Mechatronics II
Central High School
2023-2024

INSTRUCTOR: Johnathan Michael **PHONE:** 931-381-2222 ext. 1078
EMAIL: jmichael@mauryk12.org **GRADES:** 10th-12th

PREREQUISITES: Mechatronics I (6156) and Physics (3231)
Note: Physics (3231) may be taken as a co-requisite.

COURSE DESCRIPTION:
Mechatronics II is an advanced course in the manufacturing career cluster for students interested in learning more about such careers as mechatronics technician, maintenance technician, or electromechanical technician. Following the groundwork of mechanics and electronics laid in Mechatronics I, this course covers basics of pneumatic, electro pneumatic, and hydraulic control circuits in a complex mechatronic system. In addition, the course addresses basic digital logic and programmable logic controllers (PLCs) employed in the mechanical, electronic, and control systems in a mechatronics system. Upon completion of this course, proficient students are able to explain the inter-relationships of components and modules within a complex mechatronic system. They understand the differences between hydraulic and pneumatic fluid power and can explain the scientific principles that apply. They also use technical documentation (such as datasheets, circuit diagrams, displacement step diagrams, timing diagrams, and function charts) to troubleshoot and resolve malfunctioning pneumatic and hydraulic components and circuits. They demonstrate understanding of the role of programmable logic controllers (PLC) in mechatronic systems and the ability to write, debug, and run basic ladder logic.

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:

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

COURSE STANDARDS:
Safety
1) Accurately read and interpret safety rules, including but not limited to the rules of handling high-pressure pneumatics and hydraulics. Analyze the implications of the various rules and employ them accordingly while working on mechatronic systems with control system components, explaining why certain rules apply. Fluid **Power Systems**
2) Demonstrate understanding of the interrelationships and specific roles of (electro) pneumatic and hydraulic components and modules within a complex mechatronic system. For example, provide a written technical description of the expected changes in one or more systems on other components and modules in the total mechatronic system.
3) Identify the differences between hydraulic and pneumatic fluid power and justify decisions surrounding when to use control systems based on one component as opposed to the other by crafting and defending an argument with specific claim(s), reasoning and supporting evidence.

4) Create laboratory setups or simple control systems that apply hydraulic and pneumatic principles such as Boyle's Law and Pascal's Law. Apply these principles to solving problems and troubleshooting mechatronic systems, explaining the reasoning behind each step.
5) Using real-world examples of hydraulic/pneumatic systems and citing reputable print and visual sources of such systems, conduct research to identify the basic components and functions in a fluid power system. Create a visual aid to summarize and explain this information to technicians or upper management.
6) Measure and analyze basic physical properties of (electro) pneumatic and hydraulic components (such as cylinders, directional control valves, regulators, flow control valves, pumps, and motors) within a given system. Interpret resolved work orders by analyzing underlying issues and explaining the correct physical operation of the included components.
7) Citing evidence from a technical description or actual observation of a mechatronic system, describe the flow of fluid energy in a given mechatronic system or subsystem. Create a graphic illustration to represent the transfer of energy from one component to others in the system.

Computers and Control Systems

8) Research the different roles of programmable logical controllers (PLCs) in complex mechatronic systems, modules, and subsystems, and be able to verbally describe their components and operation to others. Collaboratively create a technical document for a new technician that explains the basic components of a PLC, addressing how the role of a PLC varies in different systems (such as mechatronic systems, modules, and subsystems).
9) Demonstrate understanding of the flow of information in a given mechatronic system or subsystem, focusing on the control function of PLCs in the system. Create both a schematic and explanatory narrative to describe the flow of information to/from an equipment operator.
10) Given a control scenario, bound by several logical parameters, create Boolean logic equations to prescribe the use of logic gates in the implementation of the scenario. Show how they apply to the functioning of a real-world mechatronics system, explaining the reasoning involved.
11) Demonstrate understanding of hexadecimal, decimal, octal, binary, 2s complement, and binary coded decimal (BCD) values as used in a common PLC. Write an explanation or develop and deliver a brief presentation of how these codes are relevant to mechatronic systems.
12) Convert wiring and ladder diagrams for simple logic chores into PLC programs that use common instructions such as digital, logical, compare, compute, move, file, sequencer, and program control instruction sets. **Technical Documentation and Troubleshooting**
13) Referencing technical documents (such as data sheets, circuit diagrams, displacement step diagrams, timing diagrams, function charts, operations manuals, and schematics) for pneumatic and hydraulic components within a mechatronic system, assess the required maintenance for such systems, taking appropriate measurements where needed, and perform the necessary adjustments on these systems. Document and justify adjustments in an equipment log that can be referenced by technicians and engineers.
14) Troubleshoot malfunctioning pneumatic and hydraulic systems: identify the source of the problem(s), plan a multistep procedure to correct the malfunction, implement the plan, and verify the corrective action. Using appropriate technical language and terminology, document the cause of the malfunction and justify the procedure used to correct it.

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.

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.

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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