CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Transportation, Distribution & Logistics

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Colorado CTE Course – Scope and Sequence

Course Name	Advanced Flight	Course Details Course = 0.50 Carnegie Unit Credit	Credit= 1.0 Prerequisites: Principles of Flight CTE Credential: CTE Transportation Operations
Course Description	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 Principles of Flight, students in Advanced Flight 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 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.		
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.		
SCED Identification #	20053	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.	

All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at **https://www.cde.state.co.us/standardsandinstruction/essentialskills**

Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Safety		Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Aviation sector workplace environment.	Apply concepts of safety to aircraft operations. Student is expected to: (A) Comprehend and apply air safety requirements; (B) Comprehend the airport layout, inclusive of safety elements; (C) Comprehend airspace control;	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	

		Understand how flight conditions affect human physiology, safety, and decision-making. Understand safety aspects of flight technologies. Interpret policies, procedures, and regulations regarding safety for the flight environment and aviation industry.	(D) Demonstrate procedures of radio communications during conduct of a flight; (E) Understand how to locate and apply FAA regulations; (F) Understand the effects on the body in the flight environment and identify potential hazards; (G) List and describe the safety procedures to prevent aviation accidents due to physical distress; (H) Explain key elements of aeronautical decision-making and safety data analysis; (I) Evaluate the nature of accidents and the role of the accident investigation process; and (J) Describe how safety management systems (SMS) work to decrease airport and aircraft accidents.	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 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.	
Career Development		Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: (A) Identify employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of aircraft maintenance and repair; (B) Demonstrate the principles of group participation and leadership related to citizenship and career preparation; (C) Evaluate employers' expectations and appropriate work habits; (D) Discuss the competencies related to resources, information systems, and technology; (E) Demonstrate awareness of the technical knowledge	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	

			and skills related to human factors in health and safety in the workplace, as specified by appropriate governmental regulations and an understanding of personal responsibility in this area; (F) Demonstrate awareness of the technical knowledge, skills, and attitudes related to human factors in a successful and profitable workplace and the role of the employee in creating that success, including personal responsibility; and (G) Apply reasoning skills to a variety of simulated workplace situations in order to make ethical decisions.		
Systems Troubleshooting		Apply knowledge to aircraft systems to problem-solve issues related to flight operations.	The student applies the technical knowledge and skills of aircraft systems and operations to solve problems, perform inspections, and troubleshoot issues in	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	

			aviation. The student is expected to: (A) Demonstrate knowledge of aviation regulations prescribed by the Code of Federal Regulations, Title 14, Volumes I-III, that govern mechanic privileges, the construction, maintenance, and service of aircraft, and 100-hour and annual inspections; (B) Demonstrate knowledge of aircraft categories as used with respect to the certification of aircraft based upon intended use or operating limitations such as transport, normal, utility, acrobatic, limited, restricted, and provisional; (C) Apply the principles of basic aerodynamics, theory of flight, and the function of primary and secondary flight controls; (D) demonstrate	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 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 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	

			knowledge of aircraft weight and balance and how repairs, alterations, and loading can adversely affect safe operation of an aircraft; (D) Demonstrate knowledge of aircraft finishes and corrosion prevention and removal processes; (E) Demonstrate knowledge of airframe construction and detailed repair methods and techniques, including wood structures, metal tubular structures, fabric coverings, sheet metal, and composite structures; (F) Demonstrate knowledge of aircraft assembly and rigging procedures such as structure alignment checks, balancing flight control surfaces, removing and installing flight control surfaces, and jacking aircraft; (G) Demonstrate knowledge of	c. Failed vacuum pump d. Failed flight gyros e. Two-way communications failure 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 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	

			airframe systems and components, their functions, and detailed operating principles, including landing gear, hydraulic power, cabin atmosphere control systems, aircraft instrument systems, aircraft navigation and electronic communication systems, ice and rain control systems, fire protection systems, and electrical systems; (H) Demonstrate knowledge of aircraft common terminology and standard practices required to complete maintenance, modifications, and repairs; and (I) Discuss the completion of logbooks and computer applications to maintain required aircraft documents; and (J) Describe the functions and		

			characteristics of an airplane's systems, and troubleshoot system problems to safely land aircraft in a variety of situations.		
Advanced Aerodynamics and Physics of Flight		Understand and apply scientific and physics principles related to aerodynamics.	Investigate advanced topics in aerodynamics and analyze effects on an aircraft in flight. Student is expected to: (A) Research, understand, and be able to explain the aerodynamics force that affect an aircraft on the ground and in flight; and (B) 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.	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	
Trends and Emerging Technologies		Investigate new and emerging technology in aviation.	Incorporate new information regarding the latest trends and practices for professional development. Student is expected to: (A) Engage in and recognize the need	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	

			for and life-long learning; (B) Assess contemporary issues and trends; (C) Use the techniques, skills and modern tools in aviation for professional practice.	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 Procedure		Understand rules, regulations, and procedures for flight emergencies.	Apply emergency procedures for flight operations. Students will be able to: (A) Identify the problem or failure; (B) Properly recall the appropriate emergency procedure memory checklist; (C) Determine the best plan to deal safely with the problem or failure; (D) Analyze responses to multiple problems or failures that can occur at one time; and (E) Develop a plan of action that will deal with the failures while safely flying the aircraft.	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. 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. 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. 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. 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. 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		Understand the importance of correct weight and balance for aircraft flight performance.	Identify issues related to weight and balance that affect aircraft	Consult the manufacturer's approved limits for an aircraft's center of gravity. Explain the associated	

			performance. Student is expected to: (A) Investigate manufacturer's recommendations for weight and balance (B) Explain the associated problems when the aircraft's center of gravity is forward or aft of the approved limits; Understand how to use a moment index; (C) Explain the associated problems when the aircraft's takeoff weight is greater than approved by the manufacturer; and (D) Calculate the proper reduction in weight for various combinations of passengers and cargo.	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. 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		Explore factors relating to cross-country flight planning.	Investigate flight planning procedures and relevant information to develop a cross-county	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	

			flight plan. Student is expected to: (A) Determine the different factors involved in planning the best route on each leg of a cross-country flight; (B) Determine the different factors involved in calculating the best altitude to fly on each leg of a cross-country flight; (C) calculate optimum altitude for all stages of a cross-country flight; (D) Determine the headwind/tailwind component on each leg of a cross-country flight; (E) determine the estimated groundspeed on each leg of a cross-country flight; (F) determine the estimated magnetic heading required for each leg of a cross-country flight; (G) Understand the concept of estimated time en route (ETE) and the effect of	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 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	

			flying through different time zones; (H) how to complete, file, activate, and close or cancel a VFR flight plan; (I) explore various airport information and runway layouts; and (J) Compare and contrast controlled versus non-controlled airport arrival and departure procedures.	g. 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. 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 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) 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) 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. 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. 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)		Demonstrate a working knowledge of the FAA regulations governing pilot qualifications, aircraft condition, and aircraft operations.	Demonstrate a working knowledge of the FAA regulations governing pilot qualifications, aircraft condition, and aircraft operations. Student is expected to: (A) 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.	
Judgement Training		Explain key elements of aeronautical decision-making and safety data analysis.	Apply sound reasoning and judgement to aviation flight decisions. Student is expected to: (A) Demonstrate understanding of	Continue to explore and demonstrate understanding of proper techniques for improving pilot judgment and decision-making skills in every	

			proper techniques for improving pilot judgment and decision-making skills in every aspect of the pre-flight, in-flight, and post flight stages.	aspect of the pre-flight, in-flight, and post flight stages.	
FAA Private Pilot Written Exam Preparation		Demonstrate the knowledge and skills required to obtain the private and commercial certificates and instrument rating, including aeronautical technical skills and decision-making, while demonstrating safety as their primary focus.	Student is expected to: (A) Demonstrate mastery of content for the FAA Private Pilot written exam when achieving a score of 80% on a practice 60-question exam.		