrated:

1. transformer quiz
2. transformer lab

Criteria - Performance will be satisfactory when:

1. learner sizes transformer short circuit protection
2. learner sizes transformer over-load protection
3. learner taps control transformers
4. learner taps power transformers
5. learner applies buck'n'boost transformers
6. learner applies auto transformers
7. learner calculates turns ratio
8. learner calculates current
9. learner calculates voltage
10. learner calculates KVA

H. Identify industrial mechanical and solid state switches.

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner wires up mechanical "limit" switches
2. learner wires up photo eye - retro reflective
3. learner wires up photo eye - diffuse
4. learner wires up photo eye - dual head
5. learner wires up capacitive prox
6. learner wires up inductive prox

I. Analyze mechanical drives.

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner calculate gear ratio
2. learner calculates change in torque
3. learner measure speed change
4. learner distinguish spur gear
5. learner distinguishes helical gear
6. learner distinguishes herringbone gear
7. learner size gearbox

J. Analyze belt drives

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner calculates belt size
2. learner determines speed ratio
3. learner distinguish belt type
4. learner asses efficiency
5. learner calculates slip

K. Analyze chain drives

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner calculate chain size
2. learner determine speed ratio
3. learner determines speed ratio
4. learner distinguish chain type
5. learner asses efficiency

L. Assess control systems

Competence will be demonstrated:

1. through written exam

Criteria - Performance will be satisfactory when:

1. learner distinguishes open loop control

2. learner distinguishes closed loop control
3. learner asses PID control

M. Distinguish bearings.

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner removes bearings
2. learner installs bearings
3. learner calculates proper relube schedule
4. learner distinguishes plain bearing
5. learner distinguishes frictionless bearings
6. learner determines bearing replacement

N. Distinguish machine lubrication.

Competence will be demonstrated:

1. through written exam

Criteria - Performance will be satisfactory when:

1. learner will asses viscosity
2. learner knows components of grease
3. learner knows additive placed in oil
4. learner knows why additives are placed in oil

O. Analyze fastener

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner distinguishes fastener system
2. learner torques fastener to industry standards
3. learner distinguishes proper fastener instillation
4. learner analyzes fastener failure

P. Program frequency drives

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner wires up motor and freq drive
2. learner programs frequency preset
3. learner utilizes 1305 manual to trouble shoot drive
4. learner wires in remote pot to control speed
5. learner change speed with sw1, sw2, sw3

Q. Program PLCs

Competence will be demonstrated:

1. through written exam
2. through lab performance

Criteria - Performance will be satisfactory when:

1. learner writes ladder diagrams on PC
2. learner enters ladder diagram at PICO controller
3. learner updates ladder diagram