



Western Technical College

10664110 Intro to Mechatronics

Course Outcome Summary

Course Information

Description	In this course, learners are introduced to microprocessor controlled electromechanical systems. The learner examines how individual components work, and how they are integrated into simple systems. Upon completion of the course, learners will understand what technicians do in the workplace and how industry utilizes Mechatronics in advanced manufacturing.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	2
Total Hours	54

Textbooks

10-664-110 *Intro to Mechatronics Student Lab Workbook*. Western. Publisher: Western. Required.

Course Competencies

1. Examine the basic principles of advanced manufacturing.

Assessment Strategies

- 1.1. Research
- 1.2. Written Product

Criteria

You will know you are successful when

- 1.1. you contrast manufacturing and advanced manufacturing
- 1.2. you explain the five critical performance objectives for manufacturing
- 1.3. you summarize the six functional areas of an advanced manufacturing plant
- 1.4. you differentiate types of metals

- 1.5. you identify the five general steps of manufacturing
- 1.6. you relate the use of technology to the advanced manufacturing process.

Learning Objectives

- 1.a. Define types of advanced manufacturing.
- 1.b. Describe occupational roles and responsibilities within the organizational structure.
- 1.c. Identify basic manufacturing metrics.
- 1.d. Describe the types of basic materials.
- 1.e. Explain the application of basic materials.
- 1.f. Describe the types of advanced materials.
- 1.g. Explain the application of advanced materials.
- 1.h. Describe the types of manufacturing processes.
- 1.i. Explain applications of manufacturing processes.

2. Adhere to basic safety in the manufacturing environment.

Assessment Strategies

- 2.1. Skill Demonstration
- 2.2. Simulation
- 2.3. Written Product

Criteria

You will know you are successful when

- 2.1. you explain the role of regulatory safety agencies
- 2.2. you identify the components of personal protective equipment
- 2.3. you identify elements of an unsafe work environment
- 2.4. you summarize machine operation safety guidelines
- 2.5. you summarize tool and material handling safety
- 2.6. you interpret hazardous material standards
- 2.7. you analyze fire and electricity hazards
- 2.8. you characterize a safe workplace
- 2.9. you identify the most effective response to an accident or emergency given an instructor-provided scenario

Learning Objectives

- 2.a. Explain the function of OSHA.
- 2.b. Describe types of hazards.
- 2.c. Identify the components of personal protective equipment.
- 2.d. Discuss machine operation safety.
- 2.e. Describe tool and material handling safety.
- 2.f. Identify fire and electrical safety hazards.
- 2.g. Discuss hazardous materials safety.
- 2.h. Describe work area safety.
- 2.i. List the steps in accident response.

3. Interpret prints and drawings.

Assessment Strategies

- 3.1. Class Participation Activity
- 3.2. Research
- 3.3. Written Product

Criteria

You will know you are successful when

- 3.1. you convert between U.S. customary units and S.I. metric units
- 3.2. you convert between fractions and decimals
- 3.3. you differentiate between first angle and third angle projection
- 3.4. you interpret multi-view drawings
- 3.5. you interpret section-view drawings
- 3.6. you interpret auxiliary-view drawings
- 3.7. you interpret drawing dimensions and tolerances
- 3.8. you interpret general drawing notes

- 3.9. you interpret title block and block tolerance notes
- 3.10. you interpret assembly drawings
- 3.11. you interpret drawing sizes and model scales
- 3.12. you measure an object per instruction specifications
- 3.13. you measure an instructor-identified object using a micrometer
- 3.14. you measure an instructor-identified object using a dial caliper

Learning Objectives

- 3.a. Differentiate between prints and drawings.
- 3.b. Define terminology and abbreviations associated with print reading.
- 3.c. Explain symbols and notes found on prints.
- 3.d. Compare SI and US customary measurements scales.
- 3.e. Practice using a machinist's rule.
- 3.f. Identify units of measurement conversion.
- 3.g. Discuss the layout of views.
- 3.h. Relate dimensions and scales to prints and drawings.
- 3.i. Explain basic tolerances and their relationship to dimensions.
- 3.j. Practice using a dial caliper.
- 3.k. Practice using a micrometer.

4. Investigate the principles of mechanical energy.

Assessment Strategies

- 4.1. Class Participation Activity
- 4.2. Research
- 4.3. Written Product

Criteria

You will know you are successful when

- 4.1. you use a scale to measure forces and weights
- 4.2. you use a lever and a scale to measure mechanical advantage
- 4.3. you use a scale to measure the force required to overcome friction
- 4.4. you use a lever and a scale to measure torque

Learning Objectives

- 4.a. Discuss the concept of force.
- 4.b. Discuss the concept of weight.
- 4.c. Discuss the concept of mass.
- 4.d. Describe the relationship between force, weight, and mass.
- 4.e. Identify types of levers and their operation.
- 4.f. Explain how the application of torque relates to the principles of mechanical advantage.
- 4.g. Describe the characteristics of friction.
- 4.h. Explain how static and kinetic friction are applied to mechanisms.
- 4.i. Discuss the concepts of rolling resistance.

5. Investigate the components of mechanical drives.

Assessment Strategies

- 5.1. Class Participation Activity
- 5.2. Research
- 5.3. Written Product

Criteria

You will know you are successful when

- 5.1. you assemble shafts and pillow block bearings in alignment
- 5.2. you assemble shafts and couplings in alignment
- 5.3. you assemble V-belt drives in alignment and tension
- 5.4. you assemble chain-drives in alignment and tension
- 5.5. you calculate gear ratio, speed, torque and direction using an instructor-provided gear scenario
- 5.6. you calculate pulley ratio, speed, torque and direction using an instructor-provided belt-drive scenario
- 5.7. you calculate sprocket ratio, speed, torque and direction using an instructor-provided chain-drive scenario

Learning Objectives

- 5.a. Discuss the functions of mechanical power transmission.
- 5.b. Examine methods of applying couplings to mechanical power transmissions.
- 5.c. Describe the purpose and function of bearings.
- 5.d. Contrast a variety of bearing styles.
- 5.e. Describe gear characteristics.
- 5.f. Compare characteristics of different gears.
- 5.g. Calculate gear ratios, speed, and torque.
- 5.h. Describe belt characteristics.
- 5.i. Compare characteristics of different belts.
- 5.j. Calculate belt ratios, speed, and torque.
- 5.k. Describe chain characteristics.
- 5.l. Compare characteristics of different chains.
- 5.m. Calculate chain ratios, speed, and torque.

6. Examine components of fluid power.

Assessment Strategies

- 6.1. Class Participation Activity
- 6.2. Research
- 6.3. Written Product

Criteria

You will know you are successful when

- 6.1. you construct a pneumatic system with pneumatic components per pneumatic schematic according to instructor specifications
- 6.2. you construct a hydraulic system with hydraulic components per hydraulic schematic according to instructor specifications
- 6.3. you calculate force and speed of a pneumatic system using Ideal Gas Law
- 6.4. you calculate force and speed of a hydraulic system using Pascal's Law

Learning Objectives

- 6.a. Describe fluid power components and circuits.
- 6.b. Interpret pneumatic schematics.
- 6.c. Relate pneumatic components to a functional system.
- 6.d. Interpret hydraulic schematics.
- 6.e. Relate hydraulic components to a functional system.
- 6.f. Describe how to calculate the force output of a double-acting cylinder
- 6.g. Practice measuring the force output of a cylinder
- 6.h. Describe the concept of fluid friction
- 6.i. Practice measuring delta P in a fluid power system
- 6.j. Define Pascal's Law
- 6.k. Describe the concept of fluid power leverage
- 6.l. Define absolute and gage units of pressure measurement
- 6.m. Define the Ideal Gas Law
- 6.n. Describe the factors that affect pneumatic actuator speed
- 6.o. Practice measuring pneumatic actuator speed
- 6.p. Describe the factors that affect hydraulic actuator speed
- 6.q. Practice measuring hydraulic actuator speed

7. Explore basic electricity, AC/DC.

Assessment Strategies

- 7.1. Class Participation Activity
- 7.2. Research
- 7.3. Written Product

Criteria

You will know you are successful when

- 7.1. you interpret a basic electrical schematic
- 7.2. you apply Ohm's Law to series and parallel circuits

- 7.3. you apply Power Law to series and parallel circuits
- 7.4. you apply Kirchhoff's Law to series and parallel circuits
- 7.5. you measure voltage with a DMM using an instructor provided scenario
- 7.6. you measure current with a DMM using an instructor provided scenario
- 7.7. you measure resistance with a DMM using an instructor provided scenario

Learning Objectives

- 7.a. Describe the operation of a basic electrical circuit
- 7.b. Identify the elements of a basic electrical schematic.
- 7.c. Differentiate between manual, pushbutton, and a selector switch.
- 7.d. Describe the characteristics of voltage.
- 7.e. Describe the characteristics of current.
- 7.f. Describe the characteristics of resistance.
- 7.g. Explain the relationship between voltage, current, and resistance using Ohm's Law.
- 7.h. Explain the relationship between voltage, current, and resistance using Power Law.
- 7.i. Describe the characteristics of a series circuit.
- 7.j. Describe the characteristics of a parallel circuit.
- 7.k. Explain the relationship between the various voltages within a series circuit using Kirchhoff's Voltage Law.
- 7.l. Explain the relationship between the currents at a node in a parallel circuit using Kirchhoff's Current Law.
- 7.m. Practice measuring electrical circuit characteristics using a digital multimeter (DMM).
- 7.n. Identify components used in electrical circuit protection.
- 7.o. Describe the operation of an ideal transformer.
- 7.p. Discuss single and three-phase circuits.

8. Analyze the operation of electrical relay control.

Assessment Strategies

- 8.1. Class Participation Activity
- 8.2. Research
- 8.3. Written Product

Criteria

Learner will be successful when:

- 8.1. you predict the output of the various logic functions according to instructor provided scenarios
- 8.2. you diagram logic functions according to instructor provided scenarios
- 8.3. you explain the purpose of a safety interlock circuit

Learning Objectives

- 8.a. Describe the circuit elements of control logic functions.
- 8.b. Interpret ladder control diagrams.
- 8.c. Interpret power control diagrams.
- 8.d. Use ladder logic to create a circuit diagram.
- 8.e. Describe the function of a relay in an electrical circuit.
- 8.f. Implement logic functions with relay logic.
- 8.g. Describe the operation of a safety interlock circuit.