MANUFACTURING CAREER CLUSTER DESIGN

Manufacturing Pathway

CIP CODE 48.0000

APPROVED PATHWAY:

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

INTRODUCTORY LEVEL

Title	Code	Credit
Introduction to Welding	13207	0.5
Production Blueprint Reading	21108	0.5
Introduction to Industrial Technology	38001	0.5

TECHNICAL LEVEL

Title	Code	Credit
● Agricultural Welding	18404	1
Robotics	21009	1
● Welding Processes I	39207	1
Hand and Power Tools	40400	0.5

PRODUCTION STRAND

Title	Code	Credit
Production Methods I	13052	1
Machine Tool Technology	13203	1
Computer-Aided Machining (CAM) I	13204	1
Drafting/CAD	21107	1
# Production Print Reading II	39108	0.5

MAINTENANCE STRAND

Title	Code	Credit
Mechanical Power Transmission Systems	13302	0.5
Foundations of Electronics	21201	1

APPLICATION LEVEL

Title	Code	Credit
● Welding Processes II	39208	1
● Agricultural Welding II	18407	1
■ Work Experience in Manufacturing	13348	0.5
■ Work Experience in Manufacturing - Comprehensive	13998	1

PRODUCTION STRAND

Title	Code	Credit
# Advanced Drafting/CAD	21150	1
# Advanced Materials Technology	38010	1
# Automated Integrated Systems	39010	0.5
# Production Methods II	39052	1
# Computer-Aid Machining (CAM) II	39205	0.5

MAINTENANCE STRAND

Title	Code	Credit
Sheet Metal Technology	13205	0.5
Remodeling and Building Maintenance	17009	0.5
HVAC Technology	17056	0.5
Plumbing Technology	17058	0.5
Electrical and Security Systems	17113	0.5
Digital Electronics	21008	1
# Hydraulics and Pneumatics	39302	0.5

Production strand only.

\# Has prerequisite course(s): Courses comprising a sequence are numbered consecutively. See Competency Profile for details.

■ Must take at least **ONE** credit of Technical Level course and Application Level course combined.

● May offer either Agricultural Welding I (18404) and Agricultural Welding II (18407) **OR** Welding Processes I (39207) and Welding Processes II (39208), but not both pairs of sequential courses.

Course	Introduction to Welding	Course # 13207	Credit 0.5
Pathways & CIP	Manufacturing (48.0000)- Production & Maintenance Strand		
Course Description:	An **introductory level** course designed to instruct students in basic welding skills.		

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: Safety Practices

	Competencies					
1.1	Identify hazards associated with welding.	4	3	2	1	0
1.2	Identify Personal Protective Equipment (PPE) used in welding.	4	3	2	1	0
1.3	Identify the parts of a fire triangle.	4	3	2	1	0

Benchmark 2.0: Welding Theory

	Competencies					
2.1	Recognize joint design and welding terminology.	4	3	2	1	0
2.2	Identify and describe welding symbols.	4	3	2	1	0
2.3	Identify/select welding electrodes used for arc welding.	4	3	2	1	0
2.4	Identify metals, their typical form and metallurgical properties.	4	3	2	1	0
2.5	Differentiate the different types of arc welding processes.	4	3	2	1	0
2.6	Explore various industries and occupations related to welding.	4	3	2	1	0
2.7	Describe GMAW modes of transfer.	4	3	2	1	0

Benchmark 3.0: Welding Processes

	Competencies					
3.1	Demonstrate proper set up of welding equipment.	4	3	2	1	0
3.2	Manually operate an oxyfuel torch to cut carbon steel.	4	3	2	1	0
3.3	Manually operate a plasma torch to cut carbon steel.	4	3	2	1	0

3.4	Weld joints in the F and H positions using SMAW.	4	3	2	1	0
3.5	Weld joints in the F and H positions using GMAW carbon steel.	4	3	2	1	0
3.6	Weld joints in the F and H positions using GTAW carbon steel with and without filler (autogenous) metal.	4	3	2	1	0

Course	Production Blueprint Reading	Course # 21108	Credit 0.5
Pathways & CIP Codes:	Aviation Production (15.0000) - Design & Production Strand; Aviation Maintenance (47.0000) - Avionics & Airframe Strand; Construction & Design (46.0000) - Construction & Design Strand; Engineering & Applied Mathematics (14.0101); Manufacturing (48.0000) - Production & Maintenance Strand		
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.*

Rating Scale:

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Benchmark 1.0:

	Competencies					
1.1	Identify symbols associated with blueprints.	4	3	2	1	0
1.2	Interpret work from multiview drawings.	4	3	2	1	0
1.3	Interpret size and location of features.	4	3	2	1	0
1.4	Visualizing shapes and objects in multiple views.	4	3	2	1	0
1.5	Ability to convert fractions and decimals proficiently.	4	3	2	1	0
1.6	Interpret inch and metric drawings.	4	3	2	1	0
1.7	Demonstrate legend and note reading skills.	4	3	2	1	0
1.8	Interpret basic geometric dimensioning and tolerancing terminology.	4	3	2	1	0
1.9	Identify different views utilized in blueprint reading.	4	3	2	1	0
1.10	Identify orthographic projection such as lines and symbols for electrical, piping, mechanical, architectural, welding, and machining prints.	4	3	2	1	0

Course	Introduction to Industrial Technology	Course # 38001	Credit 0.5
Pathways & CIP Codes:	Aviation Maintenance (47.0608) - Avionics & Airframe Strand; Aviation Production (15.0000) - Production & Maintenance Strand; Construction & Design (46.0000) Construction & Design Strand; Manufacturing (48.0000) - Design & Production Strand; Mobile Equipment Maintenance (47.9999) - Auto Collision & Technology Strand		
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

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

Benchmark 2.0: Industrial Math

	Competencies

2.1	Add, subtract, multiply, and divide whole numbers, fractions, decimals and percentages.	4	3	2	1	0
2.2	Use a standard ruler, a metric ruler, and a measuring tape to measure.	4	3	2	1	0
2.3	Demonstrate conversion skills for decimals and fractions.	4	3	2	1	0
2.4	Recognize and perform calculations using metric units of length, weight, volume and temperature.	4	3	2	1	0
Benchmark 3.0: Hand Tools						
	Competencies					
3.1	Recognize and identify some of the basic hand tools and their proper uses in industrial trades.	4	3	2	1	0
3.2	Demonstrate the safe use of common hand tools.	4	3	2	1	0
Benchmark 4.0: Power Tools						
	Competencies					
4.1	Recognize and identify some of the basic power tools and their proper uses in the industrial trades.	4	3	2	1	0
4.2	Demonstrate the safe use of common power tools.	4	3	2	1	0
4.3	Perform preventive maintenance on basic power tools used in the industrial trades.	4	3	2	1	0
Benchmark 5.0: Blueprint Reading						
	Competencies					
5.1	Perform the drafting principles needed to draw the basic geometric shapes.	4	3	2	1	0
5.2	Develop a pictorial sketch of an object.	4	3	2	1	0
5.3	Develop a multi-view drawing.	4	3	2	1	0
5.4	Identify basic symbols used in blueprints.	4	3	2	1	0
5.5	Identify various types of blueprint views used in Architecture and Construction, Engineering, Manufacturing, and Transportation.	4	3	2	1	0
Benchmark 6.0: Communication Skills						
	Competencies					
6.1	Interpret information and follow instructions presented in both verbal and written form.	4	3	2	1	0
6.2	Communicate effectively in on-the-job situations using verbal and written skills in various delivery modes (face-to-face,	4	3	2	1	0
6.3	Create and complete various written documents used in industrial trades.	4	3	2	1	0
6.4	Demonstrate knowledge and use of computer systems and word processing software in effective communication.	4	3	2	1	0
Benchmark 7.0: Employability Skills						

	Competencies					
7.1	Create and utilize employment documents including a resume and portfolio.	4	3	2	1	0
7.2	Demonstrate job seeking and interview skills.	4	3	2	1	0
7.3	Understand and respond to performance reviews.	4	3	2	1	0
Benchmark 8.0: 21st Century/Foundation Skills						
	Competencies					
8.1	Demonstrate critical thinking skills and the ability to solve problems using those skills.	4	3	2	1	0
8.2	Define effective relationship skills.	4	3	2	1	0
8.3	Demonstrate a working knowledge of workplace issues such as sexual harassment, stress, and substance abuse.	4	3	2	1	0
8.4	Demonstrate the ability to achieve common goals through team work.	4	3	2	1	0
Benchmark 9.0: Materials Handling						
	Competencies					
9.1	Verify that health, safety, environmental, and government regulations are met.	4	3	2	1	0
9.2	Recognize hazards and follow safety procedures required for materials handling.	4	3	2	1	0
9.3	Demonstrate ability to load and unload materials properly and safely.	4	3	2	1	0

Course	Agricultural Welding	Course # 18404	Credit
Pathways & CIP	Power, Structural & Technical Systems (01.0201); Manufacturing (48.0000); Business Management & Entrepreneurship (52.0799);		
Course Description:	Technical Level:		

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: Welding Industry and Careers

	Competencies					
1.1	Describe 10 careers in the field of ag welding	4	3	2	1	0
1.2	Explain the importance of welding and construction in the local economy	4	3	2	1	0
1.3	Identify local businesses that require ag welding skills	4	3	2	1	0
1.4	List the causes of accidents in the workplace	4	3	2	1	0
1.5	Write a 1 and ½ page paper over two agriculture careers of interest	4	3	2	1	0
1.6	Select an agriculture career, research, and write a ½ page report over the education needed	4	3	2	1	0

Benchmark 2.0: SMAW (Arc) Welding/Lab Activities

	Competencies					
2.1	Explain the physical processes of arc welding	4	3	2	1	0
2.2	List the proper arc welding safety guidelines	4	3	2	1	0
2.3	Identify arc welding safety hazards	4	3	2	1	0
2.4	Identify pieces of arc welding equipment	4	3	2	1	0
2.5	Differentiate between AC and DC welding	4	3	2	1	0
2.6	Demonstrate a 6011 series arc welds: Flat - stringer, pad, butt, T, lap; Horizontal - stringer, butt, lap; Vertical - stringer, butt, T, lap	4	3	2	1	0
2.7	Demonstrate a 6013 series arc welds: Flat - stringer, pad, butt, T, lap; Horizontal - stringer, butt, lap; Vertical - stringer, butt, T, lap	4	3	2	1	0
2.8	Demonstrate 7018 pipe-on-pipe butt in flat position	4	3	2	1	0

2.9	Demonstrate 7018 pipe-on-plate T-weld in flat position	4	3	2	1	0
Benchmark 3.0: GMAW (MIG) Welding/Lab Activities						
	Competencies					
3.1	List the proper MIG welding safety guidelines	4	3	2	1	0
3.2	Identify MIG welding safety hazards	4	3	2	1	0
3.3	Identify pieces of MIG welding equipment	4	3	2	1	0
3.4	Explain the physical processes of MIG welding	4	3	2	1	0
3.5	Demonstrate a MIG series welds: Flat - stringer, pad, butt, T, lap; Horizontal - stringer, butt, lap; Vertical - stringer, butt, T, lap	4	3	2	1	0
3.6	Demonstrate MIG pipe-on-pipe butt in flat position	4	3	2	1	0
3.7	Demonstrate MIG pipe-on-plate T-weld in flat position	4	3	2	1	0
Benchmark 4.0: Oxy-Acetylene Welding and Cutting/Lab Activities						
	Competencies					
4.1	List the oxy-acetylene welding and brazing safety guidelines	4	3	2	1	0
4.2	List the oxy-acetylene cutting safety guidelines	4	3	2	1	0
4.3	Identify oxy-acetylene cutting, welding, and brazing equipment	4	3	2	1	0
4.5	Explain the physical processes of oxy-acetylene welding, cutting, and brazing	4	3	2	1	0
4.6	Demonstrate an oxy-acetylene filler bead weld	4	3	2	1	0
4.7	Demonstrate an oxy-acetylene filler butt weld	4	3	2	1	0
4.8	Demonstrate an oxy-acetylene bead weld	4	3	2	1	0
4.9	Demonstrate a braze butt weld	4	3	2	1	0
4.10	Demonstrate a braze lap weld	4	3	2	1	0
4.11	Demonstrate oxy-acetylene cutting techniques: straight – freehand, guided; round/circle – freehand, guided.	4	3	2	1	0
Benchmark 5.0: Plasma Cutting/Lab Activities						
	Competencies					
5.1	List the plasma cutting safety guidelines	4	3	2	1	0
5.2	Identify plasma cutting equipment	4	3	2	1	0
5.3	Explain the processes of plasma cutting and proper the techniques involved.	4	3	2	1	0
5.4	Demonstrate plasma cutting techniques: straight – freehand, guided; round/circle – freehand, guided.	4	3	2	1	0
5.5	Demonstrate proper setups and adjustments for different metal thicknesses	4	3	2	1	0
Benchmark 6.0: General Shop Safety & Machine Use/Lab Activities						

	Competencies					
6.1	Explain the use and function of the bench grinder	4	3	2	1	0
6.2	Explain the use and function of the hand grinder	4	3	2	1	0
6.3	Explain the use and function of the chop saw	4	3	2	1	0
6.4	Explain the use and function of the hot saw	4	3	2	1	0
6.5	Explain the use and function of the floor sheer	4	3	2	1	0
6.6	Explain the use and function of the drill press	4	3	2	1	0
6.7	Explain the use and function of power hand drills	4	3	2	1	0
6.8	Explain the use and function of pneumatic tools	4	3	2	1	0
6.9	List the proper bench grinder safety guidelines	4	3	2	1	0
6.10	List the proper hand grinder safety guidelines	4	3	2	1	0
6.11	List the proper chop saw safety guidelines	4	3	2	1	0
6.12	List the proper hot saw safety guidelines	4	3	2	1	0
6.13	List the proper floor sheer safety guidelines	4	3	2	1	0
6.14	List the proper drill press safety guidelines	4	3	2	1	0
6.15	List the proper power hand tools safety guidelines	4	3	2	1	0
6.16	List the proper pneumatic tools safety guidelines	4	3	2	1	0
6.17	Demonstrate the proper bench grinder safety guidelines	4	3	2	1	0
6.18	Demonstrate the proper hand grinder safety guidelines	4	3	2	1	0
6.19	Demonstrate the proper chop saw safety guidelines	4	3	2	1	0
6.20	Demonstrate the proper hot saw safety guidelines	4	3	2	1	0
6.21	Demonstrate the proper floor sheer safety guidelines	4	3	2	1	0
6.22	Demonstrate the proper drill press safety guidelines	4	3	2	1	0
6.23	Demonstrate the proper power hand tools safety guidelines	4	3	2	1	0
6.24	Demonstrate the proper pneumatic tools safety guidelines	4	3	2	1	0
Benchmark 7.0: Safety & Lab Orientation/Lab Activities						
	Competencies					
7.1	Identify and demonstrate proper methods of shop/lab clean-up	4	3	2	1	0
7.2	Identify various tool storage locations	4	3	2	1	0
7.3	Learn the components of the fire triangle	4	3	2	1	0
7.4	Explain the proper use of a fire extinguisher	4	3	2	1	0
7.5	Explain proper shop safety color coding	4	3	2	1	0
7.6	Complete a shop/lab safety test with 100% accuracy	4	3	2	1	0

Course	Robotics	Course # 21109	Credit 1.0
Pathways & CIP	Engineering & Applied Mathematics (14.0101); Manufacturing (48.0000); Biomedical (14.0501)		
Course Description:	Technical Level:		

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. 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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Student: _____

Graduation Date: _____

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Instructor Signature: _____

Benchmark

	Competencies					
1.1	Build, Align, fit, or assemble robotic devices or component parts using hand tools, power tools, fixtures, templates, or microscopes.	4	3	2	1	0
1.2	Troubleshoot robotic systems using knowledge of microprocessors, programmable controllers, electronics, circuit analysis, mechanics, sensor or feedback systems, hydraulics and or pneumatics.	4	3	2	1	0
1.3	Train robots using appropriate software (multiple software platforms, if possible) to perform simple or complex tasks such as designing and carrying out a series of tests	4	3	2	1	0
1.4	Install, program, and repair programmable controllers, robot controllers, end-of-arm tools, or conveyors.	4	3	2	1	0
1.5	Read blueprints, schematics, diagrams, or technical orders to determine methods and sequences of assembly.	4	3	2	1	0
1.6	Record numerical and graphical test results and analyze them to prepare for written testing and documentation.	4	3	2	1	0
1.7	Explain complex mathematical information used in robotic operations.	4	3	2	1	0
1.8	Demonstrate knowledge of careers in robotics and applications of robotics in research, commercial and industrial settings.	4	3	2	1	0
1.9	Read and utilize blueprints, production layouts, and technical drawings relating to robotics.	4	3	2	1	0
1.10	Troubleshoot mechanical failures or unexpected problems including debugging programming.	4	3	2	1	0
1.11	Integrate robotics with peripherals, sensors or other equipment.	4	3	2	1	0
1.12	Demonstrate knowledge of how automated robotic systems increase production volume and precision in a variety of high-throughput operations.	4	3	2	1	0
1.13	Resolve engineering or science problems using robots.	4	3	2	1	0

1.14	Analyze test results in relation to design or rated specifications and test objectives, and modify or adjust equipment to meet specifications.	4	3	2	1	0
1.15	Verify dimensions and tolerances of parts in conformance with specifications in conjunction with robotic maintenance including assembly and disassembly of kit parts and or fabricated parts.	4	3	2	1	0

Course	Welding Processes I	Course # 39207	Credit 1.0
Pathways & CIP	Business Management & Entrepreneurship (52.0799); Manufacturing & Design (48.0000)		
Course Description:	A comprehensive, technical level course designed to provide students with the knowledge and skills in basic welding theories and terminology needed to perform welding procedures.		

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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Benchmark 1.0: Safety Practices

	Competencies					
1.1	Identify hazards associate with welding.	4	3	2	1	0
1.2	Identify and demonstrate proper use of Personal Protective Equipment (PPE).	4	3	2	1	0
1.3	Identify the parts of a fire triangle.	4	3	2	1	0
1.4	Demonstrate proper assembly of welding and cutting equipment.	4	3	2	1	0

Benchmark 2.0: Welding, Cutting and Inspection Theory

	Competencies					
2.1	Investigate various industries and occupations related to welding	4	3	2	1	0
2.2	Differentiate between different methods of cutting (thermal, sheering, abrasive, sawing, etc.).	4	3	2	1	0
2.3	Describe the thermal cutting process (plasma and oxyacetylene).	4	3	2	1	0
2.4	Identify and describe welding theory AND processes (e.g. laser, friction stir, etc.).	4	3	2	1	0
2.5	Explain the difference between welding, brazing and soldering.	4	3	2	1	0
2.6	Identify and describe welding theory related to standard welding processes (SMAW, GMAW, GTAW, FCAW).	4	3	2	1	0
2.7	Identify various filler metals used for welding, brazing and soldering.	4	3	2	1	0
2.8	Identify weld types (groove, fillet, etc.), joint types (T, Lap, etc.), and positions (1=flat, 2=horizontal, etc.) for plate and p	4	3	2	1	0
2.9	Describe common destructive and non-destructive inspection and testing methods.	4	3	2	1	0
2.10	Explain requirements and procedures for welder qualification test	4	3	2	1	0
2.11	Identify physical and chemical properties of metals and how they impact a metals weldability	4	3	2	1	0

2.12	Interpret welding symbols.	4	3	2	1	0
Benchmark 3.0: Cutting Processes						
	Competencies					
3.1	Demonstrate the ability to make cuts using sheering type equipment.	4	3	2	1	0
3.2	Demonstrate the ability to make cuts using abrasive type cutters.	4	3	2	1	0
3.3	Demonstrate the ability to make cuts using sawing equipment.	4	3	2	1	0
3.4	Demonstrate the ability to make cuts using oxyacetylene cutting equipment.	4	3	2	1	0
3.5	Demonstrate the ability to make cuts using plasma cutting equipment.	4	3	2	1	0
Benchmark 4.0: Shielded Metal Arc Welding (SMAW)						
	Competencies					
4.1	Describe the advantages and disadvantages of SMAW	4	3	2	1	0
4.2	Explain the importance of welding essentials such as travel speed, angles, machine settings, etc.	4	3	2	1	0
4.3	Weld joints in the F and H positions using a fast fill electrode.	4	3	2	1	0
4.4	Demonstrate 1F, 2F, 1G, and 2G welds using 6010 or 6011 on lap, Tee, corner, pipe to plate, and butt joints.	4	3	2	1	0
4.5	Demonstrate 1F, 2F, 1G, and 2G welds using 70X4 or 6013 on lap, Tee, and butt joints.	4	3	2	1	0
4.6	Demonstrate 1F, 2F, 1G, and 2G welds using 7018 on lap, Tee, corner, pipe to plate, and butt joints.	4	3	2	1	0
Benchmark 5.0: Gas Metal Arc Welding (GMAW)						
	Competencies					
5.1	Describe the advantages and disadvantages of GMAW.	4	3	2	1	0
5.2	Explain the importance of welding essentials such as travel speed, angles, machine settings, etc.	4	3	2	1	0
5.3	Demonstrate 1F, 2F, 1G, and 2G Short Circuit welds on lap, Tee, pipe to plate, and butt joints.	4	3	2	1	0
5.4	Demonstrate 1F, 2F, and 1G Globular welds in the flat and horizontal positions on lap, Tee, and butt joints.	4	3	2	1	0
5.5	Demonstrate 1F, 2F, and 1G Spray welds on lap, Tee, and butt joints.	4	3	2	1	0
5.6	Demonstrate 1F, 2F, 1G, and 2G Pulse welds on lap, Tee, and butt joints.	4	3	2	1	0
Benchmark 6.0: Gas Tungsten Arc Welding (GTAW)						
	Competencies					
6.1	Demonstrate the set-up and shut-down of GTAW equipment.	4	3	2	1	0
6.2	Describe the different types of gases used with GTAW	4	3	2	1	0
6.3	Explain the importance of welding essentials such as travel speed, angles, machine settings, etc.	4	3	2	1	0
6.4	Demonstrate 1F, 2F, and 1G welds without filler metal (autogenous) on lap, and butt joints.	4	3	2	1	0

6.5	Demonstrate 1F, 2F, 1G, and 2G welds with filler metal on lap, Tee, pipe to plate, and butt joints	4	3	2	1	0
6.6	Describe the advantages and disadvantages of GTAW.	4	3	2	1	0
Benchmark 7.0: Qualification requirements for GMAW & SMAW						
	Competencies					
7.1	Demonstrate 1F single pass ¼" weld on ¼"x2"x12" Tee joint	4	3	2	1	0
7.2	Demonstrate 2F 3 pass 3/8" welds on ¼"x2"x12" Tee joint.	4	3	2	1	0
7.3	Demonstrate 1G multi-pass welds on 3/8"x3"x7" single Vee (45 degrees) plate with ¼"x1"x9" backing bar.	4	3	2	1	0
7.4	Prepare 1G weldment (7.3) for root and face bend test.	4	3	2	1	0
7.5	Pass Bend test according to applicable testing criteria	4	3	2	1	0
7.6	Complete requirements for industry certification(s) (e.g. AWS SENSE program).	4	3	2	1	0

Course	Hand & Power Tools	Course # 40400	Credit 0.5
Pathways & CIP Codes:	Aviation Production (15.0000) - Design & Production Strand; Aviation Maintenance (47.0000) - Avionics & Airframe Strand; Manufacturing (48.0000) - Production & Maintenance Strand		
Course Description:	Provides technical level 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.*

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:

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

Course	Production Methods I	Course # 13052	Credit 1.0
Pathways & CIP	Aviation Production (15.0000); Manufacturing (48.0000); Aviation Maintenance (47.0608)		
Course Description:	A comprehensive, technical level course designed to instruct students in the knowledge and skills required for fabricating products using a variety of materials (wood, plastic, metal, composites).		

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	Competencies					
1.1	Identify materials and processes incorporated in mass production	4	3	2	1	0
1.2	Utilize technical drawings/blueprints, work orders, and other ways of conveying product specifications.	4	3	2	1	0
1.3	Apply math skills to manage distance, spacing, angle measurements, and placement for project development.	4	3	2	1	0
1.4	Perform steps to interpret, transfer and layout procedures for projects	4	3	2	1	0
1.5	Estimate production costs based on product needs assessment	4	3	2	1	0
1.6	Safely use and maintain basic hand and power tools	4	3	2	1	0
1.7	Demonstrate skills required to safely use power equipment	4	3	2	1	0
1.8	Explore and/or implement computer automations into mass production	4	3	2	1	0
1.9	Analyze and solve problems using skills related to methods in production of a product	4	3	2	1	0
1.10	Integrate mass production processes into design as related to traditional methods of manufacturing and constructing products	4	3	2	1	0
1.11	Select and perform best practices for joining, assembling, and finishing projects	4	3	2	1	0
1.12	Incorporate LEAN manufacturing concepts pertaining to mass production _ visual management, _ value stream mapping, _ 5S, _ kanban systems, _ lean metrics, _ shop layout	4	3	2	1	0
1.13	Explain the role of business and market in the free enterprise system	4	3	2	1	0
1.14	Research future technologies affecting mass production and teaming concepts related to going green, recycling supplies, alternative resources	4	3	2	1	0

Course	Machine Tool Technology	Course # 13203	Credit 1.0
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	A comprehensive, technical level course designed to provide students with experience in the basic theories, equipment and skills needed to perform machining skills. Machine tool safety and shop math will be emphasized throughout the course.		

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: Safety

	Competencies					
1.1	Explain the importance of developing safe work habits.	4	3	2	1	0
1.2	Apply safe work practices when operating machinery.	4	3	2	1	0
1.3	List the personal protective equipment (PPE) required for different machining operations and when using chemicals and fluids.	4	3	2	1	0
1.4	List shop safety hazards and how to correct them.	4	3	2	1	0

Benchmark 2.0: Print Reading and Measurement

	Competencies					
2.1	Identify the use of specialty measuring tools (eg. caliper, micrometer, dept gauge, etc.).	4	3	2	1	0
2.2	Explain the information found on a typical mechanical drawing.	4	3	2	1	0
2.3	Explain the basics of geometric dimensioning and tolerance.	4	3	2	1	0
2.4	Identify dimensions and symbols .	4	3	2	1	0
2.5	Read and interpret sketches and print drawings.	4	3	2	1	0
2.6	Perform bench work set up.	4	3	2	1	0
2.7	Explain why layouts are needed.	4	3	2	1	0
2.8	Identify common layout tools.	4	3	2	1	0
2.9	Describe the various transfer gauges found in a machine shop.	4	3	2	1	0
2.1	Explain geometry and basic algebra formulas as they apply to machining.	4	3	2	1	0

2.11	Demonstrate the use of Metric and Standard units of measurement (e.g. measure to 1/64 of an inch with a steel rule; measure to .003 of an inch using a Dial Caliper and micrometer depth gauge; measure angles to .5 of a degree using a shop protractor).	4	3	2	1	0
2.12	Perform basic layout operations.	4	3	2	1	0
2.13	Explain a machining sequence plan.	4	3	2	1	0
2.14	Demonstrate work process planning.	4	3	2	1	0
2.14	Identify feeds and speeds for machining.	4	3	2	1	0
2.16	Identify materials used in machining.	4	3	2	1	0
2.17	Determine applications for the use of various materials.	4	3	2	1	0
2.18	Establish material preparation.	4	3	2	1	0
Benchmark 3.0: Tools and Equipment Operations						
	Competencies					
3.1	Identify the most commonly used machine shop hand tools.	4	3	2	1	0
3.2	Identify several types of fasteners.	4	3	2	1	0
3.3	Select the proper fastening technique for a specific job.	4	3	2	1	0
3.4	Demonstrate the proper and safe use of hand tools.(eg. Files, taps, dies, etc).	4	3	2	1	0
3.5	Describe basic care and utilization of different dial indicators.	4	3	2	1	0
3.6	Operate power tools and equipment (eg. Grinder, drill, mill, lathe).	4	3	2	1	0
3.7	Identify tap and drill sizes.	4	3	2	1	0
3.8	Cut threads with taps and dies.	4	3	2	1	0
3.9	Perform a grinding operation.	4	3	2	1	0
3.1	List the proper blade for a given job.	4	3	2	1	0
Benchmark 4.0: Lathe and Milling Operations						
	Competencies					
4.1	Identify the various parts of a lathe.	4	3	2	1	0
4.2	Calculate cutting speeds and feeds for various sizes and types of materials.	4	3	2	1	0
4.3	Describe how a taper is turned on a lathe.	4	3	2	1	0
4.4	Demonstrate the ability to safely set up and operate manual lathes, and manual milling machines.	4	3	2	1	0
4.5	Perform drilling, boring and knurling operations on a lathe.	4	3	2	1	0
4.6	Identify the various parts of a mill.	4	3	2	1	0
4.7	Select the proper cutter for the job.	4	3	2	1	0
4.8	Explain the various work-holding devices used on a milling machine.	4	3	2	1	0

4.9	Demonstrate the ability to set-up and perform various cutting, drilling and boring operations on a milling machine.	4	3	2	1	0
4.1	Calculate proper feed and speeds in milling and turning .	4	3	2	1	0
4.11	Perform advanced techniques in lathe operation (e.g. thread cutting, tapering, etc.).	4	3	2	1	0
4.12	Perform advanced techniques in milling operation (e.g. cutting pocket, island).	4	3	2	1	0
Benchmark 5.0: Machining Setup, Layout, and Processes						
	Competencies					
5.1	Apply the post process treatments for materials.	4	3	2	1	0
5.2	Determine and demonstrate work process planning for manufacturing.	4	3	2	1	0
5.3	Apply the use of CAM (Computer Aided Manufacturing) in machining processes.	4	3	2	1	0
5.4	Identify CNC lathe and mill fundamentals.	4	3	2	1	0
5.5	Use CNC equipment to perform milling or lathe operations.	4	3	2	1	0
Benchmark 6.0: Inspection and Quality Control						
	Competencies					
6.1	Use precision measuring equipment during inspection procedures (e.g. micrometers, calipers, depth and bore gauges).	4	3	2	1	0
6.2	Apply quality control specifications to Inspection of parts.	4	3	2	1	0

Course	Computer Aided Machining (CAM) I	Course # 13204	Credit 1.0
Pathways & CIP	Business Management & Entrepreneurship (52.0799); Manufacturing (48.0000)		
Course Description:	A technical level course that introduces students to the basics of computer aided software and machining techniques . This includes 3D modeling, G code generation, and 2D machining.		

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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Student: _____

Graduation Date: _____

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Instructor Signature: _____

Benchmark 1.0: Introduction to Design

	Competencies					
1.1	Create 2-D and 3-D drawings using CAD/CAM software.	4	3	2	1	0
1.2	Demonstrate knowledge of Cartesian coordinate system in generating Code	4	3	2	1	0
1.3	Generate pictorial drawings.	4	3	2	1	0
1.4	Identify and demonstrate the use of CAD/CAM commands.	4	3	2	1	0
1.5	Demonstrate the ability to dimension drawings using CAD/CAM software.	4	3	2	1	0
1.6	Demonstrate proficiency in setting limits and scale using CAD/CAM software.	4	3	2	1	0
1.7	Use symbols and notes using CAD/CAM software.	4	3	2	1	0

Benchmark 2.0: CAM Concepts

	Competencies					
2.1	Interpret drawings to create G code.	4	3	2	1	0
2.2	Create tool paths using CAM software.	4	3	2	1	0
2.3	Demonstrate knowledge of machining fundamentals.	4	3	2	1	0
2.4	Demonstrate communication with machine tools.	4	3	2	1	0
2.5	Investigate careers utilizing CAM.	4	3	2	1	0

Benchmark 3.0: CAM Processes

	Competencies

3.1	Knowledge of various industry specific software.	4	3	2	1	0
3.2	Create multiple tool paths using CAM software.	4	3	2	1	0
3.3	Import tooling into CAM software.	4	3	2	1	0
3.4	Import models into CAM software.	4	3	2	1	0
3.5	Select tooling and create tool paths using CAM software.	4	3	2	1	0
3.6	Verify machining process for clearance and machine tool collision using CAM software.	4	3	2	1	0
3.7	Demonstrate editing CNC code with CAM.	4	3	2	1	0
Benchmark 4.0: CAM Practices						
	Competencies					
4.1	Demonstrate machine facing, drilling, and reaming using CAM.	4	3	2	1	0
4.2	Create pocket and contour machine practices using CAM software.	4	3	2	1	0
4.3	Merge tooling and geometry within part model and machine object.	4	3	2	1	0
4.4	Program multi-axis code.	4	3	2	1	0
4.5	Evaluate prototyping techniques and choose the appropriate method for a product.	4	3	2	1	0

Course	Drafting/CAD	Course # 21107	Credit 1.0
Pathways & CIP Codes:	Aviation Production (15.0000) - Design Strand; Construction & Design (46.0000) - Design Strand; Engineering & Applied Mathematics (14.0101); Manufacturing (48.0000) - Production Strand; Business Management & Entrepreneurship (52.0799)		
Course Description:	A technical level course designed to instruct students in the use of drafting and computer-aided design (CAD) software available in the industry.		

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.

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: _____

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Instructor Signature: _____

Benchmark 1.0:

	Competencies					
1.1	Identify and demonstrate the use of CAD commands and system peripherals.	4	3	2	1	0
1.2	Demonstrate the ability to dimension drawings on the CAD system.	4	3	2	1	0
1.3	Demonstrate proficiency in setting limits and scale on the CAD system.	4	3	2	1	0
1.4	Demonstrate proficiency in setting, turning on and turning off layers.	4	3	2	1	0
1.5	Create standard drawings for templates.	4	3	2	1	0
1.6	Demonstrate the ability to load, store files, and transport files via Internet.	4	3	2	1	0
17	Place text on a drawing and be able to change to different font styles, sizes, and angles.	4	3	2	1	0
1.8	Be proficient in the use of printer/plotter operations.	4	3	2	1	0
1.9	Demonstrate ability to place text on a drawing and change to different font styles, sizes, and angles.	4	3	2	1	0
1.10	Demonstrate ability to dimension drawings on the CAD system.	4	3	2	1	0
1.11	Demonstrate proficiency in setting limits and scale on the CAD system.	4	3	2	1	0
1.12	Construct drawings using straight line, circle, and hidden line statements, etc.	4	3	2	1	0
1.13	Construct isometric and 3D drawings.	4	3	2	1	0
1.14	Set grid and snap specifications.	4	3	2	1	0
1.15	Define and use commands to modify a drawing.	4	3	2	1	0
1.16	Use symbols (from a symbol library) in a drawing.	4	3	2	1	0

Course	Production Print Reading II	Course # 39108	Credit 0.5
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	A technical level course designed to develop advanced skills and knowledge needed to interpret drawings related to manufacturing occupations. Course uses examples from a wide variety of industrial and technological applications including drawings, schematics, diagrams, multi-view drawings, computer models, dimensioning, and other trade prints. (Prerequisite: Production Blueprint Reading.)		

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: Types and Purposes of Drawings

	Competencies					
1.1	Differentiate between drawings, schematics, and diagrams used in manufacturing and maintenance such as electrical, plumbing, mechanical, welding, machining, assembly, etc.	4	3	2	1	0
1.2	Troubleshoot processes and procedures required for job completion.	4	3	2	1	0
1.3	Interpret design requirements from multi-view drawings and computer models used in manufacturing applications to include engineering, architectural, and schematic representations.	4	3	2	1	0
1.4	Demonstrate the ability to visualize shapes and objects in multiple views to interpret various drawings requirements used in manufacturing which may include electrical, schematics, plumbing, piping ISO's, piping and instrumentation diagrams, architectural and civil.	4	3	2	1	0
1.5	Develop a manufacturing process plan from production/working drawings.	4	3	2	1	0

Benchmark 2.0: Dimensions, Symbols, and Notes

	Competencies					
2.1	Demonstrate proficiency in reading and interpreting dimensions.	4	3	2	1	0
2.2	Demonstrate the ability to locate and interpret notes and special instructions.	4	3	2	1	0
2.3	Identify symbols used in various technical fields (may include welding, plumbing/piping, electrical, flow, assembly, etc.).	4	3	2	1	0

2.4	Interpret meaning of symbols used various technical fields (may include welding, plumbing/piping, electrical, flow, assembly, etc.).	4	3	2	1	0
Benchmark 3.0: Working Drawings						
	Competencies					
3.1	Develop a work order from production/working drawings.	4	3	2	1	0
3.2	Describe how applicable codes, standards, governing bodies, etc. may impact completion of work.	4	3	2	1	0
3.3	Identify and interpret basic views (e.g. front, back, side).	4	3	2	1	0
3.4	Identify and interpret section, auxiliary and associated views.	4	3	2	1	0

Course	Mechanical Power Transmission Systems	Course # 13302	Credit 0.5
Pathways & CIP	Aviation Maintenance (47.0608) - Airframe Strand; Energy (17.2071); Manufacturing (48.0000) - Maintenance Strand		
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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1. Inadequate Achievement: Student lacks knowledge, skills, or professional attitude.
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Benchmark 1.0: Preventative Maintenance

	Competencies					
1.1	Demonstrate proper safe practices when doing general preventative maintenance.	4	3	2	1	0
1.2	Collect and interpret oil samples.	4	3	2	1	0
1.3	Perform equipment checks.	4	3	2	1	0
1.4	Identify various types and styles of predictive and preventative maintenance components, principles, and practices used in Industrial applications.	4	3	2	1	0

Benchmark 2.0: Flexible Drives

	Competencies					
2.1	Describe safety precautions for performing maintenance of flexible drives and chain systems.	4	3	2	1	0
2.2	Describe characteristics of flexible drive systems.	4	3	2	1	0
2.3	Identify different types of industrial belts.	4	3	2	1	0
2.4	Identify common types and styles of chain drive systems.	4	3	2	1	0

Benchmark 3.0: Couplings and Alignments						
	Competencies					
3.1	Demonstrate safe practices when working with couplings.	4	3	2	1	0
3.2	Name types and functions of couplings used in mechanical systems.	4	3	2	1	0
3.3	Align various types of couplings using a straight edge and feeler gauge.	4	3	2	1	0
Benchmark 4.0: Bearings, Shafts, and Seals						
	Competencies					
4.1	Demonstrate proper safe practices when working with shafts.	4	3	2	1	0
4.2	Identify different types of industrial bearings.	4	3	2	1	0
4.3	Identify different types of industrial seals and their functions.	4	3	2	1	0
Benchmark 5.0: Gears and Cams						
	Competencies					
5.1	Describe proper safety precautions for performing maintenance on mechanical systems.	4	3	2	1	0
5.2	Describe purpose and function of gears and gear drives.	4	3	2	1	0
5.3	Explain the functions of seals and breathers.	4	3	2	1	0
5.4	Describe the purpose and types of lubrication essential for gear life.	4	3	2	1	0
5.5	Describe the basic types of industrial cams.	4	3	2	1	0

Course	Foundations of Electronics	Course # 21201	Credit 1.0
Pathways & CIP	Engineering & Applied Mathematics (14.0101); Manufacturing (48.0000); Aviation Maintenance Pathway (47.0608) - Avionics Strand		
Course Description:	Technology Level:		

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: Lab Practices

	Competencies					
1.1	Apply proper OSHA safety standards	4	3	2	1	0
1.2	Demonstrate acceptable soldering and desoldering techniques.	4	3	2	1	0

Benchmark 2.0: Demonstrate proficiency in DC Circuits.

	Competencies					
2.1	Relate, identify, and apply Ohm's law to voltage, current, resistance, power, and energy.	4	3	2	1	0
2.2	Read and interpret color codes and symbols to identify electrical components and values.	4	3	2	1	0
2.3	Measure properties of a circuit using DMM meters, oscilloscopes, and power supplies.	4	3	2	1	0
2.4	Compute, measure, apply, construct, and verify Ohm's law to operation of series circuits.	4	3	2	1	0
2.5	Compute, measure, apply, construct, and verify Ohm's law to operation of parallel circuits.	4	3	2	1	0
2.6	Compute, measure, apply, construct, and verify Ohm's law to operation of series parallel circuits	4	3	2	1	0
2.7	Identify, define, construct, verify, and troubleshoot loaded and unloaded voltage divider circuits	4	3	2	1	0
2.8	Apply, construct, and verify the operation of DC circuits that demonstrate the maximum power transfer theory.	4	3	2	1	0
2.9	Define magnetic properties of circuits and devices.	4	3	2	1	0
2.10	Determine, define, identify, and troubleshoot RC and RL time constant circuits.	4	3	2	1	0
2.11	Define basic motor theory and operation.	4	3	2	1	0

Benchmark 3.0: Demonstrate proficiency in AC Circuits

	Competencies

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

Course	Welding Processes II	Course # 39208	Credit 1.0
Pathways & CIP	Manufacturing (48.0000)		
Course Description:	An advanced, application level courses that builds on skills learned in Welding Processes I (39207) and provides opportunities for applying welding skills. (Prerequisite: Welding Processes 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: Safety Practices

	Competencies					
1.1	Identify hazards associate with welding.	4	3	2	1	0
1.2	Identify and demonstrate proper use of Personal Protective Equipment (PPE).	4	3	2	1	0
1.3	Identify the parts of a fire triangle.	4	3	2	1	0
1.4	Demonstrate proper assembly of welding and cutting equipment.	4	3	2	1	0

Benchmark 2.0: Welding, Cutting, and Inspection Theory

	Competencies					
2.1	Identify code and standard governing bodies.	4	3	2	1	0
2.2	Explain requirements for creating Welding Procedure Specifications (WPS).	4	3	2	1	0
2.3	Demonstrate ability to match filler metal to base metal based on code, position, material capability, thickness, etc.	4	3	2	1	0
2.4	Demonstrate common destructive and nondestructive inspection and testing methods.	4	3	2	1	0
2.5	Calculate weld sizes from prints, drawings, and measure welds produced in the lab.	4	3	2	1	0
2.6	Identify and explain weld discontinuities causes and recommended corrections.	4	3	2	1	0
2.7	Measure weld discontinuities.	4	3	2	1	0

Benchmark 3.0: Shielded Metal Arc Welding (SMAW)

	Competencies

3.1	Demonstrate 3F, and 4F welds with 6010/6011 on Tee, pipe to plate joints (vertical up and down).	4	3	2	1	0
3.2	Demonstrate 3F, 3G, 4F, and 4G welds with 7018 on Tee, pipe to plate, groove welds with backing (vertical up and down).	4	3	2	1	0
3.3	Demonstrate open 3G, 4G, 5G, and 6G on butt joints (plate and pipe) using 6010/6011 root and 7018 fill/cap.	4	3	2	1	0
Benchmark 4.0: Gas Metal Arc Welding (GMAW)						
	Competencies					
4.1	Demonstrate Short Circuit 3F, and 3G welds on Tee, pipe to plate, and butt joints (plate and pipe).	4	3	2	1	0
4.2	Demonstrate Pulse 3F, and 3G welds on Tee, and butt joints (plate and pipe).	4	3	2	1	0
4.3	Demonstrate fillet and groove welds on aluminum material.	4	3	2	1	0
4.4	Demonstrate fillet and groove welds on stainless steel material.	4	3	2	1	0
Benchmark 5.0: Gas Tungsten Arc Welding (GTAW)						
	Competencies					
5.1	Demonstrate 3F, and 3G welds with filler metal on corner, Tee, pipe to plate, and butt joints (vertical up and down).	4	3	2	1	0
5.2	Demonstrate 4F, and 4G welds with filler metal on corner, Tee, pipe to plate, and butt joints.	4	3	2	1	0
5.3	Demonstrate welds on aluminum material.	4	3	2	1	0
5.4	Demonstrate welds on stainless steel material.	4	3	2	1	0
5.5	Explore Pulse GTAW welding.	4	3	2	1	0
Benchmark 6.0: Flux Core Arc Welding (FCAW)-Self Shielded and Dual Shielded.						
	Competencies					
6.1	Demonstrate 2F, and 2G welds on lap, Tee, pipe to plate, and butt joints.	4	3	2	1	0
6.2	Demonstrate 3F, and 3G welds on lap, Tee, pipe to plate, and butt joints.	4	3	2	1	0
6.3	Demonstrate 4F, and 4G welds on lap, Tee, pipe to plate, and butt joints.	4	3	2	1	0
Benchmark 7.0: Fabrication Practices						
	Competencies					
7.1	Identify material needed for fabrication project.	4	3	2	1	0
7.2	Calculate the material required from a bill of materials.	4	3	2	1	0
7.3	Prep material (cut, grind, clean, etc....) for project.	4	3	2	1	0
7.4	Layout project using appropriate techniques and tools (squares, levels, fixtures, clamps, etc....)	4	3	2	1	0
7.5	Demonstrate ability to control distortion.	4	3	2	1	0
7.6	Weld project according to print details.	4	3	2	1	0

Course	Agriculture Welding II	Course # 18407	Credit 1.0
Pathways & CIP	Power, Structural and Technical Systems (01.0201); Manufacturing (48.0000)		
Course Description:			

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: Safety & Health of Welders

	Competencies					
1.1	Identify common hazards in welding.	4	3	2	1	0
1.2	Identify common causes of job-site accidents.	4	3	2	1	0
1.3	Explain and identify proper personal protection used in welding.	4	3	2	1	0
1.4	Demonstrates proper use and inspection of ventilation equipment.	4	3	2	1	0
1.5	Demonstrates knowledge of the fire triangle and its importance in controlling a fire.	4	3	2	1	0
1.6	React effectively in case of fire, or other emergency.	4	3	2	1	0
1.7	Interpret safety color codes and importance to personal safety.	4	3	2	1	0
1.8	Demonstrates safety techniques for storing and handling cylinders.	4	3	2	1	0
1.9	Utilizes proper hand tool safety procedures.	4	3	2	1	0
1.10	Utilizes proper portable power tool safety procedures.	4	3	2	1	0
1.11	Utilizes proper stationary power tool safety procedures.	4	3	2	1	0
1.12	Explains how to avoid electrical shock when welding.	4	3	2	1	0
1.13	Understands proper use of precautionary labeling and MSDS information.	4	3	2	1	0
1.14	Demonstrates proper material handling methods.	4	3	2	1	0
1.15	Complete a Shop Safety Contract / Release form.	4	3	2	1	0
1.16	Demonstrate knowledge of basic shop safety by satisfactorily completing Safety Exam.	4	3	2	1	0
1.17	Demonstrates proper inspection and operation of equipment for each welding or thermal cutting process used.	4	3	2	1	0

Benchmark 2.0: Base Metal Preparation						
	Competencies					
2.1	Identify the types of metal contamination.	4	3	2	1	0
2.2	Identify defects caused by metal contamination.	4	3	2	1	0
2.3	Identify equipment used for cleaning base metal.	4	3	2	1	0
2.4	Clean base metal utilizing the proper equipment and procedures.	4	3	2	1	0
2.5	Identify and explain joint design.	4	3	2	1	0
2.6	Explain joint design considerations.	4	3	2	1	0
2.7	Select and demonstrate the methods of joint preparation.	4	3	2	1	0
2.8	Identify metals using nondestructive methods.	4	3	2	1	0
2.9	Identify structural steel as to shape and size.	4	3	2	1	0
2.10	Utilize measurement instruments to measure steel length, width, depth, and weight.	4	3	2	1	0
2.11	Familiarized with English and Metric measurement and conversion techniques.	4	3	2	1	0
Benchmark 3.0: Welding Symbols						
	Competencies					
3.1	Identify and explain the various parts of a welding symbol.	4	3	2	1	0
3.2	Identify and explain fillet and groove weld symbols.	4	3	2	1	0
3.3	Read welding symbols on drawings, specifications, and welding procedure specifications.	4	3	2	1	0
3.4	Interpret welding symbols from a print.	4	3	2	1	0
3.5	Draw welding symbols based on the observation of actual welds.	4	3	2	1	0
Benchmark 4.0: Reading Detail Drawings						
	Competencies					
4.1	Identify and explain a welding detail drawing.	4	3	2	1	0
4.2	Identify and explain lines, material fills, and sections.	4	3	2	1	0
4.3	Identify and explain object views.	4	3	2	1	0
4.4	Identify and explain dimensioning.	4	3	2	1	0
4.5	Identify and explain notes and bill of materials.	4	3	2	1	0
4.6	Interpret basic elements of a welding detail drawing.	4	3	2	1	0
4.7	Develop basic welding drawings.	4	3	2	1	0
Benchmark 5.0: Plasma Arc Cutting (PAC)						
	Competencies					
5.1	Identify and understand plasma arc cutting processes.	4	3	2	1	0

5.2	Identify plasma arc cutting equipment.	4	3	2	1	0
5.3	Prepare and set up plasma arc cutting equipment.	4	3	2	1	0
5.4	Use plasma arc cutting equipment to make various types of cuts	4	3	2	1	0
5.5	Properly store equipment and clean the work area after use.	4	3	2	1	0
Benchmark 6.0 Weld Quality						
	Competencies					
6.1	Identify and explain codes governing welding.	4	3	2	1	0
6.2	Explain the basic elements of welding codes.	4	3	2	1	0
6.3	Identify and explain weld imperfections and their causes.	4	3	2	1	0
6.4	Identify and explain nondestructive weld examination practices.	4	3	2	1	0
6.5	Identify and explain destructive weld testing practices.	4	3	2	1	0
6.6	Identify and explain welder qualification tests.	4	3	2	1	0
6.7	Explain the importance of quality workmanship.	4	3	2	1	0
Benchmark 7.0: Equipment & Setup; SMAW						
	Competencies					
7.1	Explain the physical processes of SMAW.	4	3	2	1	0
7.2	Identify and explain SMAW safety.	4	3	2	1	0
7.3	Identify and explain types of welding current.	4	3	2	1	0
7.4	Explain the characteristics of welding current.	4	3	2	1	0
7.5	Classify SMAW machines by type of welding current produced.	4	3	2	1	0
7.6	Identify and explain SMAW machine types.	4	3	2	1	0
7.7	Explain SMAW machine ratings.	4	3	2	1	0
7.8	Identify and explain the parts and importance of welding cable (leads).	4	3	2	1	0
7.9	Demonstrate and explain the setup of a SMAW machine.	4	3	2	1	0
7.10	Makes minor external repairs to SMAW equipment and accessories.	4	3	2	1	0
7.11	Identify and demonstrate the use of tools for weld cleaning.	4	3	2	1	0
7.12	Makes minor external repairs to SMAW equipment and accessories.	4	3	2	1	0
Benchmark 8.0: Electrodes & Selection: SMAW						
	Competencies					
8.1	Identify the function of the electrode flux.	4	3	2	1	0
8.2	Explain the A.W.S. and A.S.M.E. filler metal classification system.	4	3	2	1	0

8.3	Identify different types of filler metals.	4	3	2	1	0
8.4	Determine size of electrode by wire core.	4	3	2	1	0
8.5	Identify and explain factors that affect electrode selection.	4	3	2	1	0
8.6	Explain the storage and control of filler metals.	4	3	2	1	0
8.7	Explain filler metal traceability requirements and how to use applicable code requirements.	4	3	2	1	0
8.8	Identify and select the proper electrode for an identified welding task.	4	3	2	1	0
Benchmark 9.0: Beads & Fillet Welds: SMAW						
	Competencies					
9.1	Review safety considerations for welding.	4	3	2	1	0
9.2	Set up the area and SMAW equipment.	4	3	2	1	0
9.3	Describe the methods of striking and arc.	4	3	2	1	0
9.4	Properly strike and extinguish an arc.	4	3	2	1	0
9.5	Describe arc blow and wander	4	3	2	1	0
9.6	Practice horizontal (2F) fillet welds with E60XX and E70XX.	4	3	2	1	0
9.7	Practice vertical (3F) fillet welds with E60XX and E70XX.	4	3	2	1	0
9.8	Practice overhead (4F) fillet welds with E60XX and E70XX.	4	3	2	1	0
Benchmark 10.0: Groove Welds with Backing: SMAW						
	Competencies					
10.1	Identify the typical groove weld styles.	4	3	2	1	0
10.2	Explain the terms and parts describing a groove weld.	4	3	2	1	0
10.3	Explain the benefit of groove welds with backing.	4	3	2	1	0
10.4	Setup: review safety practices.	4	3	2	1	0
10.5	Setup: preparing the work area.	4	3	2	1	0
10.6	Setup: preparing weld coupons.	4	3	2	1	0
10.7	Setup: preparing the welding machine.	4	3	2	1	0
10.8	Practice horizontal (2G) V-groove welds with backing, using E60XX and E70XX.	4	3	2	1	0
10.9	Practice vertical (3G) V-groove welds with backing, using E60XX and E70XX.	4	3	2	1	0
10.10	Practice overhead (4G) V-groove welds with backing, using E60XX and E70XX.	4	3	2	1	0
Benchmark 11.0: Joint Fit-Up & Alignment						
	Competencies					
11.1	Identify and explain job-code requirements.	4	3	2	1	0

11.2	Check joint for proper fit and alignment using gauges and measuring tools.	4	3	2	1	0
11.3	Identify and utilize plate and pipe fit-up tools for proper joint alignment.	4	3	2	1	0
11.4	Identify and explain distortion and how it is controlled.	4	3	2	1	0
11.5	Check for joint misalignment and poor fit-up before and after welding.	4	3	2	1	0
Benchmark 12.0: Open V-Groove Welds: SMAW						
	Competencies					
12.1	Prepare SMAW equipment and materials for open V-groove welds.	4	3	2	1	0
12.2	Identify the components, features and practices for an open V-groove weld.	4	3	2	1	0
12.3	Practice horizontal (2G) open V-groove welds, using E60XX and E70XX.	4	3	2	1	0
12.4	Practice vertical (3G) open V-groove welds, using E60XX and E70XX.	4	3	2	1	0
12.5	Practice overhead (4G) open V-groove welds, using E60XX and E70XX.	4	3	2	1	0
Benchmark 13.0: Open-Root Pipe Welds: SMAW						
	Competencies					
13.1	Prepare SMAW equipment and materials for open-root pipe welds.	4	3	2	1	0
13.2	Identify the components, features and practices for open-root pipe welds.	4	3	2	1	0
13.3	Practice flat (1G-ROTATED) open-root V-groove pipe welds, using E60XX and E70XX.	4	3	2	1	0
13.4	Practice horizontal (2G) open-root V-groove pipe welds, using E60XX and E70XX.	4	3	2	1	0
13.5	Practice multiple (5G) open-root V-groove pipe welds, using E60XX and E70XX.	4	3	2	1	0
13.6	Practice multiple inclined (6G) open-root V-groove pipe welds, using E60XX and E70XX	4	3	2	1	0
Benchmark 14.0: GMAW: Equipment & Filler Metals						
	Competencies					
14.1	Explain the physical processes of GMAW.	4	3	2	1	0
14.2	Identify and explain GMAW safety.	4	3	2	1	0
14.3	Demonstrate start, termination, and restart of beads.	4	3	2	1	0
14.4	Practice stringer beads (short-circuiting transfer).	4	3	2	1	0
14.5	Prepare GMAW equipment and materials for open V-groove welds.	4	3	2	1	0
14.6	Identify the components, features and practices for an open V-groove weld.	4	3	2	1	0
14.7	Practice flat (1G) open V-groove welds,.	4	3	2	1	0
14.8	Practice horizontal (2G) open V-groove weld	4	3	2	1	0
Benchmark 15.0: GMAW - Plate						
	Competencies					

15.1	Perform GMAW multiple-pass fillet welds on plate, using solid or composite wire and shielding gas in multiple positions. E	4	3	2	1	0
15.2	Perform GMAW multiple-pass open-root V-groove welds on plate, using solid or composite wire and shielding gas, in multiple positions. E	4	3	2	1	0
15.3	Perform GMAW spray fillet and open-root V-groove welds on plate, using solid or composite wire and shielding gas, in flat and horizontal positions. E	4	3	2	1	0
Benchmark 16.0:						
	Competencies					
16.1	Prepare GMAW equipment for open-root V-groove pipe welds. E	4	3	2	1	0
16.2	Identify and explain open-root V-groove pipe weld techniques.	4	3	2	1	0
16.3	Perform open-root V-groove pipe welds using GMAW: E -1G-rotated	4	3	2	1	0
16.4	Perform open-root V-groove pipe welds using GMAW: E- 2G	4	3	2	1	0
16.5	Perform open-root V-groove pipe welds using GMAW: E- 5G	4	3	2	1	0
16.6	Perform open-root V-groove pipe welds using GMAW: E- 6G	4	3	2	1	0
Benchmark 17.0: Aluminum Plate & Pipe						
	Competencies					
17.1	Explain GMAW, and set up equipment to weld aluminum. C	4	3	2	1	0
17.2	Build a pad with stringer beads and weave beads, using aluminum wire and shielding gas. E	4	3	2	1	0
17.3	Perform multiple-pass fillet welds on aluminum plate using aluminum wire and shielding gas: E- 1F (flat)	4	3	2	1	0
17.4	Perform multiple-pass fillet welds on aluminum plate using aluminum wire and shielding gas: E- 2F (horizontal)	4	3	2	1	0
17.5	Perform multiple-pass fillet welds on aluminum plate using aluminum wire and shielding gas: E-3F (vertical)	4	3	2	1	0
17.6	Perform multiple-pass fillet welds on aluminum plate using aluminum wire and shielding gas: E-4F (overhead)	4	3	2	1	0
17.7	Perform V-groove welds on aluminum plate using aluminum wire and shielding gas: E- 1G (flat)	4	3	2	1	0
17.8	Perform V-groove welds on aluminum plate using aluminum wire and shielding gas: E- 2F (horizontal)	4	3	2	1	0
17.9	Perform V-groove welds on aluminum plate using aluminum wire and shielding gas: E- 3F (vertical)	4	3	2	1	0
17.10	Perform V-groove welds on aluminum plate using aluminum wire and shielding gas: E-4F (overhead)	4	3	2	1	0
17.11	Perform V-groove welds on aluminum pipe using aluminum wire and shielding gas: E-1G-rotated (flat)	4	3	2	1	0
17.12	Perform V-groove welds on aluminum pipe using aluminum wire and shielding gas: E-2G (horizontal)	4	3	2	1	0
17.13	Perform V-groove welds on aluminum pipe using aluminum wire and shielding gas: E-5G (multiple)	4	3	2	1	0
17.14	Perform V-groove welds on aluminum pipe using aluminum wire and shielding gas: E- 6G (inclined multiple)	4	3	2	1	0

Course	Work Experience in Manufacturing	Course # 13348	Credit 0.5
Pathways & CIP	Manufacturing (48.0000)		
Course Description:	Advanced research and application level course covering specific topics in manufacturing. Should include opportunities for Work-Based Learning (WBL) such as in-house training, job shadowing, and/or internships. (Prerequisite: Must take at least 1.0 credit of Technical level course and Application level course combined.) (SCED: Workplace Experience course provides students with work experience in the fields involving repair, supported by classroom attendance and discussion. Goals are typically set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses may include classroom activities as well, involving further study of the field or discussion regarding experiences that students encounter in the workplace.)		

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: Employability Skills and Career Development Strategies

	Competencies					
1.1	Complete a Work-Based Learning (WBL) experience plan.	4	3	2	1	0
1.2	Enhance Individual Plan of Study through interest assessment(s).	4	3	2	1	0
1.3	Research and report on careers in manufacturing.	4	3	2	1	0
1.4	Research licensing certification and credentialing in the manufacturing industry.	4	3	2	1	0
1.5	Create a professional portfolio to document activities completed while working with a mentor or through an internship in the manufacturing industry.	4	3	2	1	0
1.6	Prepare a resume to include in student Individual Plan of Study (IPS).	4	3	2	1	0
1.7	Prepare a letter of application to include in student Individual Plan of Study (IPS).	4	3	2	1	0
1.8	Demonstrate interview skills through mock or actual employment interview, utilizing business partners as applicable.	4	3	2	1	0

Benchmark 2.0: Communication and Interpersonal Skills

	Competencies

2.1	Demonstrate sound customer services principles when working with customer or client to complete a client-driven project.	4	3	2	1	0
2.2	Develop and maintain professional working relationships.	4	3	2	1	0
2.3	Apply verbal skills when obtaining and conveying information.	4	3	2	1	0
2.4	Use appropriate grammar and word usage in the creation and delivery of a formal graphic presentation using current standards and technology.	4	3	2	1	0
2.5	Develop and deliver oral presentations to provide information for specific purposes.	4	3	2	1	0
Benchmark 3.0: Best Practices in the Workplace						
	Competencies					
3.1	Demonstrate an understanding of OSHA regulations for personal safety, including utilization of PPE, safe use of tools & equipment, and safe handling of hazardous materials.	4	3	2	1	0
3.2	Demonstrate ability to access and utilize industry resources.	4	3	2	1	0
3.3	Demonstrate ability to incorporate industry specific codes in maintenance operations.	4	3	2	1	0
3.4	Utilize knowledge and skills to perform job duties to industry standards.	4	3	2	1	0
3.5	Understand MSDS (Material Safety Data Sheets) and other safety resources required for the workplace.	4	3	2	1	0
3.6	Research and report on “Green” applications in the manufacturing industry.	4	3	2	1	0
3.7	Research new technologies to meet future client needs (e.g. Research and discuss modern & future trends in equipment, methods, & techniques).	4	3	2	1	0

Course	Work Experience in Manufacturing - Comprehensive	Course # 13998	Credit 1.0
Pathways & CIP	Manufacturing (48.0000)		
Course Description:	An advanced research and application level course covering specific topics in manufacturing. Should include opportunities for Work-Based Learning (WBL) such as in-house training, job shadowing, and/or internships. (Prerequisite: Must take at least 1.0 credit of Technical level course and Application level course combined.)		

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.

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Benchmark 1.0: Employability Skills and Career Development Strategies

	Competencies					
1.1	Complete a Work-Based Learning (WBL) experience plan.	4	3	2	1	0
1.2	Enhance Individual Plan of Study through interest assessment(s).	4	3	2	1	0
1.3	Research and report on careers in manufacturing.	4	3	2	1	0
1.4	Research licensing certification and credentialing in the manufacturing industry.	4	3	2	1	0
1.5	Create a professional portfolio to document activities completed while working with a mentor or through an internship in the manufacturing industry.	4	3	2	1	0
1.6	Prepare a resume to include in student Individual Plan of Study (IPS).	4	3	2	1	0
1.7	Prepare a letter of application to include in student Individual Plan of Study (IPS).	4	3	2	1	0
1.8	Demonstrate interview skills through mock or actual employment interview, utilizing business partners as applicable.	4	3	2	1	0

Benchmark 2.0: Communication and Interpersonal Skills

	Competencies					
2.1	Demonstrate sound customer services principles when working with customer or client to complete a client-driven project.	4	3	2	1	0
2.2	Develop and maintain professional working relationships.	4	3	2	1	0

2.3	Apply verbal skills when obtaining and conveying information.	4	3	2	1	0
2.4	Use appropriate grammar and word usage in the creation and delivery of a formal graphic presentation using current standards and technology.	4	3	2	1	0
2.5	Develop and deliver oral presentations to provide information for specific purposes.	4	3	2	1	0
Benchmark 3.0: Best Practices in the Workplace						
	Competencies					
3.1	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.	4	3	2	1	0
3.2	Demonstrate ability to access and utilize industry resources.	4	3	2	1	0
3.3	Demonstrate ability to incorporate industry specific codes in maintenance operations.	4	3	2	1	0
3.4	Utilize knowledge and skills to perform job duties to industry standards.	4	3	2	1	0
3.5	Understand MSDS (Material Safety Data Sheets) and other safety resources required for the workplace.	4	3	2	1	0
3.6	Research and report on “Green” applications in the manufacturing industry.	4	3	2	1	0
3.7	Research new technologies to meet future client needs (e.g. Research and discuss modern & future trends in equipment, methods, & techniques).	4	3	2	1	0
3.8	Research & utilize information for product development.	4	3	2	1	0
3.9	Integrate alternative manufacturing methods and materials in current production process drawings.	4	3	2	1	0
3.1	Produce a working model (graphic or physical) using advanced software and/or equipment.	4	3	2	1	0
3.11	Conduct product evaluations and offer improvements critique their effectiveness.	4	3	2	1	0
3.12	Demonstrate abilities in design/planning, visual communication, and problem solving in the manufacturing industry.	4	3	2	1	0

Course	Advanced Drafting/CAD	Course # 21150	Credit 1.0
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	An advanced, application level course designed to build on and apply the skills learned in Drafting/CAD. (Prerequisite: Drafting/CAD.)		

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: Utilize Advance Controls and Functions

	Competencies					
1.1	Demonstrate knowledge of user coordinate system.	4	3	2	1	0
1.2	Demonstrate ability to manipulate UCS.	4	3	2	1	0
1.3	Demonstrate ability to set and use advanced dimensioning functions correctly.	4	3	2	1	0
1.4	Use the draw and modify commands to created and modify geometry.	4	3	2	1	0
1.5	Use the proper commands to change drawing settings.	4	3	2	1	0

Benchmark 2.0: Auxiliary Views/Section Views

	Competencies					
2.1	Demonstrate proficiency in creating auxiliary views.	4	3	2	1	0
2.2	Identify, draw, sketch, dimension and position appropriate auxiliary views.	4	3	2	1	0
2.3	Demonstrate proficiency in creating section views.	4	3	2	1	0
2.4	Identify, draw, and position appropriate section views.	4	3	2	1	0
2.5	Use draw commands to create geometry.	4	3	2	1	0
2.6	Explain the point views of lines.	4	3	2	1	0
2.7	Identify symbols, section lines, and materials.	4	3	2	1	0

Benchmark 3.0: Dimensional Modeling

	Competencies					
3.1	Demonstrate the ability to create drawings in 3D.	4	3	2	1	0

3.2	Construct solid models (e.g. orthographic models, isometric models).	4	3	2	1	0
3.3	Manipulate solid models.	4	3	2	1	0
3.4	Demonstrate the ability to create drawings in 3D.	4	3	2	1	0
3.5	Define the different types of lines and planes.	4	3	2	1	0
3.6	Describe and sketch in First Angle, Third Angle/Quadrant.	4	3	2	1	0
Benchmark 4.0: Dimensions, Text, and Layers						
	Competencies					
4.1	Create and manage drawing layers.	4	3	2	1	0
4.2	Draw objects with different colors, line types and line weights.	4	3	2	1	0
4.3	Use text and text editing commands to create and modify text in drawing.	4	3	2	1	0
4.4	Create and edit dimensions and dimension styles.	4	3	2	1	0
Benchmark 5.0: Inquiry Commands						
	Competencies					
5.1	Use the List command to find object properties.	4	3	2	1	0
5.2	Use the Distance command to find length data.	4	3	2	1	0
5.3	Use the Area and ID commands to find drawing data.	4	3	2	1	0

Course	Advanced Materials Technology	Course # 38010	Credit 1.0
Pathways & CIP	Construction & Design (46.0000) - Construction Strand; Manufacturing (48.0000) - Production Strand		
Course Description:	A progressive application level course furthering the study of CNC equipment, materials, and the processes involved with fabricating goods with these technologies (i.e. composite panel products, veneering, etc.). (Construction Prerequisites: 17007/Woodworking Principals & 38007/Furniture & Cabinetry Fabrication. Manufacturing Prerequisites: 39052/Production Methods II or 39208/Welding Processes II).		

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

	Competencies					
1.1	Research and apply composite materials fabrication.	4	3	2	1	0
1.2	Research and apply overlay/veneer materials fabrication (for woods based courses).	4	3	2	1	0
1.3	Research and apply appropriate tooling methods for chosen materials.	4	3	2	1	0
1.4	Research and apply appropriate methods of assembly for materials and applications (adhesives, welds, etc.).	4	3	2	1	0
1.5	Research and apply appropriate finishes and proper finish procedure of chosen materials.	4	3	2	1	0
1.6	Design and engineer a product using CAD and/or CAM software systems.	4	3	2	1	0
1.7	Understand and demonstrate operations of advanced technology systems.	4	3	2	1	0
1.8	Demonstrate effective techniques to manage and organize production flow.	4	3	2	1	0
1.9	Research and understand related career fields and postsecondary training opportunities.	4	3	2	1	0
1.10	Implement and manage a safety program for procedures and hazardous materials.	4	3	2	1	0

Course	Automated Integrated Systems	Course # 39010	Credit 0.5
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	An advanced application level course that focus on Programable Logic Control (PLCs) systems. This includes instruction in basic numbering systems, computer terminology, PLC functions, structure, memory, language, point I/O addressing, programing, and PLC communications. (Prerequisite: Robotics.)		

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: Programmable Logic Controller (PLC) Basics and Overview

	Competencies					
1.1	Describe components of a typical PLC system and its architecture.	4	3	2	1	0
1.2	Demonstrate knowledge pf basic numbering and computer technology.	4	3	2	1	0
1.3	Explain basic PLC function.	4	3	2	1	0

Benchmark 2.0: Programmable Logic Controller (PLC) Hardware and Processing

	Competencies					
2.1	Describe PLC memory and project organization.	4	3	2	1	0
2.2	Describe types of addressing used with/in PLC.	4	3	2	1	0
2.3	Interpret real-world I/O addresses.	4	3	2	1	0
2.4	Connect PC to PLC.	4	3	2	1	0
2.5	Configure I/O for projects.	4	3	2	1	0
2.6	Monitor point addressing.	4	3	2	1	0

Benchmark 3.0: Programming PLC

	Competencies					
3.1	Write basic ladder logic program.	4	3	2	1	0
3.2	Work with timers and counters within ladder logic program.	4	3	2	1	0

3.3	Utilize math instructions and special functions in PLC.	4	3	2	1	0
3.4	Use structured text programming to develop routines.	4	3	2	1	0
3.5	Create sequential function chart routine.	4	3	2	1	0
3.6	Demonstrate use of various types of function blocks with PLC.	4	3	2	1	0
Benchmark 4.0: Programmable Logic Controller (PLC) Communication						
	Competencies					
4.1	Describe common data communications and their characteristics.	4	3	2	1	0
4.2	Use Ethernet TCP/IP protocols.	4	3	2	1	0
4.3	Troubleshoot communications systems in PLC.	4	3	2	1	0

Course	Production Methods II	Course # 39052	Credit 1.0
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	An application level course which builds on skills learned in Production Methods I and is designed to instruct students in advanced knowledge and skills required for fabricating products using a variety of materials (wood, plastic, metal, composites). (Prerequisite: Production Methods 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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Benchmark 1.0: Safety and Tool Operation

	Competencies					
1.1	Safely use and maintain basic and advanced hand power tools.	4	3	2	1	0
1.2	Apply concepts and skills required to safely use specialized equipment.	4	3	2	1	0
1.3	Apply concepts and proper safety procedures for manufacturing processes and material handling.	4	3	2	1	0

Benchmark 2.0: Production Methods and Processes

	Competencies					
2.1	Select proper materials used in developing production processes.	4	3	2	1	0
2.2	Identify properties used in production methods and processes.	4	3	2	1	0
2.3	Create or utilize technical drawings, blueprints, work orders, and product specifications in product development.	4	3	2	1	0
2.4	Apply math skills to manage distance, spacing, angle measurements, and placement for project development.	4	3	2	1	0
2.5	Design a product using applicable production methods and processes.	4	3	2	1	0

Benchmark 3.0: Concepts in Production, Methods, and Technology

	Competencies					
3.1	Research technologies utilizing production and design.	4	3	2	1	0
3.2	Analyze and solve problems using skills related to methods in fabrication of a product.	4	3	2	1	0

3.3	Incorporate LEAN manufacturing concepts pertaining to product fabrication and design (e.g. visual management, value stream mapping, 5S, Kanban systems, lean metrics, shop layout).	4	3	2	1	0
Benchmark 4.0: Plans and Projects						
	Competencies					
4.1	Incorporate traditional methods of fabrication and design with advanced technologies to create plans, and construct products.	4	3	2	1	0
4.2	Develop project bill of material, cost estimates and plan of procedure for products.	4	3	2	1	0
4.3	Select and perform best practices for joining, assembling, and finishing products.	4	3	2	1	0

Course	Computer-Aided Machining (CAM) II	Course # 39205	Credit 0.5
Pathways & CIP	Manufacturing (48.0000) - Production Strand		
Course Description:	An application level course that builds on skills learned in Computer-Aided Machining (CAM) I. This course introduces advanced methods used in creating computer-generated models and machining practices. (Prerequisite: Computer-Aided Machining (CAM) 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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Benchmark 1.0: Dimensional Drawings

	Competencies					
1.1	Demonstrate use of CAD software for part modeling.	4	3	2	1	0
1.2	Create 2D and 3D models in CAM.	4	3	2	1	0
1.3	Generate Wireframe and Solid models using CAD.	4	3	2	1	0

Benchmark 2.0: Establish CAM Set-up Processes

	Competencies					
2.1	Select proper tooling matching specified material.	4	3	2	1	0
2.2	Identify proper feed rates and machining speeds.	4	3	2	1	0
2.3	Generate Machine set-up sheet graphics.	4	3	2	1	0
2.4	Finalize set-up documents.	4	3	2	1	0

Benchmark 3.0: Generate Milling & Turning Tool Paths

	Competencies					
3.1	Demonstrate rough pocket and contour tool-paths.	4	3	2	1	0
3.2	Demonstrate rough plunge and finish contour and shallow tool-paths.	4	3	2	1	0
3.3	Generate steep and shallow tool-paths using CAM.	4	3	2	1	0
3.4	Generate (Turning) tool-paths: Roughing, Grooving, and Finishing.	4	3	2	1	0

Benchmark 4.0: Inspection and verification of Toolpaths using CAM Software						
	Competencies					
4.1	Inspect tool-paths for collision.	4	3	2	1	0
4.2	Verify tool-paths for accuracy.	4	3	2	1	0
4.3	Correct and re-generate tool-paths as needed.	4	3	2	1	0

Course	Sheet Metal Technology	Course # 13205	Credit 0.5
Pathways & CIP	Construction & Design (46.0000) - Construction Strand; Manufacturing (48.0000) - Maintenance Strand		
Course Description:	An application level course designed to provide students with exposure to and training in the theories, equipment, and skills needed to perform sheet metal layout and fabrication techniques. (SCED: Sheet Metal courses expose students to the skills and information necessary to lay out, fabricate, assemble, install, maintain, and repair items and structures created from sheet metal components. Students learn the safe and efficient operation of various tools and typically gain skill in blueprint reading, welding, and finishing and polishing metals.)		

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: Shop and Machine-Specific Safety

	Competencies					
1.1	Safely utilize and maintain tools common to the sheet metal trade.	4	3	2	1	0
1.2	Describe types and thicknesses of sheet metal.	4	3	2	1	0
1.3	Explain and identify accident causes in the sheet metal industry.	4	3	2	1	0
1.4	Describe safe working attire in the sheet metal industry.	4	3	2	1	0
1.5	Demonstrate safe use of tools and equipment.	4	3	2	1	0

Benchmark 2.0: Sheet Metal Tools and Materials

	Competencies					
2.1	Describe terms and definitions related to sheet metal fabrication and layout.	4	3	2	1	0
2.2	Discuss the sheet metal forming equipment and their applications.	4	3	2	1	0

Benchmark 3.0: Print Reading, Measuring, and Math Skills

	Competencies					
3.1	Demonstrate print reading skills including the interpretation of plans, elevations, schedules, and details.	4	3	2	1	0
3.2	Identify the three basic types of layout: parallel line, radial line, and triangulation.	4	3	2	1	0

3.3	Utilize a tape measure to obtain correct measurements for a ductwork detail.	4	3	2	1	0
3.4	Calculate circumference and area of a circle.	4	3	2	1	0
3.5	Demonstrate architect's scale use in sheet metal.	4	3	2	1	0
3.6	Describe measuring tools.	4	3	2	1	0
Benchmark 4.0: Sheet Metal Layout and Fabrication						
	Competencies					
4.1	Discuss terms and definitions.	4	3	2	1	0
4.2	Use various sheet metal equipment to build projects.	4	3	2	1	0
4.3	Use various sheet metal hand tools.	4	3	2	1	0
4.4	Layout and use the squaring metal shear to cut sheet metal.	4	3	2	1	0
4.5	Fasten sheet metal using different bonding methods (e.g. adhesives, fasteners or spot welding).	4	3	2	1	0
4.6	Layout and fabricate a basic joint of ductwork (e.g. Rivets and Fasteners)	4	3	2	1	0
4.7	Layout and fabricate basic sheet metal fittings.	4	3	2	1	0
4.8	Describe the different seams commonly used for ductwork and explain the advantages of each.	4	3	2	1	0
4.9	Produce sheet metal/duct work project utilizing concepts and skills.	4	3	2	1	0
Benchmark 5.0: Sheet Metal Notching and Use of Forming Machines						
	Competencies					
5.1	Fasten sheet metal together using the Snap-lock machine and the Pittsburg machine.	4	3	2	1	0
5.2	Fasten sheet metal together using appropriate methods consisting of the finger break, rolls, easy edger, drive turner and notching the sheet metal for the various joints.	4	3	2	1	0
5.3	Cut various lengths of “S” clips and build drives to connect the fittings together.	4	3	2	1	0
Benchmark 6.0: Codes						
	Competencies					
6.1	Examine the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) guidelines for sheet metal construction.	4	3	2	1	0
6.2	Examine the International Mechanical Code (IMC) for the standards used in the construction of sheet metal ductwork.	4	3	2	1	0
6.3	Examine the Air Conditioning Contractors of America (ACCA) Manual D to identify the concepts of airflow, static pressure, total pressure, total equivalent length (TEL) associated with each fitting used in the construction trade.	4	3	2	1	0

Course	Remodeling & Building Maintenance	Course # 17009	Credit 0.5
Pathways & CIP	Business Management & Entrepreneurship (52.0799); Construction & Design (46.0000); Manufacturing (48.0000)		
Course Description:	An application level course designed to provide students with the knowledge and skills needed to maintain commercial, industrial, and residential buildings and homes. Instruction is provided in the basic maintenance and repair of air conditioning, heating, plumbing, electrical, and other mechanical systems. Topics covered may include identifying and using hand and power tools safely; installing and repairing floor coverings, walls, and ceilings; installing and repairing doors, windows, screens, and cabinets; applying finishes to prepared surfaces; and repairing roofs, masonry, plumbing, and electrical systems.		

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.

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

	Competencies					
1.1	Apply needed caulking and/or paint to interior and exterior finishes	4	3	2	1	0
1.2	Demonstrate ability to repair/replace damaged wallboard, wood trim and cabinetry.	4	3	2	1	0
1.3	Utilize knowledge of bearing walls when reconfiguring room design and/or constructing building additions.	4	3	2	1	0
1.4	Repair/replace floor coverings.	4	3	2	1	0
1.5	Troubleshoot and repair problems with HVAC systems	4	3	2	1	0
1.6	Troubleshoot and repair water supply, water heater, and water drainage problems	4	3	2	1	0
1.7	Troubleshoot and repair problems in lighting fixtures, including ballast replacement.	4	3	2	1	0
1.8	Utilize appropriate meters/tools to locate electrical circuit problems.	4	3	2	1	0
1.9	Replace breakers, plugs, switches and light fixtures	4	3	2	1	0
1.10	Repair/Replace windows, storm windows, doors and storm doors.	4	3	2	1	0
1.11	Install and perform maintenance procedures on electric motors	4	3	2	1	0
1.12	Evaluate and assess the extent and condition of remodeling/maintenance problems.	4	3	2	1	0
1.13	Develop a checklist to track preventative maintenance	4	3	2	1	0

Course	HVAC Technology	Course # 17056	Credit 0.5
Pathways & CIP	Engery (17.2071); Manufacturing (48.0000)		
Course Description:	An application level course designed to provide students with exposure to and training in the theories, equipment and skills needed to install and maintain HVAC systems.		

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:

	Competencies					
1.1	Safely utilize and maintain tools common to the mechanical trades industry.	4	3	2	1	0
1.2	Describe the heating and cooling process.	4	3	2	1	0
1.3	Demonstrate the use of a duct calculator and the formulas used to calculate heat loads.	4	3	2	1	0
1.4	Apply layout to HVAC projects.	4	3	2	1	0
1.5	Describe various types of heating and cooling systems, including the pros, cons and applications of each.	4	3	2	1	0
1.6	Demonstrate basic electrical knowledge of how electrical circuits work and how they are used within the industry.	4	3	2	1	0
1.7	Install basic and programmable heat/cool thermostats.	4	3	2	1	0
1.8	Describe thermostat wire and identify what each color should be used for.	4	3	2	1	0
1.9	Research future trends in “green technology” for the HVAC industry.	4	3	2	1	0
1.10	Troubleshoot and repair problems with HVAC systems.	4	3	2	1	0
1.11	Correctly measure, cut and join piping/tubing.	4	3	2	1	0
1.12	Demonstrate proper soldering techniques.	4	3	2	1	0
1.13	Demonstrate ability to maintain appropriate maintenance documentation.	4	3	2	1	0

Course	Plumbing Technology	Course # 17058	Credit 0.5
Pathways & CIP	Construction & Design (46.0000) - Construction Strand; Manufacturing (48.0000) - Maintenance Strand		
Course Description:	An application level course designed to provide students with instruction in installing waste and vent systems, water and gas pipes, trim, and fixtures. Skills taught include cutting and joining various types of pipe (for instance, steel, plastic) using various methods (cement, seat method, and so on).		

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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Instructor Signature: _____

Benchmark

	Competencies					
1.1	Demonstrate proper use of basic hand and power tools used in the plumbing trade.	4	3	2	1	0
1.2	Correctly measure, cut and join plastic, carbon steel and/or stainless steel piping/tubing.	4	3	2	1	0
1.3	Identify and install the most common types of sinks and toilets.	4	3	2	1	0
1.4	Identify and describe the functions of the major components of a water distribution system.	4	3	2	1	0
1.5	Identify and install pipe hangers and supports.	4	3	2	1	0
1.6	Identify the types of schedules and drawings used within the plumbing trade.	4	3	2	1	0
1.7	Demonstrate proper soldering techniques.	4	3	2	1	0
1.8	Identify different types of plumbing systems and their components.	4	3	2	1	0
1.9	Demonstrate proper safety procedures within the plumbing trade.	4	3	2	1	0
1.10	Troubleshoot and repair water supply, water heater, and water drainage problems.	4	3	2	1	0

Course	Electrical & Security Systems	Course # 17113	Credit 0.5
Pathways & CIP	Construction & Design (46.0000) - Construction Strand; Manufacturing (48.0000) - Maintenance Strand		
Course Description:	An application level course designed to provide students with the knowledge and skills needed to install, troubleshoot, and maintain electrical and security systems.		

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	Competencies					
1.1	Cut, ream, thread, and bend conduit.	4	3	2	1	0
1.2	Compute branch circuit loads and explain installation requirements.	4	3	2	1	0
1.3	Demonstrate the procedure for safely using a clamp-on ammeter and a voltage tester.	4	3	2	1	0
1.4	Demonstrate procedures for installing raceways and boxes.	4	3	2	1	0
1.5	Demonstrate ability to correctly pull wire through conduit.	4	3	2	1	0
1.6	Select and install appropriate service entrance equipment according to codes.	4	3	2	1	0
1.7	Demonstrate the ability to properly ground electrical circuits according to codes.	4	3	2	1	0
1.8	Install breakers, plugs, and switches.	4	3	2	1	0
1.9	Explain basic characteristics of series and parallel circuits.	4	3	2	1	0
1.1	Recognize and install various types of lighting fixtures.	4	3	2	1	0
1.11	Describe characteristics and functions of various fire alarm systems.	4	3	2	1	0
1.12	Describe characteristics and functions of various security and burglar alarm systems.	4	3	2	1	0
1.13	Describe the uses, characteristics, and theory of low voltage systems.	4	3	2	1	0
1.14	Demonstrate knowledge of the uses and installation process for Closed Circuit TV.	4	3	2	1	0
1.15	Describe the components of and uses for electric lock hardware.	4	3	2	1	0
1.16	Demonstrate safe use of electric hand and power tools.	4	3	2	1	0
1.17	Understand and interact with LAN systems as a part of an overall security installation.	4	3	2	1	0
1.18	Demonstrate ability to install a lightning protection system.	4	3	2	1	0

1.19	Troubleshoot and repair problems in lighting fixtures, including ballast replacement.	4	3	2	1	0

Course	Digitals Electronics	Course # 21008	Credit 1.0
Pathways & CIP	Engineering & Applied Mathematics (14.0101); Aviation Maintenance (47.0608) - Avionics Strand; Manufacturing (48.0000)		
Course Description:	Application Level:		

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

	Competencies					
1.1	Students will identify hazards in the lab and locations of the MSDS, safety equipment, and resources.	4	3	2	1	0
1.2	Students will understand how to prevent dangers from electric shock, including environmental concerns and precautionary measures	4	3	2	1	0
1.3	Students will define and explain direct and alternating currents along with components and schematics used in electronics circuitry.	4	3	2	1	0
1.4	Students will correctly calculate and set up lab equipment for safety, design, test, using Ohm's law and circuit measurements.	4	3	2	1	0
1.5	Students will identify and differentiate digital and analog waveforms.	4	3	2	1	0
1.6	Students will build and test a free running clock and calculate output frequencies from observations on an oscilloscope.	4	3	2	1	0
1.7	Students will design and build logic circuits derived from Boolean expressions and truth tables	4	3	2	1	0
1.8	Students will use DE Morgan's Theorem, Karnaugh mapping, NOR, NAND, and combinational logic solutions to reduce and simplify circuits.	4	3	2	1	0
1.9	Students will design, code, and build logic circuits to control different kinds of displays.	4	3	2	1	0
1.10	Students will control the flow of data by utilizing multiplexers and demultiplexers.	4	3	2	1	0
1.11	Students will design and implement logic circuits using programmable logic devices that define combinational circuit designs using logic compiler software.	4	3	2	1	0
1.12	Students will compare and contrast operation of RS flip-flops, D flip-flops, and J-K flip-flops.	4	3	2	1	0

1.13	Students will understand, design, and implement different circuits using synchronous, asynchronous, triggering, and timing using flip-flops.	4	3	2	1	0
1.14	Students will design modification counters using timing from asynchronous flip-flops.	4	3	2	1	0
1.15	Students will conduct experiments with shift registers for memory storage and arithmetic circuits.	4	3	2	1	0
1.16	Students will design both half and full adders from logic circuits to do simple addition and subtraction using binary numbers.	4	3	2	1	0
1.17	Students will appropriately select, size, and implement interface devices to control external devices.	4	3	2	1	0
1.18	Students will design and create programming to control the position of stepper motors and control speed and torque of servo motors.	4	3	2	1	0
1.19	Students will be able to formulate a flow chart to correctly apply basic programming concepts in the planning of a project.	4	3	2	1	0

Course	Hydraulics & Pneumatics	Course # 39302	Credit 0.5
Pathways & CIP	Energy (17.2071); Manufacturing (48.0000) - Maintenance Strand		
Course Description:	An application level course designed to provide students with advanced knowledge and skills in operating, maintaining and troubleshooting hydraulic & pneumatic systems		

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:

	Competencies					
1.1	Compare & contrast the principles of hydraulics & pneumatics.	4	3	2	1	0
1.2	Demonstrate a working knowledge of hydraulics & pneumatics terminology.	4	3	2	1	0
1.3	Identify basic hydraulic and pneumatic symbols.	4	3	2	1	0
1.4	Read and understand Schematic Diagrams.	4	3	2	1	0
1.5	Design and construct basic hydraulic and pneumatic circuits.	4	3	2	1	0
1.6	Demonstrate proper use of pneumatic and hydraulic-operated Tools.	4	3	2	1	0
1.7	Explain the operation of air compressors and vacuum pumps.	4	3	2	1	0
1.8	Perform diagnostic procedures on hydraulic and pneumatic systems.	4	3	2	1	0
1.9	Compare & contrast the use of synthetic and petroleum-based lubricants in hydraulic systems.	4	3	2	1	0
1.10	Create a comprehensive maintenance schedule for hydraulic & pneumatic systems.	4	3	2	1	0
1.11	Identify components in a fluid power/pneumatic circuit.	4	3	2	1	0