TENTH GRADE CURRICULUM

AIRCRAFT SYSTEMS AND PERFORMANCE

SEMESTER TWO

In the Aircraft Systems and Performance course, students in the pilot and UAS tracks will take an in-depth look at the systems that make manned and unmanned aircraft work. Beginning with aircraft propulsion, students will learn about the different types of engines that produce thrust to propel an aircraft or UAS. They will go on to explore other key aircraft systems, including fuel, electrical, landing gear, and environmental. In order to fly an aircraft safely, students must also learn about the flight instruments associated with each system and how to identify and troubleshoot common problems. This unit also covers airplane flight manuals, the pilot's operating handbook, and required aircraft documents. Finally, students will complete a project of designing their own airplane, and will explore the benefits of mentorship and work-based learning experiences.

Unit 7: Propulsion

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 and turbine combustion engines, and electric motors. They will learn how aircraft powerplants are classified and the fundamentals of how different types of powerplants operate.

		No. of Sessions Per Lesson	Day of Semester
Pre-Course Exam		1	1
Section A – Pistons			
Lesson 1	Reciprocating Engines	5	6
Lesson 2	Propellers	2	8
Lesson 3	The Power Cycle - Intake Systems	3	11
Lesson 4	The Power Cycle - Combustion and Exhaust	4	15
Lesson 5	Turbochargers and Superchargers	1	16
Section B – Jets			
Lesson 1	Turbine Engines	2	18
Section C – Powering UAS			
Lesson 1	UAS Engines and Fuel	2	20
Unit 7 Exam		1	21

Total Sessions Unit 7 21
Semester Total 21

PACING GUIDE

Unit 8: Airframe Systems

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.

		No. of Sessions Per Lesson	Day of Semester
Section A – Primary Airframe Systems			
Lesson 1	Fuel Systems	4	25
Lesson 2	Electrical Systems	2	27
Lesson 3	Hydraulics and Landing Gear	3	30
Section B – High Altitude and Weather Systems			
Lesson 1	Pressurization and Oxygen Systems	2	32
Lesson 2	Anti-Icing Systems	3	35
Unit 8 Exam		1	36

Total Sessions Unit 8 15
Semester Total 36

Unit 9: Avionics and Flight Instruments

In the first semester, students learned about the importance of air pressure in making aircraft fly. Now they 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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – Pitot-Static System</u>			
Lesson 1	Altimeter and VSI	3	39
Lesson 2	Airspeed Indicator	2	41
Lesson 3	Pitot-Static Failures	1	42
<u>Section B – Gyros and Compasses</u>			
Lesson 1	Gyroscopic Instruments	4	46
Lesson 2	The Magnetic Compass	2	48
<u>Section C – Electronic Instruments</u>			
Lesson 1	Electronic Flight Displays	1	49
<u>Unit 9 Exam</u>		1	50

Total Sessions Unit 9	**14**
Semester Total	**50**

Unit 10: Required Documentation

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.

		No. of Sessions Per Lesson	Day of Semester
Section A – Aircraft Documents			
Lesson 1	AFM/POH	1	51
Lesson 2	Registration and Airworthiness Certificates	1	52
Lesson 3	Inspections	3	55
Section B – Maintenance Documents			
Lesson 1	Preventive Maintenance and Airworthiness Directives	1	56
Section C – Pilot Responsibilities			
Lesson 1	Acting as Pilot In Command	2	58
Unit 10 Exam		1	59

Total Sessions Unit 10 9
Semester Total 59

Unit 11: End of Semester Project and Career Development

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.

		No. of Sessions Per Lesson	Day of Semester
<u>Section A – End of Semester Project</u>			
Lesson 1	Design an Airplane	7	66
<u>Section B – Growing Your Skills</u>			
Lesson 1	Mentoring	1	67
Lesson 2	Work-Based Learning Experiences	2	69
Post-Course Exam		1	70
Total Sessions Unit 11		**11**	
Semester Total		**70**	