

# Aerospace Design I YAG

**One Credit | Single-Blocked | Full Year | 36 Weeks (4 Grading Periods) | Recommended Grades 10–12**

**Course Information:** Prerequisite: Algebra I. Recommended corequisite: Geometry. AD1 = §127.413 Aerospace Design I. CTE Employability Skills §127.15(d)(1) are integrated throughout. Students study the evolution and emerging trends of aircraft and aerospace systems and apply engineering design, project management, collaboration, documentation, aerodynamics, propulsion, materials, structures, orbital mechanics, and aircraft systems to mission-driven design decisions. ACCESS may support aerospace career exploration, postsecondary planning, credential research, and portfolio development.

| GP | Wks   | Unit & Focus                                                                    | Major Learning Tasks & Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Integrated TEKS                                                                                      | Extension Activities                                                                                                                                 |
|----|-------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | 1–2   | <b>Unit 1 – Aerospace Engineering, Ethics &amp; Design Foundations</b>          | <ul style="list-style-type: none"> <li>Examine aerospace engineering careers, professionalism, standards of conduct and engineering ethics</li> <li>Apply the iterative engineering design process to a short aerospace challenge</li> <li>Analyze how scope, resources, ethics, regulations, manufacturability, technology, stakeholders and failure affect design</li> <li>Integrate professional communication, teamwork, time management and safe work practices</li> </ul>                           | <ul style="list-style-type: none"> <li>AD1-1</li> <li>AD1-2(A–D)</li> <li>§127.15(d)(1)</li> </ul>   | <ul style="list-style-type: none"> <li>ACCESS: aerospace pathways</li> <li>Engineering ethics case</li> <li>Introductory design challenge</li> </ul> |
| 1  | 3–4   | <b>Unit 2 – Project Management, Collaboration &amp; Technical Documentation</b> | <ul style="list-style-type: none"> <li>Research project-management phases, roles, tools, schedules, budgets and management of change</li> <li>Structure team projects and demonstrate critical feedback, sensemaking and productive group dynamics</li> <li>Establish engineering documentation using professional standards/templates</li> <li>Create stakeholder-appropriate executive summaries, test reports, failure documents, models, notebooks and drawing packages</li> </ul>                    | <ul style="list-style-type: none"> <li>AD1-3(A–G)</li> <li>AD1-4(A–E)</li> <li>AD1-5(A–C)</li> </ul> | <ul style="list-style-type: none"> <li>Gantt/project plan</li> <li>Team critique activity</li> <li>Engineering notebook</li> </ul>                   |
| 1  | 5–6   | <b>Unit 3 – History and Evolution of Flight</b>                                 | <ul style="list-style-type: none"> <li>Investigate successes and failures in human flight before powered flight</li> <li>Research aircraft innovation before and after the jet age and connections to world events</li> <li>Research rocket innovation before and after human spaceflight</li> <li>Discuss the history of aircraft regulation and the role of the FAA</li> <li>Communicate how historical constraints and failures shaped aerospace design</li> </ul>                                     | <ul style="list-style-type: none"> <li>AD1-6(A–F)</li> <li>AD1-5(A–C)</li> </ul>                     | <ul style="list-style-type: none"> <li>Aerospace timeline</li> <li>FAA/regulation research</li> <li>Historical design analysis</li> </ul>            |
| 1  | 7–9   | <b>Unit 4 – Aircraft Categories, Classification &amp; Emerging Trends</b>       | <ul style="list-style-type: none"> <li>Identify aircraft categories/classes using FAA frameworks</li> <li>Categorize aircraft by propulsion, power, control and piloting attributes</li> <li>Compare aircraft categories and use cases</li> <li>Research emerging aircraft trends including airships, rotary systems and alternative-energy aircraft</li> <li>Develop a mission/use-case comparison for selected aircraft</li> </ul>                                                                      | <ul style="list-style-type: none"> <li>AD1-7(A–D)</li> <li>AD1-2(A–D)</li> </ul>                     | <ul style="list-style-type: none"> <li>Aircraft classification guide</li> <li>Emerging-aircraft research</li> <li>Mission comparison</li> </ul>      |
| 2  | 10–12 | <b>Unit 5 – Atmospheric Flight, Forces, Axes &amp; Stability</b>                | <ul style="list-style-type: none"> <li>Analyze relationships among atmospheric temperature, pressure, density and altitude</li> <li>Identify yaw, pitch and roll and methods for controlling motion about each axis</li> <li>Explain lift, drag, thrust and weight and their relationships in flight</li> <li>Relate mass, weight, gravity, acceleration and g-force using appropriate units</li> <li>Draw force diagrams and identify fixed/movable components used for stability and control</li> </ul> | <ul style="list-style-type: none"> <li>AD1-8(A–J)</li> </ul>                                         | <ul style="list-style-type: none"> <li>Atmosphere investigation</li> <li>Force-diagram lab</li> <li>Stability/control model</li> </ul>               |
| 2  | 13–15 | <b>Unit 6 – Lift, Drag, Airfoils &amp; Aircraft Performance</b>                 | <ul style="list-style-type: none"> <li>Explain airfoil lift generation, angle of attack and stall</li> <li>Interpret lift-coefficient and drag-coefficient versus angle-of-attack charts</li> <li>Analyze profile/form, skin-friction, interference, trim and induced drag</li> <li>Interpret lift-to-drag data and determine optimal glide conditions</li> <li>Research airfoil applications and explain unpowered/soaring flight</li> </ul>                                                             | <ul style="list-style-type: none"> <li>AD1-9(A–M)</li> </ul>                                         | <ul style="list-style-type: none"> <li>Airfoil investigation</li> <li>L/D data analysis</li> <li>Glider performance challenge</li> </ul>             |

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| 2 | 16–17 | <b>Unit 7 – Weight, Balance &amp; Mission Requirements</b>               | <ul style="list-style-type: none"> <li>• Calculate moments created by forces and define center of gravity and center of pressure</li> <li>• Analyze how CG/CP locations influence aircraft stability using a variable-configuration model</li> <li>• Generate atmospheric and space mission requirements</li> <li>• Analyze interrelationships among payload, range, altitude, takeoff/landing, environment and recovery requirements</li> <li>• Interpret mission profiles and connect requirements to aircraft/spacecraft categories and overall design</li> </ul> | <ul style="list-style-type: none"> <li>• AD1-10(A–E)</li> <li>• AD1-11(A–F)</li> </ul>            | <ul style="list-style-type: none"> <li>• Weight-and-balance model</li> <li>• Mission requirements brief</li> <li>• Design review</li> </ul>                |
| 2 | 18    | <b>Semester 1 Exam – Aerospace Design I</b>                              | <ul style="list-style-type: none"> <li>• Cumulative written/performance assessment</li> <li>• Aerodynamics, stability and mission-requirements application</li> <li>• Engineering documentation and design-process review</li> </ul>                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Cumulative: AD1-1–11</li> <li>• §127.15(d)(1)</li> </ul> | <ul style="list-style-type: none"> <li>• Targeted review/remediation</li> </ul>                                                                            |
| 3 | 19–21 | <b>Unit 8 – Aerospace Propulsion Systems</b>                             | <ul style="list-style-type: none"> <li>• Explain piston, turboprop and jet propulsion and how each delivers thrust</li> <li>• Evaluate propulsion choices using cost, operating cost, reliability, power, altitude and speed limitations</li> <li>• Compare rocket and jet engines</li> <li>• Research solid-fuel and liquid-fuel rocket applications</li> <li>• Recommend propulsion for a mission using evidence-based design criteria</li> </ul>                                                                                                                  | <ul style="list-style-type: none"> <li>• AD1-12(A–F)</li> <li>• AD1-11 reinforcement</li> </ul>   | <ul style="list-style-type: none"> <li>• Propulsion comparison</li> <li>• Rocket research</li> <li>• Mission propulsion recommendation</li> </ul>          |
| 3 | 22–24 | <b>Unit 9 – Aerospace Materials &amp; Manufacturing</b>                  | <ul style="list-style-type: none"> <li>• Research aerospace material classes including wood, composites, metals and plastics</li> <li>• Explain material selection for aircraft components</li> <li>• Investigate manufacturing methods for landing gear, wings, fuselage, canopies and other components</li> <li>• Analyze material/manufacturing cost impacts on design</li> <li>• Relate material requirements to mission requirements</li> </ul>                                                                                                                 | <ul style="list-style-type: none"> <li>• AD1-13(A–E)</li> <li>• AD1-2(B–C)</li> </ul>             | <ul style="list-style-type: none"> <li>• Material-selection matrix</li> <li>• Manufacturing process analysis</li> <li>• Cost/design trade study</li> </ul> |
| 3 | 25–27 | <b>Unit 10 – Aerospace Structures</b>                                    | <ul style="list-style-type: none"> <li>• Identify and compare truss, semi-monocoque and monocoque structures</li> <li>• Explain why structural types vary by aircraft category and mission</li> <li>• Identify fuselage components including stringers, bulkheads and skin</li> <li>• Identify wing/empennage components including ribs, spars, stringers and skin</li> <li>• Compare structures for atmospheric flight and space flight</li> </ul>                                                                                                                  | <ul style="list-style-type: none"> <li>• AD1-14(A–F)</li> </ul>                                   | <ul style="list-style-type: none"> <li>• Structure model</li> <li>• Aircraft structural analysis</li> <li>• Atmosphere-vs-space comparison</li> </ul>      |
| 4 | 28–30 | <b>Unit 11 – Space Flight &amp; Orbital Mechanics</b>                    | <ul style="list-style-type: none"> <li>• Identify and describe orbits using the six Keplerian elements</li> <li>• Explain how changes in orbital elements change an orbit</li> <li>• Relate mission requirements to orbit selection</li> <li>• Analyze environmental conditions affecting human and autonomous space missions</li> <li>• Research spacecraft launch/recovery methods and emerging trends in space flight</li> </ul>                                                                                                                                  | <ul style="list-style-type: none"> <li>• AD1-15(A–F)</li> <li>• AD1-11(B–F)</li> </ul>            | <ul style="list-style-type: none"> <li>• Orbit modeling</li> <li>• Space mission brief</li> <li>• Emerging-spaceflight research</li> </ul>                 |
| 4 | 31–32 | <b>Unit 12 – Alternate Aerospace Applications &amp; Aircraft Systems</b> | <ul style="list-style-type: none"> <li>• Research aerospace engineering contributions to automotive and naval performance</li> <li>• Identify commercial/home applications influenced by aerospace design and aerodynamics</li> <li>• Explain basic functionality of navigation, communication, entertainment, flight-control and propulsion systems</li> <li>• Research different implementations of aircraft systems</li> <li>• Connect system choices to aircraft mission and design requirements</li> </ul>                                                      | <ul style="list-style-type: none"> <li>• AD1-16(A–C)</li> <li>• AD1-17(A–B)</li> </ul>            | <ul style="list-style-type: none"> <li>• Cross-industry aerospace case</li> <li>• Aircraft systems map</li> <li>• Systems research</li> </ul>              |

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|---|-------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | 33–35 | <b>Unit 13 – Mission-Driven Aerospace Design Capstone</b> | <ul style="list-style-type: none"> <li>• Define a mission and translate it into measurable aerospace requirements</li> <li>• Manage a team project using schedules, roles, documentation and design-process practices</li> <li>• Select aircraft/spacecraft category, aerodynamic approach, propulsion, materials, structure and systems</li> <li>• Create technical/nontechnical models and justify design decisions using mission requirements</li> <li>• Present the design, receive critique and document revisions/failures as part of iteration</li> </ul> | <ul style="list-style-type: none"> <li>• AD1-2–5</li> <li>• AD1-7–17 reinforcement</li> <li>• §127.15(d)(1)</li> </ul> | <ul style="list-style-type: none"> <li>• Aerospace capstone</li> <li>• Industry/mentor critique</li> <li>• ACCESS: portfolio/postsecondary planning</li> </ul> |
| 4 | 36    | <b>Semester 2 Exam &amp; Aerospace Design Showcase</b>    | <ul style="list-style-type: none"> <li>• Cumulative written/performance assessment</li> <li>• Mission-driven aerospace design application</li> <li>• Capstone presentation, engineering documentation and reflection</li> </ul>                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Cumulative: AD1-1–17</li> <li>• §127.15(d)(1)</li> </ul>                      | <ul style="list-style-type: none"> <li>• Stakeholder showcase</li> </ul>                                                                                       |

## Aerospace Design I TEKS Coverage Checklist

**Coverage verification:** All 17 Aerospace Design I strands and every student expectation are intentionally addressed. CTE Employability Skills §127.15(d)(1) are integrated throughout.

| Strand            | Student Expectations | YAG Placement                 | Coverage |
|-------------------|----------------------|-------------------------------|----------|
| AD1-1             | Single expectation   | Unit 1; reinforced throughout | 100%     |
| AD1-2             | A–D                  | Units 1, 4, 9, 13             | 100%     |
| AD1-3             | A–G                  | Units 2 and 13                | 100%     |
| AD1-4             | A–E                  | Units 2 and 13                | 100%     |
| AD1-5             | A–C                  | Units 2–3 and 13              | 100%     |
| AD1-6             | A–F                  | Unit 3                        | 100%     |
| AD1-7             | A–D                  | Units 4 and 13                | 100%     |
| AD1-8             | A–J                  | Units 5 and 13                | 100%     |
| AD1-9             | A–M                  | Units 6 and 13                | 100%     |
| AD1-10            | A–E                  | Units 7 and 13                | 100%     |
| AD1-11            | A–F                  | Units 7–8, 11, 13             | 100%     |
| AD1-12            | A–F                  | Units 8 and 13                | 100%     |
| AD1-13            | A–E                  | Units 9 and 13                | 100%     |
| AD1-14            | A–F                  | Units 10 and 13               | 100%     |
| AD1-15            | A–F                  | Units 11 and 13               | 100%     |
| AD1-16            | A–C                  | Units 12 and 13               | 100%     |
| AD1-17            | A–B                  | Units 12 and 13               | 100%     |
| CTE Employability | §127.15(d)(1)        | Integrated throughout         | 100%     |

### Implementation Notes

- Aerospace Design I is a one-credit course recommended for Grades 10–12. Algebra I is the prerequisite, and Geometry is the recommended corequisite.
- Professional engineering documentation should be developed throughout the year through engineering notebooks, executive summaries, test/failure reports, system models, drawing packages, project schedules, budgets, and stakeholder presentations.
- The course should connect aerospace theory to mission-driven design decisions. Students should repeatedly justify choices involving aircraft category, forces of flight, stability and control, propulsion, materials, structures, orbital environment, and aircraft systems.
- Extended learning may include engineering CTSOs, aerospace/aviation organizations, industry mentors, higher education partners, museums, aerospace facilities, and other experiences that support leadership and career development.
- Weeks 18 and 36 are reserved for cumulative semester exams. No instructional unit crosses the semester boundary, and no calendar-specific dates are included.