

## **MECHATRONICS 1**

### **CODE: 6210**

**COURSE DESCRIPTION:** Mechatronics is an interdisciplinary field involving electrical, mechanical, instrumentation, electronics, robotics/automation, computer components, and control systems. The intent of the program is to prepare students with entry-level industrial skills for the workforce or to prepare them for entry into post-secondary programs.

Mechatronics 1 focuses on safety, A/C and D/C circuits, hand and power tools, and precision measurements. Also, students will have the opportunity to acquire industry-recognized certifications such as OSHA within this course.

**NCCER CONNECT®** embedded within the Mechatronics program of study is a/n (optional) component utilized at the discretion of the district.

**OBJECTIVE:** Given the necessary equipment, materials, and instruction, the student, on completion of the prescribed course of study, will be able to successfully accomplish the following standards.

**RECOMMENDED GRADE LEVELS:** 9 - 12

**CREDIT:** 1 unit (120 hours), 2 units (240 hours)

**PREREQUISITE:** None

**RESOURCES:** [Instructional Materials](#)

#### **A. SAFETY**

**Proficient professionals know the academic subject matter, including safety as required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Review school safety policies and procedures.
2. Review classroom safety rules and procedures.
3. Review safety procedures for using equipment in the classroom.
4. Identify major causes of work-related accidents in office environments.
5. Demonstrate safety skills in an office/work environment.

#### **B. STUDENT ORGANIZATIONS**

**Proficient professionals know the academic subject matter, including professional development, required for proficiency within their area. They will use this knowledge as**

**needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

### **C. TECHNOLOGY KNOWLEDGE**

**Proficient professionals know the academic subject matter, including the ethical use of technology as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; illegal downloading; cyberbullying; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, Creative Commons, fair use laws, and ethics pertaining to downloading of images, photographs, Creative Commons, documents, video, sounds, music, trademarks, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

### **D. PERSONAL QUALITIES AND EMPLOYABILITY SKILLS**

**Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate creativity and innovation.
2. Demonstrate critical thinking and problem-solving skills.
3. Demonstrate initiative and self-direction.
4. Demonstrate integrity.
5. Demonstrate work ethic.
6. Demonstrate conflict resolution skills.

7. Demonstrate listening and speaking skills.
8. Demonstrate respect for diversity.
9. Demonstrate customer service orientation.
10. Demonstrate teamwork.

## **E. PROFESSIONAL KNOWLEDGE**

**Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate global or “big picture” thinking.
2. Demonstrate career and life management skills and goal-making.
3. Demonstrate continuous learning and adaptability skills to changing job requirements.
4. Demonstrate time and resource management skills.
5. Demonstrates information literacy skills.
6. Demonstrates information security skills.
7. Demonstrates information technology skills.
8. Demonstrates knowledge and use of job-specific tools and technologies.
9. Demonstrate job-specific mathematics skills.
10. Demonstrates professionalism in the workplace.
11. Demonstrates reading and writing skills.
12. Demonstrates workplace safety.

## **NCCER CONNECT CORE© MODULES (UTILIZED PER DISTRICT ADVISORY BOARD RECOMMENDATION)**

### **MODULE A: BASIC SAFETY**

**Proficient manufacturing professionals demonstrate basic safety knowledge as needed in their role. The following accountability criteria are considered essential for students in the mechatronics program of study.**

1. Identify the responsibilities and personal characteristics of a professional craftsperson.
2. Describe the safe work requirements for elevated work.
3. Identify and explain how to avoid struck-by and caught-in-between hazards.
4. Explain the appropriate safety precautions around common job-site hazards.
5. Demonstrate the use and care of appropriate personal protective equipment (PPE).
6. Identify and describe other specific job-site safety hazards.
7. Follow safe procedures for lifting heavy objects.
8. Describe safe behavior on and around ladders and scaffolds.
9. Explain the importance of the Hazard Communication Standard (HazCom) requirement and Safety Data Sheets (SDS).

10. Describe fire prevention and firefighting techniques.
11. Define safe work procedures around electrical hazards.
12. Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement).
13. Complete Performance Tasks.

## **MODULE B: BASIC MATH**

**Proficient manufacturing professionals demonstrate basic math skills as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler and a metric ruler to measure.
3. Add, subtract, multiply, and divide fractions.
4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percent and percent to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

## **MODULE C: INTRODUCTION TO HAND TOOLS**

**Proficient manufacturing professionals demonstrate how to safely use various hand tools as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Recognize and identify various types of basic hand tools used in the construction trade.
2. Identify and describe how to use various types of measurement and layout tools.
3. Identify and explain how to use various types of cutting and shaping tools.
4. Use these tools safely.
5. Describe the basic procedures for taking care of these tools.
6. Complete Performance Tasks.

## **MODULE D: INTRODUCTION TO POWER TOOLS**

**Proficient manufacturing professionals demonstrate how to safely use power tools as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Identify and explain how to use various types of power drills and impact wrenches used in the construction trade.

2. Identify and explain how to use various types of power saws.
3. Identify and explain how to use various grinders and grinder attachments.
4. Identify and explain how to use miscellaneous power tools.
5. Use power tools safely.
6. Explain how to maintain power tools properly.
7. Complete Performance Tasks.

## **MODULE E: INTRODUCTION TO CONSTRUCTION DRAWINGS**

**Proficient manufacturing professionals demonstrate knowledge and the use of blueprints/construction drawings as needed in their role. The following accountability criteria are considered essential for students in the mechatronics program of study.**

1. Identify and describe various types of construction drawings, including their fundamental components and features.
2. Recognize and identify basic blueprint terms, components, and symbols.
3. Relate information on blueprints to actual locations on the print.
4. Recognize different classifications of drawings.
5. Interpret and use drawing dimensions.
6. Complete Performance Tasks.

## **MODULE F: BASIC RIGGING (Optional)**

**Proficient manufacturing professionals demonstrate how to use basic rigging as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site.
2. Describe inspection techniques and load-handling safety practices.
3. Explain the American National Standards Institute (ANSI) hand signals.
4. Complete Performance Tasks.

## **MODULE G: BASIC COMMUNICATION SKILLS (SDE Requirement)**

**Proficient manufacturing professionals demonstrate appropriate communication skills as needed in their role. The following accountability criteria are considered essential for students in the mechatronics program of study.**

1. Describe the communication, listening and speaking processes and their relationship to job performance.
2. Describe good reading and writing skills and their relationship to job performance
3. Demonstrate telephone and e-communication skills necessary in the workplace.
4. Complete Performance Tasks

## **MODULE H: BASIC EMPLOYABILITY SKILLS (SDE Requirement)**

**Proficient manufacturing professionals demonstrate appropriate workplace behavior as needed in their role. The following accountability criteria are considered essential for students in the mechatronics program of study.**

1. Describe the opportunities in the construction business and how an individual enters the construction workforce.
2. Explain the importance of critical thinking and how to solve problems in the workplace.
3. Explain the importance of social skills and identify ways good social skills are applied in the construction trade.
4. Describe computer systems and their industry applications.
5. Explain interpersonal relationship skills, self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

**Mechatronics 1 is the minimum standards for articulation of Mechatronics to (some) technical colleges in South Carolina.**

### **F. INDUSTRIAL SAFETY**

**Mechatronics professionals demonstrate appropriate industrial safety skills as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Explain the idea of a safety culture and its importance to mechatronics.
2. Identify causes of accidents and the impact of accident costs.
3. Explain the role of OSHA in job-site safety.
4. Explain OSHA's General Duty Clause and 1926 CFR Subpart C.
5. Recognize hazard recognition and risk assessment techniques.
6. Explain fall protection and ladder, stair, and scaffold procedures and requirements.
7. Identify struck-by hazards.
8. Demonstrate safe working procedures and requirements related to lock out-tag out procedures.
9. Identify caught-in-between hazards.
10. Demonstrate safe working procedures and requirements related to caught-in-between hazards.
11. Demonstrate safe work procedures to use around electrical hazards.
12. Demonstrate the use and care of appropriate personal protective equipment (PPE).
13. Explain the importance of hazard communications (HazCom) and Safety Data Sheets (SDSs).
14. Identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.
15. Acquire appropriate safety certification.

## **G. AC/DC CIRCUITS**

**Mechatronics professionals demonstrate appropriate knowledge and skills for using AC/DC circuits as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Analyze what atoms are and how they are constructed.
2. Identify ways in which voltage can be produced.
3. Demonstrate the difference between conductors and insulators.
4. Define the units of measurement that are used to measure the properties of electricity.
5. Identify proper use of a multimeter, including reading symbols.
6. Explain how voltage, current, and resistance are related to each other.
7. Calculate electrical quantities using Ohm's Law.
8. Calculate the amount of power used by a circuit.
9. Demonstrate understanding of capacitance and inductance in a DC circuit.
10. Construct a basic series circuit.
11. Construct a basic parallel circuit.
12. Construct a series-parallel combination circuit.
13. Calculate, using Kirchhoff's Voltage Law, the voltage drop and total current in series, parallel, and series-parallel circuits.
14. Measure the total amount of resistance in a series circuit.
15. Measure the total amount of resistance in a parallel circuit.
16. Measure the total amount of resistance in a series-parallel circuit.
17. Compare calculated and measured electrical properties.

## **H. HAND AND POWER TOOL OPERATIONS**

**Mechatronics professionals demonstrate appropriate knowledge and skills for using hand and power tool operations as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Illustrate use of basic hand and power tools (see tools and equipment list).
2. Use torque wrenches per specifications.
3. Describe the basic procedures for taking care of hand and power tools.
4. Use hand and power tools safely.
5. Demonstrate how to maintain hand and power tools properly.
6. Compare the use of threaded fasteners and non-threaded fasteners.
7. Demonstrate applications for fasteners and anchors.

## **I. PRECISION MEASUREMENT TOOLS**

**Mechatronics professionals demonstrate appropriate knowledge and skills for using precision measurement tools as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Evaluate the metric system and how it is important in mechatronics.
2. Use metric units of length, weight, volume, and temperature.
3. Convert English/standard to metric.
4. Demonstrate use of precision measurement tools (English and metric).
  - a. Use levels.
  - b. Use feeler gauges.
  - c. Use calipers.
  - d. Use micrometers.
  - e. Uses dial indicators.
  - f. Use protractors.
  - g. Use parallels and gauge blocks.
  - h. Use precision straightedges.
  - i. Use a standard ruler and a metric ruler to measure.
5. Demonstrate the ability to perform layout work to include the use of calipers, drills, height and depth gauges, and other measurement tools.

Additional Materials/Resources

Course Academic Standards and Indicators