

# Folsom Cordova Unified School District

## Aerospace Engineering (Project Lead the Way)

**DATE:** January 2014

**SUBJECT AREA:** Career and Technology

**PROPOSED GRADE LEVEL(s):** 11 – 12

**COURSE LENGTH:** 1 Year

**GRADING:** A-F

**NUMBER OF CREDITS:** 5 per semester

**SUBJECT AREA CREDIT:** Technology

**PREREQUISITES:** Principles of Engineering with a Grade of 'C' or better

### **COURSE DESCRIPTION:**

The major focus of the Aerospace Engineering course is to expose students to the world of aeronautics, flight, and engineering. Students will be introduced to the activity-based, project-based, and problem-based learning by exploring the world of aerospace engineering. They will employ engineering and scientific concepts in solving aerospace problems. The entire curriculum sequence will include experiences from the diverse fields of aeronautics, aerospace engineering and related areas of study. Lessons will engage students in engineering design problems related to aerospace information systems, astronautics, rocketry, propulsion, the physics of space science, space life sciences, the biology of space science, principles of aeronautics, structures and materials, and systems engineering.

### **GENERAL GOALS/PURPOSES:**

- Students will recognize the various concepts of safety as it relates to technical apparatus operation and performance in industrial settings.
- Students will know how to prepare engineering sketches and develop reports and technical data specifications of typical product designs,
- Students will understand the principles of robotic systems and use multiple components in developing a programmable logic controller demonstration.
- Students will understand how to use a computer, computer-aided design software and peripheral devices to create an image or drawing in the design and documentation,
- Students will understand key concepts in group dynamics, team conflict resolution, and negotiation. They will demonstrate cooperative working relationships.
- Students will demonstrate problem solving ability through competition-based applications and projects of engineering concepts.
- Students will understand principles of flight as they apply to real world situations through engineering design problems and computer aided simulations.
- Students will understand key concepts of orbital dynamics and be able to use conic sections to establish a cross-curricular connection.

### **STUDENT READING COMPONENT:**

Students will locate, understand, and interpret written information in documents such as manuals, graphs, and textbooks.

## **STUDENT WRITING COMPONENT:**

Students will communicate thoughts, ideas, information, and messages in writing through journals, reports, and graphs.

## **STUDENT ORAL COMPONENT:**

Students will communicate orally in giving directions to a project and in short oral presentations.

## **STUDENT MATH COMPONENT:**

Students will perform basic and algebraic and geometric computations and approaches to practical problems by choosing appropriately from a variety of mathematical techniques.

## **DETAILED UNITS OF INSTRUCTION:**

- Unit 1      Overview of Aerospace Engineering  
Knowledge of the History of Flight, Aerospace History, Describe the many types of vehicles designed to fly, and several of the major components used in the design and operation of an airplane.
- Unit 2      Aerodynamics and Aerodynamics Testing  
Understand the forces of lift, weight, drag, and thrust; wing design; use of computer simulation tools; creating multiple solutions to a problem and evaluating and ranking solutions. Create sub-scale models to represent full-size system; use coordinate geometry to create varied shapes such as airfoils; learn to use basic hand tools and equipment. Test prototypes; analyze test results.
- Unit 3      Flight Systems  
Predict flight performance using software and mathematics of flight theory; collect flight testing data; and construct a multi-component device in assembly and alignment jigs. Develop spatial awareness; use GPS to calculate position and motion in all three axes and time.
- Unit 4      Astronautics  
Measure rocket thrust; calibrate thrust using measurement devices; use a strip chart recorder to measure thrust vs. time data. Learn the parts of a model rocket and the rocket engine; use Newton's three laws of motion to describe and predict events during each phase of a rocket launch. Calculate a rockets maximum altitude as well as maximum velocity and maximum acceleration. Use scientific method to design a project to answer a research question. Use aerial photography to identify, classify, and enumerate objects.
- Unit 5      Space Life Sciences  
Learn about physiological needs of the human body living within and outside the earth's atmosphere; understand how force, mass, acceleration, and G-forces affect astronauts, fighter pilots, etc. Understand the effects of gravity on the human body, how cooperative and supportive team behavior results in increased safety and higher quality data. Understand a microgravity environment.
- Unit 6      Aerospace Materials  
Understand the properties of composite materials related to strength and stiffness, use of deflection test to determine elasticity of a composite plastic sample. Understanding of thermal protection systems for space vehicles; how energy is dissipated and converted into heat.
- Unit 7      Intelligent Vehicle Design  
Development of robots and other interactive systems; determining the pH of an unknown substance.

## **SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:**

### *National Science Education Standards*

*NSES* Content Standard A: Science As Inquiry

*NSES* Content Standard B: Physical Science

*NSES* Content Standard C: Life Science

*NSES* Content Standard D: Earth and Space Science

*NSES* Content Standard E: Science and Technology

*NSES* Content Standard F: Science in Personal and Social Perspectives

*NSES* Content Standard G: History and Nature of Science

### *Industrial and Technology Education Content and Performance:*

Standard 3 Electronics

Standard 4 Manufacturing

Standard 5 Chemical

Standard 6 Physics

Standard 7 Mechanics of Solids

## **DISTRICT ESLR'S TO BE ADDRESSED:**

When students complete an Industrial and Technology Education course, they will be:

- **Self-directed Learners** who will be able to independently develop research questions and solve engineering problems.
- **Effective Communicators** who can express technology concepts to others effectively in both written and verbal formats.
- **Quality Producers** who can solve technology problems in a neat and organized manner.
- **Constructive Thinkers** who are able to approach complex technology problems in a organized, logical, and systematic fashion.
- **Collaborative Workers** who can work in teams to accomplish a task; and
- **Responsible Citizens** who accept responsibility for their actions.