M-CAM Learning Objectives

Programmatic Alignment to Industry Credentials Matrices

Learning Objective Alignment

For three of the four program areas, faculty identified industry credentials as a starting point to align programmatic learning objectives within each college and across M-CAM colleges offering a specific industry certification. This process made it easier to identify existing college courses delivering content found in industry credentials and to identify areas where there were gaps if the program existed. The following tables illustrate how that alignment was identified in CNC/Machining, Production Operations and Welding/Fabricating programmatic areas for M-CAM Colleges offering the specific industry certification.

CNC/Machining

National Institute for Metalworking Skills (NIMS) Credential Alignment Matrix

NIMS Credential	Learning Objectives	Grand Rapids CC	Kellogg CC	Lake Michigan	Macomb CC	Mott CC	Schoolcraft
Measurement, Materials & Safety	• Introduction to Safety • Measurement Systems and Machine Tool Math Overview • Semi-Precision Measurement • Precision Measurement • Quality Assurance, Process Planning, & Quality Control • Metal Composition & Classification • Heat Treatment of Metals • Maintenance, Lubrication, and Cutting Fluid Overview	MN199, MN119	INMT 05010, 10010, 20010, 20020, 20030, 20040, 20050, 20060, 20070, 20080, 20090, 25010, 25020, 25030, 25040, 25050, 25060, 25100, INTD 10010, INT 10010 10020, 30140, 45010, 45020, 45030, 45040,	MACH 110 Machine Tool I MACH 120 Machine Tool II		MECH 144 - Basic Machining MECH 150 - Material Systems & Evaluation	MFG 102,
CNC Turning: Operations	CNC Basics Introduction to CNC Turning	MN235, MN236, MN238	INMT 65010, 65020	MACH 140 Intro to CNCMACH 241CNC	ATAP 1050	MECH 246 - CNC Lathe	MFG 203

				Programming I MACH242 CNC Programming II			
CNC Milling: Operations	Introduction to CNC Milling	MN235, MN236, MN238	INMT 65010, 65030	MACH 140 Intro to CNCMACH 241CNC Programming I MACH 242 CNC Programming II	ATAP 1050	MECH 247 - CNC Mill	MFG 103

Production Operations

Manufacturing Skill Standards Council (MSSC) Certifications

1. **Safety**
2. **Quality**
3. **Process and Production**
4. **Maintenance and Awareness**

Learning Objective	Bay	Grand Rapids	Kellogg	Lake Michigan	Lansing	Macomb	Mott	Schoolcraft
1	N/A	TE 272 Industrial Safety (2 credits)	1.63 credits	N/A	METS 102 Industrial/Construction Safety (students must also have their CPR card and OSHA 10 card) – 2 credits	At this point must also have OSHA 10 certification to receive credit **ATTR1600-Industrial Safety-Skilled Trades 2 credits**		N/A
2	N/A	PLA		N/A	PLA			N/A
3	N/A	MN 102 Lean Manufacturing Principles (2 credits)		N/A	PLA			N/A
4	N/A	PLA		N/A	PLA			N/A

Learning Objective 1 – MSSC Safety

1. Work in a Safe and Productive Manufacturing Workplace
2. Perform safety and environmental inspections
3. Perform emergency drills and participate in emergency teams
4. Identify unsafe conditions and take corrective action
5. Provide safety orientation for all employees
6. Train personnel to use equipment safely
7. Suggest processes and procedures that support safety of work environment
8. Fulfill safety and health requirements for maintenance, installation, and repair
9. Monitor safe equipment and operator performance
10. Utilize effective, safety-enhancing workplace practices

This certification validates that an individual has the fundamental knowledge of general shop safety for a machining environment and awareness of hazards. Safety topics covered include MSDS sheets, personal protective equipment, lockout tag out, and more. *See link for specific competencies.*

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Learning Objective 2 – MSSC Quality

1. Participate in periodic internal quality audit activities
2. Check calibration of gages and other data collection equipment
3. Suggest continuous improvements
4. Inspect materials and product/process at all stages to ensure they meet specifications
5. Document the results of quality tests
6. Communicate quality problems.
7. Take corrective actions to restore or maintain quality
8. Record process outcomes and trends
9. Identify fundamentals of blueprint reading
10. Use common measurement systems and precision measurement tools

This certification validates that an individual has the fundamental knowledge of employee's role in producing a quality product including the benefits of quality and the costs of quality, and problem solving tools for continuous improvement. *See link for specific competencies.*

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Learning Objective 3 – MSSC Process and Production

1. Identify customer needs
2. Determine resources available for the production process
3. Set up equipment for the production process
4. Set team production goals
5. Make job assignments
6. Coordinate work flow with team members and other work groups
7. Communicate production and material requirements and product specifications
8. Perform and monitor the process to make the product
9. Document product and process compliance with customer requirements
10. Prepare final product for shipping or distribution

This certification validates that an individual has the fundamental knowledge of how to improve quality, eliminate waste, reduce lead time and inventory, and develop productive customer and supplier relationships. Cycle time, kanban, demand-pull, and order push techniques to reduce inventory in the supply chain are also covered. *See link for specific competencies.*

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Learning Objective 4 – MSSC Maintenance Awareness

This certification validates that an individual has the fundamental knowledge of the basic mechanical skills needed by a technician, including use and care of hand tools and small power tools, drilling, tapping, removal of broken bolts, studs, and helicoil insertion. Basic measuring tools and techniques are covered, as well as type and use of fasteners, lubricants and adhesives used in repair, and assembly. *See link for specific competencies.*

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Welding/Fabrication

American Welding Society (AWS) Certification (8 of 9 Certification Categories)

Learning Objective	Bay	Grand Rapids	Kellogg	Lake Michigan	Lansing	Macomb	Mott	Schoolcraft
1		MN 116 2 credits	INWE 05 0.43 credit		Weld 103 4 credits	ATWD 1110 2 credits	Weld 143 3 credits	Weld 110 3 credits
2	Weld 110 3 credits	MN 134 2 credits	INWE 05 0.43 credit		Weld 103 4 credits	ATWD 1110 2 credits	Weld 143 3 credits	Weld 113 3 credits

3	Weld 120 4 credits Weld 210 4 credits	MN 136 4 credits	INWE 25 4.02 credits INWE 30 5.74 credits	Weld 102 2 credits	Weld 103 4 credits Weld 105 4 credits	ATWD 1130 2 credits	Weld 166 4 credits	Weld 113 3 credits
4	Weld 220 4 credits	MN 202 3 credits	INWE 40 2.80 credits	Weld 103 2 credits Weld 201 2 credits	Weld 110 4 credits	ATWD 1140 2 credits	Weld 170 4 credits	Weld 115 3 credits
5	Weld 260 4 credits	MN 203 3 credits	INWE 45 5.01 credits	Weld 202 2 credits	Weld 111 4 credits	ATWD 1150 3 credits	Weld 168 4 credits	Weld 119 3 credits
6		MN 231 4 credits	INWE 35 1.27 credits	Weld 203 2 credits Weld 204 1 credit	Weld 105 4 credits Weld 110 4 credits Weld 120 4 credits	ATWD 1160 3 credits ATWD 1161 3 credits		Weld 206 2 credits
7	Weld 240 4 credits	MN 232 5 credits	INWE 50 4.37 credits	Weld 205 1 credit	Weld 205 4 credits	ATWD 1163 3 credits		Weld 214 3 credits
8		MN 233 3 credits			Weld 115 3 credits	ROBO 1435 3 credits		

Learning Objective 1 – Basic Welding

1. Demonstrates safe operation of gas welding
2. Demonstrates safe operation of gas cutting
3. Demonstrates safe operation of arc welding equipment
4. Demonstrates safe operation of industry tools and shop practices
5. Proper selection of filler materials

Learning Objective 2 – Gas Welding OAW

1. Demonstrates safe work habits and use of equipment
2. Demonstrates proper assembly of an oxy-acetylene unit
3. Demonstrates safe operation of gas cutting
4. Demonstrates proper oxy-acetylene welding techniques
5. Students will demonstrate proper braze welds

Learning Objective 3 – Shielded Metal Arc Welding (SMAW)

1. Performs safety inspections of SMAW equipment and accessories.
2. Makes minor external repairs to SMAW equipment and accessories.
3. Sets up for SMAW operations on carbon steel.
4. Operates SMAW equipment on carbon steel.
5. Makes fillet weld in all positions on carbon steel.
6. Makes groove welds, in all positions, on carbon steel.

Learning Objective 4 – Gas Metal Arc Welding (GMAW)

1. Performs safety inspections of GMAW equipment and accessories.
2. Makes minor external repairs to GMAW equipment and accessories.

3. Sets up for GMAW operations on carbon steel.
4. Operates GMAW equipment on carbon steel.
5. Makes fillet welds in multiple positions on carbon steel.

Learning Objective 5 – Gas Tungsten Arc Welding (GTAW)

1. Performs safety inspections of GTAW equipment and accessories.
2. Makes minor external repairs to GTAW equipment and accessories.
3. Sets up for GTAW operations on carbon steel.
4. Operates GTAW equipment on carbon steel.
5. Makes fillet welds in multiple positions on carbon steel.

Learning Objective 6 – Weld Testing

1. Demonstrate knowledge of the American Welding Society (AWS) testing procedures
2. Demonstrate proper use of a welding procedure for weld testing
3. Complete groove test welds according to AWS codes using the Gas Metal Arc Welding (GMAW) and Shielded Metal Arc Welding (SMAW) procedures
4. Examine welds for weld defects

Learning Objective 7 – Pipe Welding

1. Demonstrate knowledge of the American Welding Society (AWS) testing procedures
2. Demonstrate proper use of a welding procedure for weld testing
3. Complete groove test welds according to AWS codes using the Gas Metal Arc Welding (GMAW) and Shielded Metal Arc Welding (SMAW) procedures
4. Examine welds for weld defects

Learning Objective 8 – Welding Automation (Robotics)

1. Demonstrate safety precautions while operating automated equipment
2. Demonstrate the fundamentals of the teach pendant and arc tool programming language
3. Demonstrate programming language techniques and editing commands
4. Demonstrate position of the robot using the teach pendant and various motion types
5. Perform welding program structure, operation, and editing

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