

APPROVED PATHWAY:

1. Includes minimum of three secondary-level credits.
2. Includes a work-based element.
3. Consists of a sequence:
 - Introductory-level.
 - Technical-level.
 - Application-level courses.
4. Supporting documentation includes Articulation Agreement(s), Certification, Program Improvement Plan and a Program of Study.
5. Technical-level and Application-level courses receive .5 state-weighted funding in an approved CTE pathway.



TRANSPORTATION CAREER CLUSTER DESIGN

Aviation Maintenance Pathway

CIP CODE 47.0608

INTRODUCTORY LEVEL

Title	Code	Credit
Introduction to Industrial Technology	38001	.5 credit

Title	Code	Credit
Production Blueprint Reading	21108	.5 credit

TECHNICAL LEVEL

Title	Code	Credit
*Hand and Power Tools	40400	.5 credit
*Aviation Fundamentals	40410	.5 credit
Aviation Systems	40420	1 credit

Avionics Strand

Title	Code	Credit
Foundations of Electronics	21201	1 credit

Airframe Strand

Title	Code	Credit
Production Methods I	13052	1 credit
Mechanical Power Transmission Systems	13302	.5 credit

APPLICATION LEVEL

Title	Code	Credit
***Unmanned Aircraft Systems (UAS)	40490	1 credit
**Work Experience in Aviation	40700	.5 credit
**Work Experience in Aviation - Comprehensive	40701	1 credit

Avionics Strand

Title	Code	Credit
AC Electronics	40450	1 credit
DC Electronics	40460	1 credit
Digital Electronics	21008	1 credit

Airframe Strand

Title	Code	Credit
*** Hydraulics and Pneumatics	39302	.5 credit
*** Flight Training	40540	1 credit

- * Courses required for Pathway approval.
- ** Has prerequisites - Must take at least 1.0 credit of Technical level course and Application level course combined.
- *** Has a specific prerequisite course(s) - See Competency Profile for details.

KANSAS STATE CAREER CLUSTER COMPETENCY PROFILE FOR: TRANSPORTATION CLUSTER PATHWAYS

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

- 4. Exemplary Achievement: Student possesses outstanding knowledge, skills, or professional attitude.
- 3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
- 2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
- 1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
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Graduation Date: _____

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Instructor Signature: _____

COMMON CAREER TECHNICAL CORE – Career Ready Standards (To be taught throughout the pathway.) www.careertech.org		4	3	2	1	0
1.	Act as a responsible and contributing citizen and employee.					
2.	Apply appropriate academic and technical skills.					
3.	Attend to personal health and financial well-being.					
4.	Communicate clearly, effectively and with reason.					
5.	Consider the environmental, social, and economic impacts of decisions.					
6.	Demonstrate creativity and innovation.					
7.	Employ valid and reliable research strategies.					
8.	Utilize critical thinking to make sense of problems and persevere in solving them.					
9.	Model integrity, ethical leadership, and effective management					
10.	Plan education and career path aligned to personal goals.					
11.	Use technology to enhance productivity.					
12.	Work productively in teams while using cultural/global competence.					

COMMON CAREER TECHNICAL CORE – Transportation Cluster Standards (To be taught throughout the pathway.) www.careertech.org		4	3	2	1	0
1.	Describe the nature and scope of the Transportation, Distribution & Logistics.					
2.	Career Cluster and the role of transportation, distribution and logistics in society and the economy.					
3.	Describe the application and use of new and emerging advanced techniques to provide solutions for transportation, distribution, and logistics problems.					
4.	Describe the key operational activities required of successful transportation, distribution, and logistics facilities.					
5.	Identify governmental policies and procedures for transportation, distribution, and logistics facilities.					
6.	Describe transportation, distribution and logistics employee rights and responsibilities and employers' obligations concerning occupational safety and health.					
7.	Describe career opportunities and means to achieve those opportunities in each of the Transportation, Distribution & Logistics Career Pathways.					
8.	Develop preventative maintenance plans and systems to keep facility and mobile equipment inventory in operation.					
9.	Design ways to improve facility and equipment system performance.					

Kansas Architecture & Construction Cluster

Course:	Introduction to Industrial Technology	Course #:	38001	Credit:	.5
Pathways & CIP Codes:	Aviation Maintenance (47.0608) Aviation Production (15.0000) Construction & Design (46.0000) Manufacturing (48.0000) Mobile Equipment Maintenance (47.9999)	Strand(s):	Avionics & Airframe Production & Maintenance Construction & Design Design & Production Auto Collision & Technology	Level:	Introduction
Course Description:	An introductory level course designed to instruct students in the basic skills necessary to all occupations in the Construction, Manufacturing, and Transportation career clusters.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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Benchmark 1.0: Basic Safety		4	3	2	1	0
1.1	Identify causes of accidents and the impact of accident costs.					
1.2	Follow safe behavior procedures on and around ladders, scaffolds and stairs.					
1.3	Follow safe behavior procedures around electrical hazards.					
1.4	Demonstrate the use, care and inspection of appropriate personal protective equipment (PPE).					
1.5	Explain the importance of hazard communications (HazCom) and material safety data sheets (MSDSs).					
1.6	Respond to hazardous-materials and hazardous-waste emergency situationsn accordance with regulatory requirements.					
1.7	Follow safety procedures required for lifting heavy objects.					
1.8	Demonstrate a working knowledge of safety education, environment, and enforcement for life and work.					
1.9	Apply safe practices while using tools and equipment.					
1.10	Apply safe practices for housekeeping, dress, fire, chemicals & personal protection while working in a shop.					
1.11	Describe fire prevention and firefighting techniques.					

1.12	Explain the purpose of OSHA and how it promotes safety on the job.					
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Benchmark 2.0: Industrial Math		4	3	2	1	0
2.1	Add, subtract, multiply, and divide whole numbers, fractions, decimals and percentages.					
2.2	Use a standard ruler, a metric ruler, and a measuring tape to measure.					
2.3	Demonstrate conversion skills for decimals and fractions.					
2.4	Recognize and perform calculations using metric units of length, weight, volume and temperature.					

Benchmark 3.0: Hand Tools		4	3	2	1	0
3.1	Recognize and identify some of the basic hand tools and their proper uses in industrial trades.					
3.2	Demonstrate the safe use of common hand tools.					

Benchmark 4.0: Power Tools		4	3	2	1	0
4.1	Recognize and identify some of the basic power tools and their proper uses in the industrial trades.					
4.2	Demonstrate the safe use of common power tools.					
4.3	Perform preventive maintenance on basic power tools used in the industrial trades.					

Benchmark 5.0: Blueprint Reading		4	3	2	1	0
5.1	Perform the drafting principles needed to draw the basic geometric shapes.					
5.2	Develop a pictorial sketch of an object.					
5.3	Develop a multi-view drawing.					
5.4	Identify basic symbols used in blueprints.					
5.5	Identify various types of blueprint views used in Architecture and Construction, Engineering, Manufacturing, and Transportation.					

Benchmark 6.0: Communication Skills		4	3	2	1	0
6.1	Interpret information and follow instructions presented in both verbal and written form.					
6.2	Communicate effectively in on-the-job situations using verbal and written skills in various delivery modes (face-to-face, paper, & electronic).					
6.3	Create and complete various written documents used in industrial trades.					
6.4	Demonstrate knowledge and use of computer systems and word processing software in effective communication.					

Benchmark 7.0: Employability Skills		4	3	2	1	0
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7.1	Create and utilize employment documents including a resume and portfolio.					
7.2	Demonstrate job seeking and interview skills.					
7.3	Understand and respond to performance reviews.					

Benchmark 8.0: 21 st Century/Foundation Skills		4	3	2	1	0
8.1	Demonstrate critical thinking skills and the ability to solve problems using those skills.					
8.2	Define effective relationship skills.					
8.3	Demonstrate a working knowledge of workplace issues such as sexual harassment, stress, and substance abuse.					
8.4	Demonstrate the ability to achieve common goals through team work.					

Benchmark 9.0: Materials Handling		4	3	2	1	0
9.1	Verify that health, safety, environmental, and government regulations are met.					
9.2	Recognize hazards and follow safety procedures required for materials handling.					
9.3	Demonstrate ability to load and unload materials properly and safely.					

Kansas Engineering Cluster

Course:	Production Blueprint Reading	Course #:	21108	Credit:	.5
Pathways & CIP Codes:	Aviation Production (15.0000) Aviation Maintenance (47.0608) Construction and Design (46.0000) Engineering and Applied Math (14.0101) Manufacturing (48.0000)	Strand(s):	Design & Production Avionics & Airframe Construction & Design N/A Production & Maintenance	Level:	Introductory
Course Description:	An introductory level course to provide students with the knowledge and ability to interpret the lines, symbols, and conventions of drafted blueprints. They generally emphasize interpreting, not producing, blueprints, although the courses may provide both types of experiences. Blueprint Reading courses typically use examples from a wide variety of industrial and technological applications.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
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Benchmark 1.0:		4	3	2	1	0
1.1	Identify symbols associated with blueprints.					
1.2	Interpret work from multiview drawings.					
1.3	Interpret size and location of features.					
1.4	Visualizing shapes and objects in multiple views.					
1.5	Ability to convert fractions and decimals proficiently.					
1.6	Interpret inch and metric drawings.					
1.7	Demonstrate legend and note reading skills.					
1.8	Interpret basic geometric dimensioning and tolerancing terminology.					
1.9	Identify different views utilized in blueprint reading.					

1.10	Identify orthographic projection such as lines and symbols for electrical, piping, mechanical, architectural, welding, and machining prints.					
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Kansas Transportation, Distribution and Logistics Cluster

Course:	Hand and Power Tools	Course #:	40400	Credit:	.5
Pathways & CIP Codes:	Aviation Production (15.0000) Aviation Maintenance (47.0000) Manufacturing (48.0000)	Strand(s):	Design & Production Avionics & Airframe Production & Maintenance	Level:	Technical
Course Description:	Provides technical knowledge used in Aviation and Manufacturing area related to hand and power tools.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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Benchmark 1.0:		4	3	2	1	0
1.1	Apply basic concepts and terminology to precision instruments.					
1.2	Utilize precision instruments.					
1.3	Demonstrate safety procedures used with portable and stationary electrical equipment used in manufacturing including lockout and tagout.					
1.4	Utilize portable and stationary electrical equipment used in aviation/manufacturing.					
1.5	Explain procedures for using the correct electrical tools based on project specifications.					
1.6	Describe and understand how to drill, deburr and chamfer quality holes.					
1.7	Describe and understand the use of power and pneumatic hand tools used in aviation/manufacturing					
1.8	Demonstrate how to safely use power and pneumatic hand tools used in aviation/manufacturing.					
1.9	Identify drilling and countersinking techniques used in aviation/manufacturing.					
1.10	Identify fasteners used in the aviation/manufacturing industry.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Aviation Fundamentals	Course #:	40410	Credit:	.5
Pathways & CIP Codes:	Aviation Production (15.0000); Aviation Maintenance (47.0000)	Strand(s):	Design & Production Avionics & Airframe	Level:	Technical
Course Description:	A technical level course providing students with an introduction to the fundamentals related to materials, processes, and history of Aviation.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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Benchmark 1.0: Introduction to Aviation and Aerospace		4	3	2	1	0
1.1	Describe the timeline of aviation history.					
1.2	Describe the principles of flight.					
1.3	Interpret how the mechanical systems and the design of an airplane impact flight characteristics.					
1.4	Compare and contrast opportunities available today with and without modern aviation and aerospace systems (e.g. commercial, military, general aviation).					
1.5	Explain the similarities and differences between aerospace and aviation.					
1.6	Analyze the utility of UAS against various applications and operations.					
1.7	Describe and explain the basic reasons for space exploration.					
1.8	Explain flight in a variety of situations (e.g. including as it relates to animals)					

Benchmark 2.0: Aircraft Construction		4	3	2	1	0
2.1	Describe and discuss the types of materials used on an airplane (e.g. composites).					
2.2	Identify the methods of airplane construction.					
2.3	Identify and discuss primary assemblies/structures and their functions.					
2.4	Compare and contrast aviation manufacturing processes.					

2.5	Identify and describe the impact of corrosion on airplane.					
2.6	List and describe the main components of a jet engine.					

Benchmark 3.0: Aircraft Performance and Quality Control		4	3	2	1	0
3.1	Interpret the purpose and importance of regulation in the aviation industry (e.g. aviation safety, FAA responsibilities and functions).					
3.2	Discuss the usage of statistical process control in relationship to quality concepts in the aerospace industry.					
3.3	Discuss and describe the history of the quality movement in manufacturing.					
3.4	Employ basic lean manufacturing concepts for the aerospace industry (e.g. technology and modernization).					
3.5	Summarize how innovation and technology help solve airspace capacity and integration limitations and increase safety.					
3.6	List and describe the general elements related to the aircraft accident investigation process.					

Benchmark 4.0: Exploring Careers in Aviation and Aerospace		4	3	2	1	0
4.1	Explore the wide range of career opportunities for pilots and/or aircraft mechanics.					
4.2	Identify and summarize career opportunities available with the FAA.					
4.3	Compare personal strengths, interests, and skills needed for the many types of careers in the aviation industry.					
4.4	Describe and analyze the process of obtaining a career in aviation and aerospace (e.g. training and educational options).					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Aviation Systems	Course #:	40420	Credit:	1.0
Pathways & CIP Codes:	Aviation Production (15.0000); Aviation Maintenance (47.0000)	Strand(s):	Design & Production Avionics & Airframe	Level:	Technical
Course Description:	A technical level course providing students with an in-depth knowledge of the major components and systems of an Aircraft.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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Benchmark 1.0: Categories and Classes of Airplane Systems		4	3	2	1	0
1.1	Identify and explain aircraft categories, classes and characteristics (e.g. Common aircraft, UAS, fixed-wing airplanes, rotorcraft, lighter-than-air aircraft, etc.).					
1.2	Explain how a single aircraft type can serve multiple purposes.					
1.3	Students will demonstrate an understanding of the knowledge of aerospace history that provides insight to future challenges involving travel through the atmosphere and space.					
1.4	Identify and discuss primary assemblies/structures and their functions.					

Benchmark 2.0: Aircraft Construction and Systems		4	3	2	1	0
2.1	Distinguish between flight control systems in aircraft and their functions, including UAS flight.					
2.2	Explain how air density affects aircraft performance.					
2.3	Describe how four key forces act on airplanes during flight (e.g. lift, weight, thrust, drag).					
2.4	State and explain Newton's first three laws of motion.					
2.5	Categorize safety design features of modern aircraft.					
2.6	Identify and describe the types of materials that have been used in aircraft construction (e.g. manned and unmanned aircraft).					
2.7	Identify the major components of airplanes which has a specific function in the design and operation of the airplane.					

	<ul style="list-style-type: none"> Describe aircraft avionic and electrical systems and their functions. Describe environmental control systems in aircraft and their functions (e.g. heating systems, cooling systems, pressurization systems). Analyze window and door systems in aircraft and their functions. Compare hydraulic and pneumatic systems in aircraft and their functions. Explain landing gear systems in aircraft and their functions. Describe and discuss fuel systems in aircraft and their functions. Illustrate propulsion systems in aircraft and their functions. Compare and contrast Anti-Ice and De-ice systems in aircraft and their functions. 					
2.8	Interpret how the mechanical systems and the design of an airplane impact flight characteristics.					

Benchmark 3.0: Airframe Systems		4	3	2	1	0
3.1	Compare the benefits and disadvantages of different types of induction systems (e.g. forced induction systems).					
3.2	Differentiate among various engines according to their features (e.g. turbine engine, reciprocating engine.)					
3.3	Explain how an airplane engine is cooled.					
3.4	Explain procedures for constant-speed propeller management.					
3.5	Summarize the five stages of jet engine operation.					
3.6	Analyze accidents involving fuel systems and assess possible causes.					
3.7	Analyze the mechanical advantage for a given simple hydraulic system.					
3.8	Describe the components of aircraft electrical systems and their purpose including analyzing causes for electrical system failure.					
3.9	Compare the advantages of different types of landing gear systems.					
3.10	Describe guidelines for how to fuel an airplane safely.					

Benchmark 4.0: Structural Loads Encountered in Flight		4	3	2	1	0
4.1	Analyze how G forces and load limits affect aviation operations for both humans and aircraft.					
4.2	Calculate the radius and rate of turn in aircraft.					
4.3	Explain how aircraft design and operations take into account load limits to enhance safety.					
4.4	Explain the aerodynamics involved in a turn.					

Benchmark 5.0: Principles of Lift, Thrust, Weight, and Drag		4	3	2	1	0
5.1	<i>Identify and describe the principles and forces applied to an airplane in-flight: lift, weight, drag and thrust.</i>					
5.2	<i>Demonstrate basic knowledge of aerodynamics and physics.</i>					
5.3	Analyze an airplane's design to determine if it has safe and predictable stall characteristics.					
5.4	Explain how lift is created and the interdependent nature of the lift factors for an aircraft in flight.					

5.5	Explain how wings provide the lifting forces needed to overcome the weight of an airplane.					
5.6	Identify airfoil design characteristics.					
5.7	Analyze how propellers create thrust including the four turning tendencies caused by propellers.					
5.8	Explain how jet engines create thrust.					
5.9	Explain how an aircraft's operation is affected by weight and balance (e.g. calculate using industry standard charts and graphs).					
5.10	Solve aircraft loading problems using the weight-shift equation.					
5.11	Analyze the impact of aircraft design elements on drag (e.g. types of drag, calculate using drag equation).					
5.12	Demonstrate an understanding of power to weight ratio.					

Benchmark 6.0: Altitude and Weather Systems		4	3	2	1	0
6.1	Analyze the relative merits of flying pressurized aircraft and supplemental oxygen systems.					
6.2	Assess the need for pressurized aircraft at high altitudes.					
6.3	Describe the circumstances in which icing forms and compare icing solutions.					

Benchmark 7.0: Pitot-Static System		4	3	2	1	0
7.1	Analyze instrument readings to determine whether the pitot and or static systems are blocked (e.g. compare and predict effects of blockages on flight instruments).					
7.2	Analyze the settings and readings of pitot static instruments to determine altitude and calculate altitude changes.					
7.3	Describe the components and operation of an airspeed indicator.					
7.4	Differentiate between instruments that require static air and those that require ram air to operate.					
7.6	Explain the operation of the altimeter in terms of what they have learned about air density and pressure.					
7.7	Interpret the standard markings on an airspeed indicator.					

Benchmark 8.0: Avionics and Flight Instruments		4	3	2	1	0
8.1	Analyze images of heading indicators to determine the airplane's orientation.					
8.2	Calculate a magnetic course from a true course.					
8.3	Compare the different types of gyroscopic instruments, including how they're mounted and the flight attitude information they provide.					
8.4	Construct a simple gyroscope and explain its properties in terms of what they know about airfoils, air pressure, and gyroscopes.					
8.5	Predict the behavior of a compass in various situations including magnetic compass errors.					
8.6	Analyze electronic flight display readings to determine the attitude, airspeed, and heading of an aircraft in flight.					
8.7	Compare the appearance and functionality of analog and electronic flight instruments.					

Benchmark 9.0: Aircraft and Maintenance Documents		4	3	2	1	0
9.1	Analyze a preflight inspection checklist and explain its importance.					
9.2	Analyze and summarize the information for manned and unmanned aircraft registration certificates and airworthiness certificates.					
9.3	Analyze an Airworthiness Directive and determine the required course of action.					
9.4	Use a Pilot's Operating Handbook (POH) to find specific information about an aircraft and draw conclusions about how they can operate the aircraft safely (e.g. assess situations using the POH).					
9.5	Compare the registration requirements for manned and unmanned aircraft.					
9.6	Design a personal pre-activity checklist.					
9.7	Differentiate between the inspections required for aircraft used for recreation and those used for hire including items of preflight inspection.					
9.8	Summarize the importance of preventive maintenance and the ramifications for not performing preventive maintenance.					

Benchmark 10.0: Careers in Aviation		4	3	2	1	0
10.1	Describe the history and future of aviation.					
10.2	Describe the options available to high school students to begin a career in aviation.					
10.3	Research and compare core aviation and aerospace-related jobs.					
10.4	Explain the requirements for a job in the aviation industry (e.g. pilot, aircraft mechanic, etc.)					
10.5	Create a personal aviation plan with goals to pursue outside of class.					

Kansas Engineering Cluster

Course:	Foundations of Electronics	Course #:	21201	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0608) Engineering and Applied Math (14.0101) Manufacturing (48.0000)	Strand(s):	Avionics N/A Maintenance	Level:	Technical
Course Description:	A technical level course that offers instruction in the basic concepts of electronics and electronic components; electrical quantities and units; basic circuits, laws and measurements; circuit components; multiple-load circuits; complex-circuit analysis; magnetism and electromagnetism; alternating current and voltage; power in ac circuits; capacitance; inductance; transformers; R, C, and L circuits; electric motors; instruments and measurements; algebraic, trigonometric, and logarithmic tenets as applied to electronic components, theory of electricity and in the terminology, skills, and safety procedures common to careers involving electricity and electronics. Students will demonstrate acceptable soldering and de-soldering techniques, knowledge of surface mount technology, methods for building circuitry and proper utilization of electronic components such as capacitors, LEDs, and transistors.				

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Benchmark 1.0: Lab Practices		4	3	2	1	0
1.1	Apply proper OSHA safety standards.					
1.2	Demonstrate acceptable soldering and desoldering techniques.					

Benchmark 2.0: DC Circuits		4	3	2	1	0
2.1	Relate, identify, and apply Ohm's law to voltage, current, resistance, power, and energy.					
2.2	Read and interpret color codes and symbols to identify electrical components and values.					
2.3	Measure properties of a circuit using DMM meters, oscilloscopes, and power supplies.					
2.4	Compute, measure, apply, construct, and verify Ohm's law to operation of series circuits.					

2.5	Compute, measure, apply, construct, and verify Ohm's law to operation of parallel circuits.					
2.6	Compute, measure, apply, construct, and verify Ohm's law to operation of series-parallel circuits.					
2.7	Identify, define, construct, verify, and troubleshoot loaded and unloaded voltage divider circuits.					
2.8	Apply, construct, and verify the operation of DC circuits that demonstrate the maximum power transfer theory.					
2.9	Define magnetic properties of circuits and devices.					
2.10	Determine, define, identify, and troubleshoot RC and RL time constant circuits.					
2.11	Define basic motor theory and operation.					

Benchmark 3.0: AC Circuits		4	3	2	1	0
3.1	Identify, analyze, and measure AC signals.					
3.2	Define, construct, verify, and troubleshoot AC capacitive circuits.					
3.3	Define, construct, verify, and troubleshoot AC inductive circuits.					
3.4	Construct, verify, and troubleshoot AC circuits utilizing transformers.					
3.5	Define, construct, and verify series and parallel resonant circuits.					
3.6	Define, construct, verify, and troubleshoot filter circuits.					
3.7	Set up and operate DVMs, power supplies, oscilloscopes, and frequency counters for AC circuits.					

Kansas Manufacturing Cluster

Course:	Production Methods I	Course #:	13052	Credit:	1.0
Pathways & CIP Codes:	Manufacturing (48.0000) Aviation Production (15.0000) Aviation Maintenance (47.0608)	Strand(s):	Production Production Airframe	Level:	Technical
Course Description:	A comprehensive, technical level course designed to instruct students in the knowledge and skills common to manufacturing occupations using a variety of materials (wood, plastic, metal, composites). <i>(SCED: Material and Processes courses expose students to the tools, equipment, and processes that may be encountered in manufacturing-related occupations. In particular, these courses stress the analysis, testing, and processing of metals, plastics, woods, ceramics, and composite materials.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

4. Exemplary Achievement: Student possesses outstanding knowledge, skills, or professional attitude.
3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
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Benchmark 1.0: Safety and Tool Operation		4	3	2	1	0
1.1	Explain the safe and correct use of basic hand and power tools.					
1.2	Demonstrate skills required to safely use power equipment.					
1.3	Demonstrate proper safety procedures for manufacturing processes and material handling.					
1.4	Select and use the correct personal protective equipment (PPE) for specific manufacturing processes.					

Benchmark 2.0: Methods, Materials, and Processes		4	3	2	1	0
2.1	Identify materials and processes incorporated in the manufacturing industry.					
2.2	Utilize technical drawings/prints, work orders, and other ways of conveying product specifications.					
2.3	Apply math skills to manage distance, spacing, angle measurements, and placement for project development.					
2.4	Describe the use of measuring devices related to manufacturing and materials processes.					
2.5	Perform steps to interpret, transfer and layout procedures for projects.					

2.6	Describe gauging and measuring devices used with manufacturing and material processing for dimensioning, measurement and quality control.					
2.7	Discuss properties of materials.					
2.8	List physical, chemical and mechanical properties of selected materials.					
2.9	Explain how thermoplastics and wood structure and properties fit into the manufacturing and materials process.					
2.10	Demonstrate and develop skills for bonding, combining, forming, and separating processes.					
2.11	Demonstrate soldering abilities.					

Benchmark 3.0: Concepts in Production, Methods, and Technology		4	3	2	1	0
3.1	Explore and/or implement computer automations into manufacturing processes.					
3.2	Analyze and solve problems using skills related to methods in production of a product.					
3.3	Integrate mass production processes into design as related to traditional methods of manufacturing and constructing products.					
3.4	Select and perform best practices for joining, assembling, and finishing projects.					
3.5	Incorporate LEAN manufacturing concepts pertaining to mass production, visual management, value stream mapping, 5S, kanban systems, lean metrics, shop layout.					
3.6	Explain the role of business and market in the free enterprise system.					
3.7	Research future technologies affecting manufacturing concepts related to going green, recycling supplies, alternative resources.					

Kansas Manufacturing Cluster

Course:	Mechanical Power Transmission Systems	Course #:	13302	Credit:	.5
Pathways & CIP Codes:	Aviation Maintenance (47.0608) Energy (17.2071) Manufacturing (48.0000)	Strand(s):	Airframe N/A Maintenance	Level:	Technical
Course Description:	A technical level course designed to provide students with knowledge and skills needed to adjust, maintain, and repair parts of machinery and equipment. Includes preventive maintenance, flexible drives, couplings, alignment, bearings/shafts/seals, gears, and cams. (SCED: Equipment Maintenance and Repair courses prepare students to adjust, maintain, replace, and repair parts of machinery and to repair tools, equipment, and machines. The courses may have a general emphasis or may focus on a specific type of machinery or equipment related to a particular industry. Depending upon the intent, course topics may include electric, hydraulic, pneumatic, or mechanic systems; programmable logic and motor control devices, valves, and gates; or supplemental equipment such as fans, hoses, and pipes.)				

Directions: The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.

Rating Scale:

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3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
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Benchmark 1.0: Preventative Maintenance		4	3	2	1	0
1.1	Demonstrate proper safe practices when doing general preventative maintenance.					
1.2	Collect and interpret oil samples.					
1.3	Perform equipment checks.					
1.4	Identify various types and styles of predictive and preventative maintenance components, principles, and practices used in Industrial applications.					

Benchmark 2.0: Flexible Drives		4	3	2	1	0
2.1	Describe safety precautions for performing maintenance of flexible drives and chain systems.					
2.2	Describe characteristics of flexible drive systems.					

2.3	Identify different types of industrial belts.					
2.4	Identify common types and styles of chain drive systems.					

Benchmark 3.0: Couplings and Alignments		4	3	2	1	0
3.1	Demonstrate safe practices when working with couplings.					
3.2	Name types and functions of couplings used in mechanical systems.					
3.3	Align various types of couplings using a straight edge and feeler gauge.					

Benchmark 4.0: Bearings, Shafts, and Seals		4	3	2	1	0
4.1	Demonstrate proper safe practices when working with shafts.					
4.2	Identify different types of industrial bearings.					
4.3	Identify different types of industrial seals and their functions.					

Benchmark 5.0: Gears and Cams		4	3	2	1	0
5.1	Describe proper safety precautions for performing maintenance on mechanical systems.					
5.2	Describe purpose and function of gears and gear drives.					
5.3	Explain the functions of seals and breathers.					
5.4	Describe the purpose and types of lubrication essential for gear life.					
5.5	Describe the basic types of industrial cams.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Unmanned Aircraft Systems (UAS)	Course #:	40490	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0000)	Strand(s):	Avionics & Airframe	Level:	Application
Course Description:	A course that will provide students with the academic knowledge about commercial remote pilot operations, while also giving hands-on experience planning and executing UAS missions. <i>(Prerequisite: Aviation Fundamentals or Aviation Systems.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

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Benchmark 1.0: Drones and their Components		4	3	2	1	0
1.1	Compare the types of missions that might be flown by both fixed-wing and multicopter drones.					
1.2	Compare the ways that multicopters achieve thrust and lift with those of airplanes.					
1.3	Identify the similarities and differences between categories of unmanned aerial systems (UAS).					
1.4	Summarize safe and smart practices for flying UAS.					
1.5	Relate control inputs made to a multicopter to changes in the platform's thrust.					

Benchmark 2.0: Part 107 and Beyond		4	3	2	1	0
2.1	Identify the major topics covered by the Code of Federal Regulations (CFR) 14 Part 107.					
2.2	Construct a list of rules, using research on local ordinances and knowledge of NTIA guidelines, that the class should adhere to while flying an UAS.					
2.3	Develop a logical argument for how to approach certain operational scenarios taking into consideration federal regulations, local ordinances, and operational best practices.					
2.4	Distinguish between UAS operations included within Part 107 and those that are excluded from the rule.					
2.5	Recall best practices and guidelines suggested by the NTIA.					
2.6	Summarize the process by which a remote pilot can become certificated under Part 107.					

2.7	Summarize the process in which a remote pilot can register an UAS under Code of Federal Regulations (CFR) 14 Part 107.					
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Benchmark 3.0: Weather and Performance		4	3	2	1	0
3.1	Assess weather conditions based on reports, forecasts, and observations to decide if an unmanned operation can be completed safely, and how it can best be conducted.					
3.2	Identify and describe different ways that atmospheric conditions and aerodynamic principles might impact Unmanned Aircraft System (UAS) performance.					
3.3	Assess real-world scenarios to determine risks posed by factors such as density altitude, wind, or vortex ring state, and identify ways to mitigate them.					
3.4	Make observations and draw conclusions about how an Unmanned Aerial Vehicle's (UAV) Center-of-Gravity (CG) can shift in flight, using manufacturer data, experimentation, and weight and balance formulas.					
3.5	Identify different characteristics that an Unmanned Aerial Vehicle (UAV) might exhibit if it is overloaded or unbalanced in flight.					

Benchmark 4.0: UAS Safety and Management		4	3	2	1	0
4.1	Assess the readiness of a UAS for safe operation through careful examination of its components using a risk matrix assessment to mitigate identified risks (e.g. common abnormalities and emergencies).					
4.2	Identify important components of a UAS that should be inspected prior to every flight (e.g. construct a preflight checklist).					
4.3	Identify the various members of a multi-person drone crew and explain their roles, including key elements of effective communication in a UAS operation.					
4.4	Make observations about aeronautical decision making (ADM) in a variety of scenarios, and identify hazardous attitudes.					
4.5	Research and build emergency checklists for a UAS.					

Benchmark 5.0: Planning and Executing a Mission		4	3	2	1	0
5.1	Demonstrate concepts on the practical act of controlling and flying the classroom drone.					
5.2	Draw conclusions about the type of UAS that would be ideal, given a specific mission to be flown.					
5.3	Relate the appropriateness of a drone's payload to the operation it will be performing.					
5.4	Summarize common sensors that can be found in flight controllers, as well as the flight modes that they make possible.					
5.5	Apply concepts to plan and execute an operation using a drone.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Work Experience in Aviation	Course #:	40700	Credit:	.5
Pathways & CIP Codes:	Aviation Maintenance (47.0608)	Strand(s):	Avionics & Airframe	Level:	Application
Course Description:	An advanced topics, research, and application course covering specific topics in aviation. Opportunities for Work-Based Learning (WBL) such as in-house training, job shadowing, and/or internships. <i>(Prerequisite: Must take at least 1.0 credit of Technical and Application level courses combined.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

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Benchmark 1.0: Employability Skills and Career Development		4	3	2	1	0
1.1	Complete a Work-Based Learning experience plan.					
1.2	Enhance Individual Plan of Study through interest assessment(s).					
1.3	Research and report on careers in aviation.					
1.4	Research licensing certification and credentialing in the transportation industry.					
1.5	Create a professional portfolio to document activities completed while working with a mentor or through an internship in the transportation industry.					
1.6	Compare the differences between requirements for earning a private pilot certificate and earning a commercial pilot certificate.					
1.7	Construct a portfolio of information about an aviation job of interest and a company where they will be able to perform that job.					
1.8	Organize information about general aviation pilot and non-flying jobs related to their interests.					
1.9	Match personal interests with their aviation career goals.					
1.10	Compare similar aviation business models.					
1.11	Make observations about the types of businesses found at general aviation airports.					
1.12	Organize ideas about a potential new business in the format of a business plan.					
1.13	Summarize information contained in a business plan by creating an executive summary.					

1.14	Apply concepts of professional etiquette in face-to-face and virtual meetings and use these concepts to secure and communicate with a professional mentor.					
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Benchmark 2.0: Making Informed Decisions for Business Operations		4	3	2	1	0
2.1	Demonstrate sound customer services principles when working with customer or client to complete a client-driven project.					
2.2	Develop and maintain professional working relationships.					
2.3	Apply verbal skills when obtaining and conveying information.					
2.4	Use appropriate grammar and word usage in the creation and delivery of a formal graphic presentation using current standards and technology.					
2.5	Develop and deliver oral presentations to provide information for specific purposes.					

Benchmark 3.0: Professional and Technical Knowledge and Skills in the Workplace		4	3	2	1	0
3.1	Research and report on an aviation topic of choice.					
3.2	Research and discuss modern and future trends in aviation equipment, methods, and techniques.					
3.3	Identify emerging trends and directions in aviation.					
3.4	Understand MSDS (Material Safety Data Sheets) and other safety resources required for the workplace.					
3.5	Demonstrate an understanding of OSHA regulations for personal safety, including utilization of PPE, safe use of tools and equipment, and safe handling of hazardous materials.					
3.6	Apply concepts to interpret flight instruments and determine how to perform basic maneuvers using the information they provide.					
3.7	Assess weather conditions for a proposed Instrument Flight Rules (IFR) flight to determine if the flight may be conducted safely.					
3.8	Assess whether a proposed flight can be flown under Visual Flight Rules (VFR) or Instrument Flight Rules (IFR).					
3.9	Utilize knowledge and skills to perform job duties to industry standards (e.g. Construct a basic flight plan for an Instrument Flight Rules (IFR) flight, Construct an Instrument Flight Rules (IFR) route of flight between airports, Define instrument flight conditions).					
3.10	Utilize effective management techniques to organize workflow (e.g. Record air traffic control clearance instructions in an organized manner).					
3.11	Identify systems and characteristics of aircraft that may be more advanced than those of common training aircraft.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Work Experience in Aviation - Comprehensive	Course #:	40701	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0608)	Strand(s):	Avionics & Airframe	Level:	Application
Course Description:	An advanced topics, research, and application course covering specific topics in aviation. Opportunities for Work-Based Learning (WBL) such as in-house training, job shadowing, and/or internships. <i>(Prerequisite: Must take at least 1.0 credit of Technical and Application level courses combined.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

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Student: _____

Graduation Date: _____

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Instructor Signature: _____

Benchmark 1.0: Employability Skills and Career Development		4	3	2	1	0
1.1	Complete a Work-Based Learning experience plan.					
1.2	Enhance Individual Plan of Study through interest assessment(s).					
1.3	Research and report on careers in aviation.					
1.4	Research licensing certification and credentialing in the transportation industry.					
1.5	Create a professional portfolio to document activities completed while working with a mentor or through an internship in the transportation industry.					
1.6	Compare the differences between requirements for earning a private pilot certificate and earning a commercial pilot certificate.					
1.7	Construct a portfolio of information about an aviation job of interest and a company where they will be able to perform that job.					
1.8	Organize information about general aviation pilot and non-flying jobs related to their interests.					
1.9	Match personal interests with their aviation career goals.					
1.10	Compare similar aviation business models.					
1.11	Make observations about the types of businesses found at general aviation airports.					

1.12	Organize ideas about a potential new business in the format of a business plan.				
1.13	Summarize information contained in a business plan by creating an executive summary.				
1.14	Apply concepts of professional etiquette in face-to-face and virtual meetings, and use these concepts to secure and communicate with a professional mentor.				
1.15	Prepare a resume to include in student Individual Plan of Study (IPS).				
1.16	Prepare a letter of application to include in student Individual Plan of Study (IPS).				
1.17	Demonstrate interview skills through mock or actual employment interview.				

Benchmark 2.0: Making Informed Decisions for Business Operations		4	3	2	1	0
2.1	Demonstrate sound customer services principles when working with customer or client to complete a client-driven project.					
2.2	Develop and maintain professional working relationships.					
2.3	Apply verbal skills when obtaining and conveying information.					
2.4	Use appropriate grammar and word usage in the creation and delivery of a formal graphic presentation using current standards and technology.					
2.5	Develop and deliver oral presentations to provide information for specific purposes.					
2.6	Prepare simple documents and other business communications.					
2.7	Use information technology tools to manage and perform work responsibilities.					

Benchmark 3.0: Professional and Technical Knowledge and Skills in the Workplace		4	3	2	1	0
3.1	Research and report on an aviation topic of choice.					
3.2	Research and discuss modern and future trends in aviation equipment, methods, and techniques.					
3.3	Identify emerging trends and directions in aviation.					
3.4	Understand MSDS (Material Safety Data Sheets) and other safety resources required for the workplace.					
3.5	Demonstrate an understanding of OSHA regulations for personal safety, including utilization of PPE, safe use of tools and equipment, and safe handling of hazardous materials.					
3.6	Apply concepts to interpret flight instruments and determine how to perform basic maneuvers using the information they provide.					
3.7	Assess weather conditions for a proposed Instrument Flight Rules (IFR) flight to determine if the flight may be conducted safely.					
3.8	Assess whether a proposed flight can be flown under Visual Flight Rules (VFR) or Instrument Flight Rules (IFR).					
3.9	Utilize knowledge and skills to perform job duties to industry standards (e.g. Construct a basic flight plan for an Instrument Flight Rules (IFR) flight, Construct an Instrument Flight Rules (IFR) route of flight between airports, Define instrument flight conditions).					

3.10	Utilize effective management techniques to organize workflow (e.g. Record air traffic control clearance instructions in an organized manner).					
3.11	Identify systems and characteristics of aircraft that may be more advanced than those of common training aircraft.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	AC Electronics	Course #:	40450	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0000)	Strand(s):	Avionics	Level:	Application
Course Description:	An application level course that teaches the fundamental concepts of Alternating Current.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

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Requires limited supervision.
2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
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Benchmark 1.0: Sine and Non-Sinusoidal Waveforms		4	3	2	1	0
1.1	Identify properties of an AC signal.					
1.2	Define peak, peak-to-peak, average, and RMS voltage and current.					
1.3	Define RMS power, apparent power, true power, and reactive power.					
1.4	Analyze and measure AC signals using oscilloscope, frequency meter, and generator.					

Benchmark 2.0: Phasors and Complex Numbers		4	3	2	1	0
2.1	Explain how sine waves are expressed as phasors.					
2.2	Express sine waves in rectangular and polar form.					
2.3	Describe the complex number plane and use it to perform mathematical operations.					
2.4	Convert the polar form of a complex quantity, such as a sine wave, impedance, or admittance, to the rectangular form and vice versa.					
2.5	Define resistance, reactance, and impedance.					
2.6	Draw a circuit phasor diagram for an RC, RL, and RLC circuit.					
2.7	Explain the meaning of total circuit phase angle for an RC and RL circuit.					
2.8	Apply and relate Ohm's Law for complex circuit quantities.					
2.9	Calculate power in RC, RL, and RLC circuits.					

Benchmark 3.0: Capacitors		4	3	2	1	0
3.1	Define capacitance in terms of physical & electrical characteristics as well as in terms of stored charge & voltage.					
3.2	Calculate capacitive reactance describing changes with applied frequency & capacitor farad rating.					
3.3	Explain how capacitors are combined in series and parallel capacitive circuits.					
3.4	Solve series and parallel capacitive circuits for voltage division, current flow, and charge distribution.					
3.5	Explain how to test a capacitor using an ohmmeter and capacitor analyzer.					
3.6	Construct AC capacitive circuits and verify their operation.					

Benchmark 4.0: Inductors		4	3	2	1	0
4.1	Construct AC inductive circuits and verify their operation.					
4.2	Define inductance in terms of its physical and electrical characteristics.					
4.3	Calculate inductive reactance describing changes in frequency and inductor size.					
4.4	Explain how inductors are combined in series and parallel.					
4.5	Solve an inductive circuit having AC sources with series and parallel inductors.					

Benchmark 5.0: Transformers		4	3	2	1	0
5.1	Construct AC circuits using transformers and verify their operation.					
5.2	Explain the attributes of a transformer and classifications.					
5.3	Solve circuits using transformers with loaded secondaries.					
5.4	Describe how a transformer acts as an impedance matching device.					
5.5	Describe the common attributes of a non-ideal transformer.					
5.6	Describe common variations of the basic transformer.					

Benchmark 6.0: RC Circuit Analysis		4	3	2	1	0
6.1	Describe how impedance is used to find circuit current in an RC circuit.					
6.2	Describe the meaning of circuit phase lead in an RC circuit.					
6.3	Define RC circuits including series, parallel, and time constant components.					
6.4	Describe the response of an RC circuit to an applied sinusoidal waveform.					
6.5	Describe impedance of a series and parallel RC circuit as a phasor in polar and rectangular form.					
6.6	Describe applications of RC circuits.					
6.7	Describe how to troubleshoot an RC circuit.					

Benchmark 7.0: RL Circuit Analysis		4	3	2	1	0
7.1	Explain how impedance is used to find circuit current for series and parallel RL circuits.					
7.2	Explain the meaning of current phase lag in an RL circuit.					
7.3	Define RL circuits including series, parallel, and time constant components.					
7.4	Describe the response of an RL circuit to an applied sinusoidal waveform.					
7.5	Describe impedance of a series and parallel RL circuit as a phasor in polar and rectangular form.					
7.6	Describe applications of RL circuits.					
7.7	Describe how to troubleshoot an RL circuit.					

Benchmark 8.0: RLC Circuits and Resonance		4	3	2	1	0
8.1	Define RLC Circuits including series and parallel components.					
8.2	Describe resonance of RLC circuits.					
8.3	Compute RLC circuit currents using impedance.					
8.4	Explain total circuit phase lead or lag of an RLC circuit.					
8.5	Describe impedance of a series and parallel RLC circuit as a phasor in polar and rectangular form.					
8.6	Describe applications of RC, RL, and RLC circuits.					
8.7	Describe how to troubleshoot an RC, RL, and RLC circuit.					

Benchmark 9.0: Filters		4	3	2	1	0
9.1	Construct passive filter circuits and verify their operation.					
9.2	List and describe the purpose and categories of filters in an electronic circuit.					
9.3	Calculate the critical frequency and roll-off rate for each category of filter.					
9.4	Draw and interpret a Bode Plot for each category of filter.					

Benchmark 10.0: Pulse Response of Reactive Circuits		4	3	2	1	0
10.1	Describe the response of first-order RC and RL circuits to a unit-step and impulse.					
10.2	Define the categories of pulse response circuits including integrators and differentiators.					
10.3	Describe the time response diagram for a single and repetitive pulse input.					
10.4	Identify applications of pulse response circuits in electronics.					
10.5	Troubleshoot differentiator and integrator circuits.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	DC Electronics	Course #:	40460	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0000)	Strand(s):	Avionics	Level:	Application
Course Description:	An application level course that teaches the fundamental concepts of Direct Current.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

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1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
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Benchmark 1.0: Basic Electronic Principles		4	3	2	1	0
1.1	Identify metric prefixes used in electronics measurement.					
1.2	Calculate powers of 10 represented by metric prefixes.					
1.3	Solve problems using values expressed in metric prefixes and powers of 10.					
1.4	Read and interpret color codes and symbols to identify resistive electrical components and values.					
1.5	Define voltage, current, resistance, power, and energy.					
1.6	Measure electrical properties of a circuit using a digital multimeter circuit.					
1.7	Set up and utilize power supplies, oscilloscopes, and multimeters (e.g. ammeter, ohmmeter, and voltmeter).					

Benchmark 2.0: Voltage, Current, and Resistance		4	3	2	1	0
2.1	Describe the atomic model of matter.					
2.2	Explain the concept of electric charge.					
2.3	Explain the relationship between EMF, current, and resistance.					

Benchmark 3.0: Ohm's Law		4	3	2	1	0
3.1	Apply and relate Ohm's Law.					

3.2	Construct and Verify Voltage Divider Circuits.					
3.3	Compute and measure conductance and resistance of conductors and insulators.					

Benchmark 4.0: Power and Energy		4	3	2	1	0
4.1	Compute power using Watt's Law.					
4.2	Describe and apply maximum power transfer theory.					

Benchmark 5.0: Series Resistive Circuits		4	3	2	1	0
5.1	Construct and verify series circuits.					
5.2	Construct and verify voltage divider Circuits.					
5.3	Troubleshoot various circuit failures.					

Benchmark 6.0: Parallel Resistive Circuits		4	3	2	1	0
6.1	Construct and verify parallel circuits.					
6.2	Troubleshoot various circuit failures.					

Benchmark 7.0: Series-Parallel Circuits		4	3	2	1	0
7.1	Construct and verify series-parallel circuits.					
7.2	Troubleshoot various circuit failures.					

Benchmark 8.0: Circuit Theorems and Conversions		4	3	2	1	0
8.1	Summarize the differences between an ideal and non-ideal (practical) voltage source.					
8.2	Explain the meaning of an ideal and non-ideal (practical) current source.					
8.3	Convert a non-ideal (practical) voltage source to a non-ideal (practical) current source.					
8.4	Convert a non-ideal (practical) current source to a non-ideal (practical) voltage source.					
8.5	Explain the application of the superposition theorem.					
8.6	Solve electrical circuits using the superposition theorem.					
8.7	Explain Thevenin's theorem.					
8.8	Solve for voltage and current in a branch of an electrical circuit by using Thevenin's theorem.					

Kansas Engineering Cluster

Course:	Digital Electronics	Course #:	21008	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0608) Engineering and Applied Math (14.0101) Manufacturing (48.0000)	Strand(s):	Avionics N/A Maintenance	Level:	Application
Course Description:	An application level course designed to teach students how to use applied logic in the development of electronic circuits and devices. Students may use computer simulation software to design and test digital circuitry prior to the actual construction of circuits and devices.				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

4. Exemplary Achievement: Student possesses outstanding knowledge, skills, or professional attitude.
3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
0. No Instruction / Training: Student has not received instruction or training in this area.

Student: _____ Graduation Date: _____ <p style="text-align: center;">I certify that the student has received training in the areas indicated.</p> Instructor Signature: _____
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Benchmark 1.0:		4	3	2	1	0
1.1	Students will identify hazards in the lab and locations of the MSDS, safety equipment, and resources.					
1.2	Students will understand how to prevent dangers from electric shock, including environmental concerns and precautionary measures.					
1.3	Students will define and explain direct and alternating currents along with components and schematics used in electronics circuitry.					
1.4	Students will correctly calculate and set up lab equipment for safety, design, test, using Ohm's law and circuit measurements.					
1.5	Students will identify and differentiate digital and analog waveforms.					
1.6	Students will build and test a free running clock and calculate output frequencies from observations on an oscilloscope.					
1.7	Students will design and build logic circuits derived from Boolean expressions and truth tables.					
1.8	Students will use DE Morgan's Theorem, Karnaugh mapping, NOR, NAND, and combinational logic solutions to reduce and simplify circuits.					
1.9	Students will design, code, and build logic circuits to control different kinds of displays.					

1.10	Students will control the flow of data by utilizing multiplexers and demultiplexers.					
1.11	Students will design and implement logic circuits using programmable logic devices that define combinational circuit designs using logic compiler software.					
1.12	Students will compare and contrast operation of RS flip-flops, D flip-flops, and J-K flip-flops.					
1.13	Students will understand, design, and implement different circuits using synchronous, asynchronous, triggering, and timing using flip-flops.					
1.14	Students will design modification counters using timing from asynchronous flip-flops.					
1.15	Students will conduct experiments with shift registers for memory storage and arithmetic circuits.					
1.16	Students will design both half and full adders from logic circuits to do simple addition and subtraction using binary numbers.					
1.17	Students will appropriately select, size, and implement interface devices to control external devices.					
1.18	Students will design and create programming to control the position of stepper motors and control speed and torque of servo motors.					
1.19	Students will be able to formulate a flow chart to correctly apply basic programming concepts in the planning of a project.					

Kansas Manufacturing Cluster

Course:	Hydraulics and Pneumatics	Course #:	39302	Credit:	.5
Pathways & CIP Codes:	Manufacturing (48.0000) Aviation Maintenance (47.0000) Energy (17.2071)	Strand(s):	Maintenance Airframe N/A	Level:	Application
Course Description:	Explains the fundamental concepts of fluid power. Covers the principles of fluid power, calculations of physical properties of fluids and their ability to do work. Introduces the various fluid power components, symbols, and circuits. Introduces troubleshooting of fluid power components and systems with an emphasis on safety. <i>(For Manufacturing Pathway: Recommend students to take Mechanical Power Transmission Systems prior to this course.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

4. Exemplary Achievement: Student possesses outstanding knowledge, skills, or professional attitude.
3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
0. No Instruction / Training: Student has not received instruction or training in this area.

Student: _____

Graduation Date: _____

I certify that the student has received training in the areas indicated.

Instructor Signature: _____

Benchmark 1.0: Hydraulic and Pnuematic Fundamentals		4	3	2	1	0
1.1	Demonstrate hydraulic and pneumatic safety knowledge.					
1.2	Describe basics of fluid power systems.					
1.3	Perform calculations on fluid power systems.					
1.4	Describe powering up a hydraulic or pneumatic system.					

Benchmark 2.0: Reservoirs, Fluids, and Filters		4	3	2	1	0
2.1	Identify reservoir types and components located on fluid power systems.					
2.2	Describe functions, properties, and types of hydraulic fluids.					
2.3	Identify the source and effect of contamination on hydraulic and/or pneumatic systems.					
2.4	Replace filters on hydraulic/pneumatic systems.					

Benchmark 3.0: Hose, Piping, and Tubing		4	3	2	1	0
3.1	Identify and select connecting lines (hose, piping, tubing, and fittings) used in fluid power systems.					
3.2	Troubleshoot hydraulic hose and tubing used in fluid power systems.					
3.3	Repair hydraulic hose and tubing.					
3.4	Replace hydraulic hose and tubing used in fluid power systems.					

Benchmark 4.0: Pumps, Actuators, and Accumulators		4	3	2	1	0
4.1	Describe the type, function, and operations of pumps, actuators, and accumulators.					
4.2	Perform mechanical adjustments and verify proper settings of pressure and flow in pumps, actuators, and accumulators.					
4.3	Demonstrate basic electrical principles as it relates to electrohydraulic and pneumatics.					
4.4	Identify fundamental of fluid power components including electrical and mechanical limit devices.					

Benchmark 5.0: Flow, Directional, and Pressure Control Valves		4	3	2	1	0
5.1	Describe the type, function, and operation of directional control valves.					
5.2	Describe the type, function, and operation of pressure control valves.					
5.3	Describe the type, function, and operation of flow control valves.					

Kansas Transportation, Distribution and Logistics Cluster

Course:	Flight Training	Course #:	40540	Credit:	1.0
Pathways & CIP Codes:	Aviation Maintenance (47.0000)	Strand(s):	Airframe	Level:	Application
Course Description:	This course builds upon knowledge previously learned on aircraft systems. Students will additionally explore weather, operations, and basic navigation principles. <i>(Prerequisite: Aviation Systems or Aviation Fundamentals.)</i>				

Directions: *The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.*

Rating Scale:

- 4. Exemplary Achievement: Student possesses outstanding knowledge, skills, or professional attitude.
- 3. Proficient Achievement: Student demonstrates good knowledge, skills, or professional attitude.
Requires limited supervision.
- 2. Limited Achievement: Student demonstrates fragmented knowledge, skills, or professional attitude.
Requires close supervision.
- 1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
- 0. No Instruction / Training: Student has not received instruction or training in this area.

Student: _____

Graduation Date: _____

I certify that the student has received training in the areas indicated.

Instructor Signature: _____

Benchmark 1.0: Understanding Weather and Atmosphere		4	3	2	1	0
1.1	Interpret weather symbology.					
1.2	Define select aviation weather terms.					
1.3	Infer that weather tools are critical to safe and comfortable flight but have limitations.					
1.4	Analyze how air masses change as they pass over various land and water surfaces.					
1.5	Summarize large scale circulation patterns in the atmosphere.					
1.6	Summarize the role of uneven heating on the creation of weather.					
1.7	Connect convective currents resulting from uneven heating to the creation of turbulence.					
1.8	Assess if the freezing level will affect a flight.					
1.9	Name the conditions associated with each stage of thunderstorm development and assess the possible risk(s) with a thunderstorm forecast.					
1.10	Explain the four types of lifting actions and their relationship to thunderstorm development.					
1.11	Differentiate among different types of precipitation and various components of the atmosphere					
1.12	Identify the types of precipitation and clouds that form with different frontal boundaries.					
1.13	Categorize different types of clouds and predict weather conditions based on cloud type.					
1.14	Predict the height of a cloud base.					
1.15	Analyze weather scenarios to determine how fronts affect the flight experience.					

Benchmark 2.0: Weather Observations and Forecasts		4	3	2	1	0
2.1	Make observations and analyze current weather, weather forecasts and charts to determine go/no-go of a planned flight.					
2.2	Compare the different types of weather briefings available and explain when each would be appropriate during flight planning to make a go/no-go decision.					
2.3	Compare the different types of weather forecasts and explain how one might use them to develop a complete picture of the weather during flight planning.					
2.4	Decode and interpret Meteorological Aerodrome Reports (METAR) and Pilot Reports (PIREP).					
2.5	Decode and interpret sources of weather information used in flying including Terminal Aerodrome Forecasts (TAF), Airman's Meteorological Information (AIRMET), Significant Meteorological Information (SIGMET), and winds and temperatures aloft forecasts.					
2.6	Summarize the differences between weather reports and weather forecasts.					
2.7	Analyze weather decision making using the Perceive—Process—Perform risk-management framework.					
2.8	Analyze weather products and services to determine their effectiveness for both preflight planning and inflight updates.					
2.9	List different in-flight weather services a pilot may use and actions a pilot may take to ensure weather does not adversely affect the flight.					
2.10	Use concepts to solve non-routine problems pilots may be confronted with en route.					

Benchmark 3.0: Understanding Airport Operations		4	3	2	1	0
3.1	Analyze an airport diagram and interpret airport information contained in one.					
3.2	Apply concepts to determine ways in which aircraft incidents at airports can be avoided.					
3.3	Apply understanding of airport information to prepare for a flight scenario.					
3.4	Compare the capabilities of primary radar, radar beacon systems, and Automatic Dependent Surveillance-Broadcast (ADS-B) systems.					
3.5	Compare the communications practices that pilots should use at towered and nontowered airports.					
3.6	Compare various sources of airport data and explain the types of information that each source contains.					
3.7	Construct a simple approach path indicator.					
3.8	Critique recorded pilot and air traffic controller communications.					
3.9	Distinguish between different markings and signs and explain how a pilot should react to them.					
3.10	Explain how a pilot would enter an airport traffic pattern and how to scan for traffic.					
3.11	Formulate a plan for aircraft movement as a pilot and as an air traffic controller.					
3.12	Identify different categories and types of airports.					
3.13	Identify different types of airport signs and markings.					

3.14	Identify the causes and effects of wake turbulence.					
3.15	Identify ways aircraft can avoid collisions.					
3.16	Interpret the meaning of common phrases used by ATC and other pilots in the airport environment.					
3.17	Summarize the need for standardized traffic pattern procedures and recall the different legs of an airport traffic pattern.					
3.18	Recall the phonetic alphabet and light gun signals.					
3.19	Recognize the various forms of airport lighting systems and their intended purpose.					
3.20	Summarize the services ATC is able to provide pilots.					

Benchmark 4.0: Aeronautical Charts and Airspace		4	3	2	1	0
4.1	Analyze the topography, facilities, and obstacles, in a given region for limitations that may affect a given UAS or manned flight.					
4.2	Assess whether or not a particular flight may be conducted based upon pilot qualifications and airspace regulations.					
4.3	Identify different aeronautical chart symbols and what they mean.					
4.4	Identify different categories and types of airspace.					
4.5	Calculate local time and Coordinated Universal Time.					
4.6	Evaluate a prescribed route of flight to determine appropriate landmarks.					
4.7	Show the location of an object identified in the Aeronautical Chart Bulletin on a sectional chart.					
4.8	State position using latitude and longitude.					

Benchmark 5.0: The Geometry of Navigation		4	3	2	1	0
5.1	Apply the concepts of the E6-B to determine wind correction angle, heading, and groundspeed.					
5.2	Apply the concepts of wind and magnetic corrections in an explanation of how an aircraft compensates for those effects during flight.					
5.3	Calculate compass headings after taking true course, wind correction angle, magnetic variation, and magnetic deviation into account.					
5.4	Compare preflight navigation planning results with in-flight performance.					
5.5	Construct a wind triangle to model the effect of wind on true course.					
5.6	Measure distances and true course on an aeronautical chart using two methods.					

Benchmark 6.0: Reading Aircraft Performance Charts		4	3	2	1	0
6.1	Assess the safety of a proposed flight based on performance calculations for varying density altitude conditions.					
6.2	Calculate density altitude using a variety of tools, including charts and the E6B.					
6.3	Calculate range, endurance, and required fuel using industry standard tables and graphs.					
6.4	Calculate the weight and balance of an aircraft using industry standard tables and graphs.					

6.5	Estimate takeoff and landing distances using industry standard tables and graphs.					
6.6	Estimate time, fuel, and distance required for a climb using industry standard tables and graphs.					
6.7	Explain factors that affect fuel planning procedures.					
6.8	Explain factors that affect required takeoff and landing distances for aircraft.					
6.9	Explain how an aircraft's operation is affected by weight and balance.					
6.10	Predict how different density altitude conditions will affect aircraft performance.					
6.11	Explain important terms and information relevant to density altitude, weight, and balance.					

Benchmark 7.0: Certificates, Regulations, and Safety						
7.1	Assess a pilot's go/no-go decisions in relation to the IMSAFE (Illness, Medication, Stress, Alcohol, Fatigue, Eating) checklist.					
7.2	Explain the importance of medical certification including conditions that may require a pilot to obtain a special issuance medical certificate.					
7.3	Organize medical certification standards according to medical certificate classifications (e.g. First-Class, Second-Class, Third-Class).					
7.4	Identify the known side effects of some common drugs.					
7.5	Distinguish the differences between the four types of publications produced by the FAA and NTSB publications applicable to general aviation flying.					
7.6	Assess scenarios related to FAR Part 91 (flights for non-commercial operations).					
7.7	Identify and classify information contained in a sample document as either an Advisory Circular (AC), Airworthiness Directive (AD), Notice to Airmen (NOTAM), or part of NTSB Part 830.					
7.8	Identify the types of information contained in the Aeronautical Information Manual (AIM).					

Benchmark 8.0: Impacts of Flight on Human Anatomy and Physiology							4	3	2	1	0
8.1	Describe the cause and effect of common visual illusions.										
8.2	Describe what a pilot should do to treat symptoms of hypoxia, hyperventilation, decompression sickness, carbon monoxide poisoning, or excessive exposure to carbon dioxide.										
8.3	Distinguish between the symptoms of hypoxia, hyperventilation, decompression sickness, carbon monoxide poisoning, and excessive exposure to carbon dioxide.										
8.4	Identify parts of the human ear associated with balance and orientation.										
8.5	Label an anatomical diagram of a human eye.										
8.6	List methods pilots can use to prevent spatial disorientation.										
8.7	Predict sensations a pilot may feel when specific physical motions are encountered.										
8.8	Illustrate aircraft positions given specific flight scenarios.										

Benchmark 9.0: Aeronautical Decision Making							4	3	2	1	0
9.1	Apply multiple risk management models to Aeronautical Decision Making (ADM).										

9.2	Assess the safety of a proposed flight based on scenarios related to hazardous attitudes and other factors.					
9.3	Explain the elements of common risk management models.					
9.4	List factors that affect a pilot's ability to fly safely.					