Indiana Department of Education
Academic Standards Course Framework

AEROSPACE ENGINEERING (Non-PLTW)

Aerospace Engineering should provide students with the fundamental knowledge and experience to apply mathematical, scientific, and engineering principles to the design, development, and evolution.. of aircraft, space vehicles and their operating systems. Emphasis should include investigation and research on flight characteristics, analysis of aerodynamic design, and impact of this technology on the environment. Classroom instruction should provide creative thinking and problem-solving activities using software that allows students to design, test, and evaluate a variety of air and space vehicles, their systems, and launching, guidance and control procedures.

- DOE Code: 5518
- Recommended Grade Level: Grade 9-12
- Recommended Prerequisites:
- Credits: 1 credit per semester, Maximum of 2 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

Application of Content

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences.

Content Standards

Domain – Basic Aerodynamics

Core Standard 1 Students evaluate the design of an airfoil to analyze aerodynamic forces.

Standards

ASE-1.1 Calculate associated forces and conditions of flight considering four forces that affect flight

ASE-1.2 Evaluate the four major forces that act on an aircraft flying in the Earth's atmosphere

ASE-1.3 Identify the control surfaces of an aircraft and the impact of each on the axis of rotation and motion

ASE-1.4 Utilize information from avionics systems to provide stable and controlled flight

ASE-1.5 Hypothesize the flight characteristics of an aerospace surface based on test data

ASE-1.6 Investigate the historical impact of the design of aerospace technologies

ASE-1.7 Compare and contrast the various methods by which different aerospace technologies achieve and maintain stable flight

Domain – Aerospace Materials

Core Standard 2 Students validate the selection of materials and processes to produce cost-effective and structurally sound aerospace products.

Standards

ASE-2.1 Identify material types and discuss how they are used

ASE-2.2 Evaluate the reaction of stress on the different material types and infer the best application for each

ASE-2.3 Differentiate between proper and improper structural shapes within specific aerospace applications

ASE-2.4 Design, construct, and test an alternative aerospace material

ASE-2.5 Research the career opportunities that include materials selection and fabrication of aerospace engineering technologies

ASE-2.6 Investigate the future of aerospace materials and their impact on air and space travel

Domain – Power Plants

Core Standard 3 Students evaluate differing methods of propulsion to verify the proper application given a specific aerospace need.

Standards

ASE-3.1 Differentiate between the various types of aerospace engines in terms of structure, operation, placement, and specific use

ASE-3.2 Compare and contrast rocket engines with other types of aerospace engines

ASE-3.3 Predict and explain the flight path taken by a suborbital rocket

ASE-3.4 Connect propulsion in relation to the four forces of flight

ASE-3.5 Summarize the relationship between Newton's three laws and different methods of aerospace propulsion

ASE-3.6 Determine the career opportunities involving propulsion in aerospace engineering

Domain – Avionics and Flight Systems

Core Standard 4 Students apply and adapt navigation skills and tools to demonstrate an understanding of the rules of flight planning and navigation.

Standards

ASE-4.1 Cite evidence for the development of different navigational techniques

ASE-4.2 Plan a successful flight using modern (GPS) and traditional (VOR and "dead-rekoning") navigation aids

ASE-4.3 Identify the benefits and demands of a career as an Air Traffic Controller

ASE-4.4 Investigate the constraints that affect cost effective flight planning

ASE-4.5 Assess the functionality of GPS in terms of accuracy and reliability

Domain – Astronautics

Core Standard 5 Students analyze efficiently managed space systems in order to better understand the correlation between space travel and orbital mechanics.

Standards

ASE-5.1 Justify the regulation of the use of space

ASE-5.2 Describe the history of space travel emphasizing the impact of the space race on society

ASE-5.3 Illustrate the orbit of a satellite

ASE-5.4 Utilize Kepler's Laws to describe and predict the path of an orbiting satellite

Domain – Aerospace Physiology

Core Standard 6 Students analyze efficiently managed space systems in order to better understand the correlation between space travel and orbital mechanics.

Standards

ASE-6.1 Identify flight constraints based on the limitations of the human body

ASE-6.2 Investigate the role of human interaction as the cause of aerospace accidents and propose the advances in airline safety as a result

ASE-6.3 Suggest modifications for flight control based upon structure and function of the human body

ASE-6.4 Justify the use of unmanned aerial vehicles (UAVs) based on the limitations imposed on flight by humans

ASE-6.5 Examine the effects of spaceflight on the human body

ASE-6.6 Prescribe accommodations used during short-term and long-term space travel to maintain functioning body systems

Domain – Offshoots of Aerospace Engineering

Core Standard 7 Students connect the evolution and cost effectiveness of aerospace engineering technologies to the development of flight and non-flight related industries.

Standards

ASE-7.1 Investigate spinoff applications of aerospace engineering both flight and non-flight related

ASE-7.2 Correlate the link between processes used in aerospace engineering design to profitability, cost effectiveness, and impact on the environment

ASE-7.3 Distinguish between the different careers that stem from alternative applications of aerospace engineering

ASE-7.4 Validate the requirements for a working system at a distance based on a specific task

ASE-7.5 Differentiate between the various control systems used in distant operations

ASE-7.6 Identify the hurdles to delivering a system at a distance due to a harsh environment

ASE-7.7 Summarize the process by which a system at a distance is controlled from any distance

ASE-7.8 Establish successful autonomous navigation

ASE-7.9 Justify the need for unmanned aerial and terrestrial vehicles for both military and civilian purposes

Process Standards

Common Core Literacy Standards for Technical Subjects

Reading Standards for Literacy in Technical Subjects 9-10

The standards below begin at grade 9 and define what students should understand and be able to do by the end of grade 10. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Key Ideas and Details

9-10.RT.1 Cite specific textual evidence to support analysis of technical texts, attending to the precise details of explanations or descriptions.

9-10.RT.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

9-10.RT.3 Follow precisely a complex multistep procedure when performing technical tasks, attending to special cases or exceptions defined in the text.

Craft and Structure

9-10.RT.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to *grades 9-10 texts and topics*.

9-10.RT.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

9-10.RT.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

Integration of Knowledge and Idea

9-10.RT.7 Translate technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

9-10.RT.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a technical problem.

9-10.RT.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Range of Reading and Level of Text Complexity

9-10.RT.10 By the end of grade 10, read and comprehend technical texts in the grades 9-10 text complexity band independently and proficiently

Writing Standards for Literacy in Technical Subjects 9-10

The standards below begin at grade 9 and define what students should understand and be able to do by the end of grade 10. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Text Types and Purposes

9-10.WT.1 Write arguments focused on *discipline-specific content*.

9-10.WT.2 Write informative/explanatory texts, including technical processes.

9-10.WT.3 Students will not write narratives in technical subjects. *Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In technical, students must be able to write precise enough descriptions of the step-by-step procedures they use in their technical work that others can replicate them and (possibly) reach the same results.*

Production and Distribution of Writing

9-10.WT.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

9-10.WT.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

9-10.WT.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Research to Build and Present Knowledge

9-10.WT.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.

9-10.WT.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 selectivity to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation

9-10.WT.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

9-10.WT.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Career and Technical Student Organizations

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in a Career and Technical Student Organization, such as Business Professional of America, DECA, or Future Business Leaders of America.