Department of Education | College, Career and Technical Education

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Aviation II: Advanced Flight

Primary Career Cluster:	Transportation
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C20H18
Prerequisite(s):	*Aviation I: Principles of Flight* (C20H16)
Credit:	1
Grade Level:	11-12
Elective Focus - Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Transportation courses.
POS Concentrator:	This course satisfies one out of two required courses that meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
Programs of Study and Sequence:	This is the third and final course in the *Aviation Flight* program of study.
Aligned Student Organization(s):	SkillsUSA: https://www.skillsusatn.org/
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html.
Available Student Industry Certifications:	Students are encouraged to demonstrate mastery of knowledge and skills learned in this course by earning the appropriate, aligned department-promoted industry certifications. Access the promoted list here for more information.
Teacher Endorsement(s):	594, 774
Required Teacher Certifications/Training:	FAA Industry Certification
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-transportation-distribution-logistics.html

Course Description

Aviation II: Advanced Flight is the capstone course in the *Aviation Flight* program of study intended to prepare students for careers in aviation. While continuing to build upon the knowledge, skills, and competencies acquired in *Introduction to Aerospace* and *Aviation I*, students in *Aviation II* will receive rigorous instruction in preparation to take the Federal Aviation Administration (FAA) Private Pilot written exam. This course goes beyond the mastery of procedures under normal conditions learned in *Aviation I: Principles of Flight* and introduces students to the troubleshooting and diagnostic

techniques used by pilots and other aircraft personnel to assess and correct for malfunctions, make adjustments in hazardous weather conditions, and perform other crucial emergency procedures. Continued emphasis is placed on maintaining the safety of flight and developing sound judgment ("judgment training") throughout these conditions.

In addition, students will develop a keen understanding of advanced aerodynamics and the physics of flight to aid in decision-making and technical adjustments while working under simulated abnormal procedures. Finally, upon graduation, proficient students will be better prepared to begin flight training in pursuit of a private pilot's license should they choose.

Flight simulators are required in order to fully master many of the standards in this course. Instructors may use a range of equipment to meet this requirement, from simple computer software such as Microsoft Flight SimX to advanced freestanding simulators such as the Redbird FMX. This course also draws on preparation materials for the FAA Private Pilot Ground Test. Sample materials may be found on the FAA website or by order from Gleim Aviation at http://www.gleim.com/aviation/.

Program of Study Application

This is the capstone course in the *Aviation Flight* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Transportation, Distribution, & Logistics website at https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-transportation-distribution-logistics.html.

Course Standards

Aviation Safety

1) Apply the safety concepts learned in previous classes to develop several detailed plans to potential problems faced in flight. To guide the planning, students should ask and then answer the question, "What would I do if……?" in response to problems such as, but not limited to:
    a. Aircraft door pops open just after lift off
    b. Engine fails at 100 feet AGL on takeoff
    c. Engine fails at 500 feet AGL on takeoff
    d. Oil on windshield on climb out
    e. Fuel being siphoned out of fuel tank on climb out due to an unsecured fuel cap
    f. Cabin fire
    g. Engine fire
    h. Minimum fuel situation
    i. Deteriorating weather
    j. Sick or unruly passenger

2) Demonstrate understanding of the five hazardous thoughts and associated antidotes to each of the following:
    a. Anti-authority
    b. Impulsivity
    c. Invulnerability

d. Macho
e. Resignation

Students will determine if they have one or more of these hazardous thoughts and explain what they do to realize when their decisions may be influenced by a hazardous thought. Students should also explain how they will counteract this thought in order to remain as safe as possible.

Careers in Aviation

3) Demonstrate understanding and be able to explain the privileges and FAA requirements for each of the following pilot certificates and ratings:
    a. Certificates
        i. Sport
        ii. Private
        iii. Commercial
        iv. Airline Transport Pilot (ATP)
    b. Ratings
        i. Instrument
        ii. Sea Plane
        iii. Multi engine
        iv. Glider
    c. License (Mechanic)
        i. Airframe
        ii. Power Plant

Systems Problem Solving

4) Describe the functions and characteristics of an airplane's aileron, elevator, and rudder, including the trim system if appropriate. Troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
    a. Frozen or stuck ailerons
    b. Frozen or stuck elevators
    c. Frozen or stuck rudder
    d. Taking off with a control lock still in place
    e. Aileron, elevator, or rudder hooked up backwards

5) Describe the functions and characteristics of an airplane's power plant, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
    a. Partial engine failure
    b. Complete engine failure
    c. Low oil pressure
    d. High oil and/or cylinder head temperature

6) Describe the functions and characteristics of an airplane's instrument systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
    a. Blocked pitot system
    b. Blocked static system
    c. Failed vacuum pump

    d. Failed flight gyros
    e. Two-way communications failure
7) Describe the functions and characteristics of an airplane's fuel systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including but not limited to:
    a. Low fuel
    b. Vapor lock
    c. Contaminated fuel

8) Describe the functions and characteristics of an airplane's electrical systems, and troubleshoot system problems to safely land aircraft in a variety of situations, including, but not limited to:
    a. Alternator/generator failure
    b. Alternator/generator overcharging
    c. Electrical fire
    d. Popped circuit breaker(s)
    e. Runaway electric trim
    f. Electrical smoke

Advanced Aerodynamics and Physics of Flight

9) Research, understand, and be able to explain the aerodynamics force that affect an aircraft on the ground and in flight. Anticipate, prevent, and recommend actions to recover from unsafe flight conditions such as, but not limited to:
    a. Becoming airborne at too slow an airspeed in ground effect
    b. Aircraft stalling at an unsafe altitude
    c. Aircraft spin
    d. High density altitude airport operations

10) Explain the effects of high-density altitudes on aircraft takeoff distances, aircraft rate of climb, aircraft angle of climb, Indicated Airspeed (IAS) versus True Airspeed (TAS), and landing distances.

Trends and Emerging Technologies

11) Drawing on industry magazines, scholarly research, and news media, explore in an informational essay the chief features, advantages, and disadvantages of emerging aviation technologies, such as unmanned aerial vehicles (UAVs) and mobile technologies gaining prominence in aviation fields. Discuss how these technologies work, how they have impacted (or are expected to impact) the aviation industry, and their impact on aircraft safety.

Emergency Procedures

In order to demonstrate mastery of the following standards students must: (a) be able to determine that there is a problem or failure, (b) determine the problem or failure, (c) properly recall the appropriate emergency procedure memory checklist, (d) refer to the appropriate written emergency checklist, (e) determine the best plan to deal safely with the problem or failure, (f) and how to safely land the aircraft. Moreover, students must be able to realize there may be multiple problems or failures that can occur at one time; they must be able to develop a plan of action that will deal with the failures while safely flying the aircraft.

12) Demonstrate the ability to follow an emergency procedure for a low fuel situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

13) Demonstrate the ability to follow an emergency procedure for an aircraft fire situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

14) Demonstrate the ability to follow an emergency procedure for a medical emergency situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

15) Demonstrate the ability to follow an emergency procedure for a deteriorating weather situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

16) Demonstrate the ability to follow an emergency procedure for a two-way radio failure situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

17) Demonstrate the ability to follow an emergency procedure for a partial or complete engine failure situation. Read, recite, and complete the appropriate memory and non-memory checklists in front of peers or in a mock emergency situation while safely flying the aircraft.

Problems with Aircraft Performance and Weight & Balance

18) Consult the manufacturer's approved limits for an aircraft's center of gravity. Explain the associated problems when the aircraft's center of gravity is forward or aft of the approved limits. Given a designated degree of imbalance, determine and demonstrate in a mock setting how to move passengers and/or cargo to bring the center of gravity within the manufacturer's approved takeoff CG envelope. Correctly use a moment index to plot these changes on a loading graph to aid in the demonstration, attending to appropriate units, quantities, and terminology.

19) Consult the manufacturer's approved maximum takeoff weight. Explain the associated problems when the aircraft's takeoff weight is greater than approved by the manufacturer. Calculate the proper reduction in weight for various combinations of passengers and cargo; be "able and willing" to reduce the payload as needed to bring the aircraft within the manufacturer's approved takeoff weight.

Cross-Country Planning

20) Determine the different factors involved in planning the best route on each leg of a cross-country flight. For each factor, describe why it should be considered when determining the route, citing, by contrast, what could go wrong if the factor was not considered. Examples include the following:

a. Shortest distance
b. Lowest terrain
c. Best emergency landing options
d. Smoothest air

21) Determine the different factors involved in calculating the best altitude to fly on each leg of a cross-country flight. Factors may include the following:
    a. VFR – Easterly heading (odd thousand + 500') or Westerly heading (even thousand + 500')
    b. IFR – Easterly heading (odd thousand) or Westerly heading (even thousand) (below FL 290)
    c. Distance between departure airport and destination airport
    d. Headwind/tailwind components at different altitudes
    e. Terrain features
    f. Emergency landing options
    g. Smoothest air
    h. Pressurized versus non-pressurized aircraft

    Given a specific route, calculate optimum altitude for all stages of a cross-country flight, incorporating consideration of the factors identified above and relying on sectional and world aeronautical charts, aircraft specifications, and other resources to make proper determinations.

22) Given a specific flight route, determine the headwind/tailwind component on each leg of a cross-country flight. Specifically,
    a. Determine forecast winds aloft for each leg
    b. Determine best altitude for each leg
    c. Determine headwind/tailwind component for each leg

23) Given a specific flight route, determine the estimated groundspeed on each leg of a cross-country flight. Specifically,
    a. Determine altitude
    b. Determine true airspeed (TAS)
    c. Determine headwind/tailwind component
    d. Determine crosswind component
    e. Determine estimated groundspeed (GS)

24) Given a specific flight route, determine the estimated magnetic heading required for each leg of a cross-country flight. Specifically,
    a. Determine True Course (TC) / Magnetic Course (MC)
    b. Determine crosswind component
    c. Determine True Heading (TH)
    d. Determine amount of variation; show how to add variation if it is a Westerly variation and subtract variation if it is an Easterly variation
    e. Determine Magnetic Heading (MH)

25) Citing relevant examples and supporting texts, explain to both a lay audience and a technical audience the concept of estimated time enroute (ETE) and the effect of flying through different time zones. For a given scenario, determine and communicate departure and arrival times in local times and GMT.

26) Correctly simulate how to complete, file, activate, and close or cancel a VFR flight plan, following proper procedures and determining the information requested in each box of the flight plan.

27) Research, role play, communicate, and write about the factors involved in correctly departing from and arriving at an airport. For each of the following, consult and cite the Airman's Information Manual and FAA guidelines when modeling the behaviors necessary for successful takeoff and landing, including communications with ground control, air traffic control, any passengers, and relevant superiors, peers, and authorities:
    a. Controlled airport – Departure
        i. ATIS
        ii. Clearance delivery (assigned headings, altitudes, transponder codes, departure frequencies)
        iii. Ground control (taxi instructions)
        iv. Tower (VFR flight plan activation)
        v. Departure control

    b. Controlled airport – Arrival
        i. ATIS
        ii. Approach control (tower)
        iii. VFR flight plan closure
        iv. Ground Control (taxi instructions)
    c. Non-controlled airport – Departure
        i. AWOS
        ii. CTAF / Unicom (pre-taxi communication, pre-takeoff communication)
        iii. Proceeding on course
        iv. VFR Activation with FSS
    d. Non-controlled airport – Arrival
        i. AWOS
        ii. CTAF / Unicom (airport advisory, pre-pattern communication, pattern communication, base communication, clearing runway communication)
        iii. VFR flight plan closure with FSS via radio or telephone

Federal Aviation Regulations (FARs)

28) Demonstrate understanding and be able to explain important FARs that relate to Private Pilot operations included in the following, citing specific text and wording from the regulations:
    a. FAR Part 1
    b. FAR Part 21
    c. FAR Part 39
    d. FAR Part 43
    e. FAR Part 61
    f. FAR Part 71
    g. FAR Part 91
    h. NTSB Part 830

    Articulate why these regulations are necessary and analyze how the FAA has structured the FARs in order to quickly retrieve such information in the future.

Judgment Training

29) Continue to explore and demonstrate understanding of proper techniques for improving pilot judgment and decision-making skills in every aspect of the pre-flight, in-flight, and post-flight stages.

FAA Private Pilot Written Exam Preparation

Note on the FAA Private Pilot Exam: Throughout all three courses in the Aviation Flight program of study, students will be exposed to the FAA Private Pilot written exam questions based on the material being covered. Upon completion of this course, students may qualify to sit for the exam at the discretion of the instructor, and based upon performance on a practice exam as indicated below.

30) Students will demonstrate mastery of corresponding course content for the FAA Private Pilot written exam when achieving a score of 80% on a practice 60-question exam.

Standards Alignment Notes

*References to other standards include:

- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.