**Mechatronics I**
**Central High School**
**2023-2024**

**INSTRUCTOR:** Johnathan Michael **PHONE:** 931-381-2222 ext. 1078
**EMAIL:** jmichael@mauryk12.org **GRADES:** 9th-12th

**PREREQUISITES:** Algebra I, Geometry, Physical Science, Digital Electronics

**COURSE DESCRIPTION:**
Mechatronics I is an applied course in the manufacturing cluster for students interested in learning more about careers as a mechatronics technician, maintenance technician, electromechanical technician, and manufacturing engineer. This first of two courses covers basic electrical and mechanical components of mechatronics systems as well as their combined uses with instrument controls and embedded software designs. Upon completion of this course, proficient students will be able to describe and explain basic functions of physical properties and electrical components within a mechatronic system. They can logically trace the flow of energy through a mechatronic system and can communicate this process to others. They know how to effectively use technical documentation such as data sheets, schematics, timing diagrams, and system specifications to troubleshoot basic problems with equipment. Finally, they develop strategies to identify, localize, and correct malfunctioning components and equipment.

**LEARNING MANAGEMENT SYSTEMS: AMATROL (CSCC) and SCHOOLOGY (CHS)**

**GRADE SCALE:**
A numerical average will be derived over the semester by dividing total points possible into total points earned by the student. Letter grades will be assigned based on final numerical averages in accordance with county policy. Please note that students will not receive a numerical grade over 100, because this is not an advanced placement course.

**EVALUATION:**
The final grade for the course will be based on the following items:

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| 1. Participation/Activities | 50% |
| 2. Tests/Skills | 35% |
| 3. Final Exam | 15% |
| **TOTAL** | **100 %** |

**COURSE STANDARDS:**
**Mechatronics Overview**
1) Drawing on various media, including visual, quantitative, and written resources, trace the historical development of the four facets (mechanical systems, electronic systems, computers, and control systems) of a mechatronic system and explain their chief applications in modern society, citing specific textual evidence.
2) Citing specific evidence from a textual description or actual observation of a mechatronic system, describe the flow of electrical and mechanical energy in the system. Create a computational model to represent the transfer of energy from one component to others in a system.
**Safety**
3) Accurately read and interpret safety rules, including but not limited to rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA), state and national code requirements. Apply them accordingly while working on electrical and mechanical components and explain why certain rules apply.
**Electronics**
4) Demonstrate understanding of the specific roles of various electrical components discerned in a circuit schematic by correctly predicting the effects of changing selected parameter values. For example, predict

the effect of halving a resistor's value. Compare and contrast these roles and explain how electronic designs vary within a given system or module.

5) Create, measure, and analyze basic director current (DC) circuits prescribed by schematics using Ohm's law, Kirchhoff's law, and Watt's law to predict and verify circuit behavior. Apply understanding of these laws to troubleshoot simple circuits, and document the steps required to remedy the trouble.

6) Create, measure, and analyze circuits prescribed by schematics to predict and verify the behavior of series versus parallel DC circuits or resistances. Where unexpected behavior is observed, cite specific evidence to explain the observations.

7) Using technical documentation, such as manuals and schematics, craft an informative narrative to explain the physical operation of electromagnetic and electrostatic components (such as coils, solenoids, relays, and various sensors) in a mechatronic system. Interpret resolved work orders by analyzing underlying issues and explaining the correct physical operation of the included components.

8) Create, measure, and analyze circuits prescribed by schematics to predict and verify the behavior of the electrical and physical properties of components (such as resistors, capacitors, diodes, transformers, relays, and power supplies). Report findings explaining the typical application and operation in circuits of the previously listed components, citing measurement and/or observed evidence supporting the explanation.

**Mechanical**

9) Demonstrate understanding of the specific role of various mechanical components in mechatronic systems, discerning in a system schematic the effects of various design parameters on the system behavior. For example, predict the effect of a larger gear size. Compare and contrast these roles in the context of mechatronic systems, modules, and subsystems, explaining how designs vary within a given system or module.

10) Create, measure, and analyze mechanical systems prescribed by drawings to predict and verify the behavior of the physical operation of components in a mechatronic system, including but not limited to: a. Springs, and spring-like effects b. Dampers and energy dissipation c. Masses (weights) Craft an explanatory narrative to report findings and outline the typical application in systems of the components listed above, citing the observed behavior to support explanations.

11) Interpret technical information in design problems to analyze forces, speeds, torque, and power, for mechanical drives including: a. Gears, cams, screws, and levers b. Belt and chain drives c. Flywheels d. Motors and generators Explain the typical application and operation in systems of the components listed above, citing measurement and/or observed evidence to support explanations. Create equations that describe relationships to solve the design problems and justify the solutions.

12) Research and measure the behavior of different types of alternating current (AC) motors and direct current (DC) motors, comparing and contrasting behaviors and drawing inferences from the observations to create a checklist for use by a technician to ensure proper functioning of equipment.

13) Referencing appropriate technical documents (such as data sheets, timing diagrams, operating manuals, and schematics), design an experiment to observe and measure the mechanical properties and behavior of shafts, couplings, and sealing devices with and without proper lubrication. Document research and measurement results in a technical report to be used by other technicians.

14) Demonstrate understanding of power transmission components, such as clutches and brakes, by measuring the operation of working automotive equipment. Create a graphic illustration showing the roles of each component and how they work together in a system.

15) Assess the required maintenance for a variety of mechatronic system components in a mechatronic device, and carry out the necessary adjustments to the system. Document and justify the adjustments in an equipment log that can be easily referenced by technicians and engineers.

**Technical Documentation and Troubleshooting**

16) Consult technical documents (such as data sheets, timing diagrams, operating manuals, and schematics) to assess a mechatronic system and effectively troubleshoot the malfunctions in electrical components. Record and analyze test results and prepare written testing documentation to justify a solution.

17) Verify by observation and measurement the parts, relationships, and behavior depicted by the technical data sheets for the mechanical and electrical components within a mechatronic system. Use

these data sheets to create a training document to instruct a new technician on maintaining and operating these components and drives.

**MAKE-UP WORK:** When a student has an absence:

- The student must check Schoology or Amatrol site to get work.
- It is the student's responsibility to see what needs to be made up and that this is done at the teacher's convenience.
- If the work is not completed by the extended due date assigned, the student receives a zero for The incomplete work.

**CLASSROOM RULES AND EXPECTATIONS:**

Every student will be expected to conduct him or herself in a manner that does not interfere with the learning process. Students that interfere with the ability of the teacher to teach and other student's ability to learn will be dealt with swiftly. All specific Technology Lab rules, and the general school rules listed in the Student/Parent Handbook, will be enforced! The following are important teacher expectations:

- Respect everyone and everything.
- Clean up after yourself!
- Be on time to class.
- Be prepared for class: Book, paper and writing instrument.
- All school rules apply.
- Complete all assignments and submit for grades by all due dates.
- NO PHONES ALLOWED

Just as you expect honesty and integrity from the instructor, I will expect the same from you!

**DISCIPLINE:**

All students will be given a warning about expectations/rules upon first violation. A second violation will result in a conversation witnessed by another teacher and a reminder of expectations. A third violation results in an immediate phone call to parents. Any further violations will be written up and sent to an administrator. All discipline issues will be recorded in a discipline journal that will be referred to later if violations continue.

**NOTE:**

The instructor reserves the right to change the requirements of the course to reflect the educational needs of the class.

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**SIGNATURES:** Both the parent/guardian and the student will need to sign below indicating that they have received, read, understand, and agree to the requirements and responsibilities of the course as described in the syllabus.

**Student Signature**_____ **Date** _____

**Parent Signature** _____ **Date**_____

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