SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Aircraft Systems and Performance	**Length of Course:** 15 cycles
Grade Level(s): 10	**Periods Per Cycle:** 6
Units of Credit: .5	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 64.5 hours

Course Description

This course will introduce students to the primary systems found on most manned and unmanned aircraft. Students will learn about the variety of powerplants used in manned and unmanned aircraft including piston combustion engines, turbine combustion engines, and electric motors. Students will learn how aircraft powerplants are classified and also understand the basic fundamentals of how different types of powerplants operate. This course is the fourth course of eight courses over a four-year program to prepare students for careers in aviation.

Instructional Strategies, Learning Practices, Activities, and Experiences

Hands on Activities Lesson Objectives (Videos, Slide Shows) Digital Content	Formative Assessments Labs Group Projects	Online Resources Summative Assessments Engineering Projects

Assessments

Observation Discussions	Quizzes Exams	Unit Exams Projects

Materials/Resources

Next Generation Science Standards	All materials and resources are provided digitally via the AOPA curriculum; including lesson plans, activities, projects, and assessments.	Various craft supplies, tools, and drones to complete hands-on activities

Adopted: 5/24/21
Revised:

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 7: Propulsion **Description:** To begin their exploration of primary systems found on most manned and unmanned aircraft, students will first learn about the variety of powerplants used in manned and unmanned aircraft, including piston combustion engines, turbine combustion engines, and electric motors. Students will learn how aircraft powerplants are classified and the fundamentals of how different types of powerplants operate.	**HS-ETS1-2** – Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. - ETS1.A: Defining and Delimiting Engineering Problems **HS-ETS1-3** – Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.B: Developing Possible Solutions **HS-PS1-4** – Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. - PS1.B: Chemical Reactions **HS-PS3-2** – Develop and use models to illustrate that energy at the microscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects). - PS3.A: Definitions of Energy **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. - PS3.A: Definitions of Energy - PS3.B: Conservation of Energy and Energy Transfer **HS-PS3-5** – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. - PS3.C: Relationship Between Energy and Forces

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Unit 8: Airframe Systems **Description:** The type of powerplant and the performance requirements determine the type of fuel used in an aircraft. Students will learn about the variety of fuel sources used in aircraft, including JetA, avgas, diesel, and electricity. They also will learn how aircraft fuel systems are designed to accommodate each of these fuel types, the types of instrumentation used to monitor aircraft fuel systems, and how to identify and troubleshoot fuel system issues. In addition, students learn the basics of aircraft electricity, including how it is generated and stored. Heating, hydraulics, landing gear, environmental control systems, and anti/de-ice systems will also be covered.	**HS-ETS1** – Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.B: Developing Possible Solutions **HS-ETS1-2** – Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.C: Optimizing the Design Solution **HS-ETS1-3** – Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.B: Developing Possible Solutions **HS-PS2-6** – Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. - PS1.A: Structure and Properties of Matter - PS2.B: Types of Interactions **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. - PS3.A: Definitions of Energy - ETS1.A: Defining and Delimiting Engineering Problems **HS-PS3-5** – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. - PS3.C: Relationship Between Energy and Forces

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Unit 9: Avionics and Flight Instruments **Description:** In the first semester, students learned about the importance of air pressure in making aircraft fly. Students will expand their understanding of air pressure by examining pitot-static systems used to supply key information about airspeed and altitude. Students will learn how pitot-static systems are designed, how they function, the types of instrumentation they supply, and how to troubleshoot common problems. In some aircraft, gyroscopic instruments such as heading indicators, attitude indicators, and turn coordinators may be driven by a vacuum system. Students will learn how vacuum systems function, the types of instruments they drive, and how to troubleshoot common problems. Even in today's world of electronic navigation, the magnetic compass is an essential tool for pilots. Students will learn about the cardinal directions, principles of magnetism, errors associated with magnetic compasses in aircraft, and how to determine a flight course using a magnetic compass.	**HS-ETS1-3** – Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - PS2.A: Forces and Motion - ETS1.B: Developing Possible Solutions **HS-ETS1-4** – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. - ETS1.B: Developing Possible Solutions **HS-PS1-5** – Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. **HS-PS3-2** – Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects). - PS3.A: Definitions of Energy **HS-PS3-5** – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. - PS3.C: Relationship Between Energy and Forces **HS-PS4-2** – Evaluate questions about the advantages of using a digital transmission and storage of information. - PS4.C: Information Technologies and Instrumentation

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Unit 10: Required Documentation **Description:** Knowledge of required documents and manuals is essential for a pilot to conduct a safe flight. In this unit, students will become familiar with required documents pertaining to aircraft ownership, airworthiness, maintenance, and operations with inoperative equipment. Students will also learn how to use airplane flight manuals and pilot operating handbooks. By understanding the operations, limitations, and performance characteristics of a particular aircraft, the pilot can make educated flight decisions.	**HS-ETS1-3** – Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.B: Developing Possible Solutions

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Unit 11: End of Semester Project and Career Development **Description:** The tenth-grade year culminates in a review of aircraft components and design, a final project, and continued planning for a career in aviation and aerospace. Students will individually answer Private Pilot Knowledge Test questions from previous lessons to jog their memories and begin thinking about how the various aircraft components work together in particular designs to complete missions. Then they will work in pairs to create and present a poster that explains how a particular aircraft system and its components operate for different kinds of aircraft and missions. Students will then divide into teams of 3 or 4, with each team imagining it is launching a new aircraft company that will build a particular type of aircraft to serve a specific purpose or function. In the final lesson, students will explore the value of mentorships and work-based learning experiences.	**HS-ETS1-2** – Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.B: Developing Possible Solutions - ETS1.C: Optimizing the Design Solution **HS-ETS1-3** – Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.B: Developing Possible Solutions - ETS1.C: Optimizing the Design Solution