

## **MECHATRONICS 2**

### **COURSE CODE: 6211**

**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 2 is the second course in the Mechatronics program of study. This course focuses on programmable logic controllers (PLC), electrical industrial controls, fluid power (pneumatics), and motor controls and starters.

**NCCER CONNECT**© embedded within the program of study is an (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:** 10 - 12

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

**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.

**Mechatronics 2 is the minimum standards for articulation of Mechatronics to (some) technical colleges in South Carolina.**

## **F. PROGRAMMABLE LOGIC CONTROLLERS (PLC)**

**Mechatronics professionals demonstrate appropriate knowledge and usage of programmable logic controllers as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Describe the function and purpose of a programmable logic controller (PLC).
2. Compare hardwired and PLC systems.
3. Identify the numbering systems, e.g., binary, hexadecimal, base 10.
4. Analyze Boolean logic.
5. Describe the purpose of the various power supplies used within a PLC.
6. Construct input/output (I/O) circuits.
7. Define the function of the PLC processor module.
8. Describe the interrelations between analog, digital, and input/output components.
9. Demonstrate the features of relay ladder logic instruction categories.

10. Demonstrate the principles used to correlate PLC hardware components to software instructions.
11. Convert and program a PLC using a converted ladder diagram.
12. Troubleshoot problems in a PLC circuit using a given diagram.

## **G. ELECTRICAL INDUSTRIAL CONTROLS**

**Mechatronics professionals demonstrate appropriate knowledge and usage of electrical industrial controls as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Analyze diagrams and schematics with symbols for electrical circuits.
2. Identify operation of relays in a circuit.
3. Identify the different types of transformers used in a control system.
4. Construct control systems using fuses, breakers, and circuit protection/interrupters,
5. Identify and properly connect and terminate conductors in electrical circuits.
6. Identify Motor Control Panel (MCC).
7. Construct a basic motor start/stop circuit.
8. Identify and construct proper conduits.

## **H. FLUID POWER (PNEUMATICS)**

**Mechatronics professionals demonstrate appropriate knowledge and usage of fluid power (pneumatics) as needed in their role. The following accountability criteria are considered essential for students in the Mechatronics program of study.**

1. Demonstrate pneumatic system safety.
2. Calculate the physical characteristics and compressibility of gasses (Pascal's Law, Boyle's Law, and Bernoulli Law).
3. Describe the pneumatic transmission of energy.
4. Identify types of compressors.
5. Analyze the principles of compressor operation and compressed-air treatment.
6. Construct pneumatic systems from components and schematic symbols.
7. Demonstrate the ability to read, construct, and interpret fluid power symbols as well as fluid power diagrams.
8. Identify the various configurations of directional control valves (DCV).
9. Demonstrate correct installation and maintenance as well as preventive maintenance techniques for fluid power systems using schematic diagrams.
10. Troubleshoot and repair fluid power systems using schematic diagrams.

Additional Materials and Resources

Academic Standards and Indicators