Winter Lakes High School
2021 - 2022

MECHATRONICS
Syllabus - 2021-22

Instructor
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Google Classroom Code
lwt2eu6

COURSE DESCRIPTION

Mechatronics has been called the science of intelligent machines. It is a study that integrates electrical and mechanical systems, robotics, the internet of things and computer science. (The term, mechatronics, was created by combining “mechanics” and “electronics.”) In today’s society, technicians and engineers with mechatronic backgrounds are in demand. Mechatronics at WLHS is a project-based learning (PBL) course. Students will design, build, and present prototypes (examples) of “smart machines”. Each project is designed to allow different students to develop several and distinct solutions to the same problem. The problem presents the student with an opportunity to plan, organize, and conduct research. Supporting activities provide students with needed skills and knowledge as needed. Students incorporate research in the design, prototyping, testing, evaluation, and redesign of a solution. According to the National Association of Colleges and Employers these skills are in high demand by prospective employers.

WLHS is launching the Mechatronics Course in October of 2021. Because of the current COVID pandemic limitations on in-person instruction, we will focus on completing the first trimester of the three trimester course.

FIRST TRIMESTER PROJECTS:

1. **Simple Machines for a Children’s Museum Exhibit**
2. **Mechanical Systems: Vehicle that Transports Cargo Up a Ramp**
3. **Electricity: Wiring Lights and Motors for a Factory**

QUARKS

Students earn quarks for completing projects. Projects range in value from 10 - 20 quarks. At the beginning of each project, students receive a project summary and a list of deliverables.

Eighth Graders:

Quarks earned for completed projects are recorded on progress reports under Electives - Mechatronics.

High School Credit :

First Trimester: One trimester credit (toward physical science requirement) is granted after a student earns a total of **50 quarks**.

After the First Trimester -- Mixed Academic Credit: Because Mechatronics is a PBL (Project Based Learning) course, each project meets a combination of **Science**, **Math**, and **English/Language Arts** learning standards. Students may choose to earn partial credits in these academic areas. At the start of each project, students will receive a breakdown of the number of quarks/partial credits that can be earned in each core academic area.

GRADES

Each project is graded using rubrics. Students receive a copy of each rubric at the beginning of a project. Letter grades use the following percent scale:

A = 90 +
B = 80-89
C = 70- 79

Projects that do not yet earn 70% are considered incomplete and are returned to the student for improvement.

STANDARDS - GRADES 9-12

NGSS eight science and engineering practices:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Trimester 1 Science Content Standards:

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

English/LanguageArts

(Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects)

Text Types and Purposes

1. Write arguments focused on discipline-specific content.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation

Math

Modeling with Geometry G-MG Apply geometric concepts in modeling situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

3. Apply geometric methods to solve design problems.

Create equations that describe numbers or relationships CED

A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

MP.2 Reason abstractly and quantitatively .

MP.4 Model with mathematics.

HSN-Q.A .1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN-Q.A .2 Define appropriate quantities for the purpose of descriptive modeling.

HSN-Q.A .3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.