

***MANUFACTURING
TECHNOLOGIES
CURRICULUM FRAMEWORK***



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INTRODUCTION

The Nevada CTE Curriculum Frameworks are a resource for Nevada's public and charter schools to design, implement, and assess their CTE programs and curriculum. The content standards identified in this document are listed as a model for the development of local district programs and curriculum. They represent rigorous and relevant expectations for student performance, knowledge, and skill attainment which have been validated by industry representatives.

The intent of this document is to provide a resource to districts as they develop and implement CTE programs and curricula.

This program ensures the following thresholds are met:

- The CTE course and course sequence teaches the knowledge and skills required by industry through applied learning methodology and, where appropriate, work-based learning experiences that prepare students for careers in high-wage, high-skill and/or high-demand fields. Regional and state economic development priorities shall play an important role in determining program approval. Some courses also provide instruction focused on personal development.
- The CTE course and course sequence includes leadership and employability skills as an integral part of the curriculum.
- The CTE course and course sequence are part of a rigorous program of study and include sufficient technical challenge to meet state and/or industry-standards.

The CTE program components include the following items:

- Program of Study
- State Skill Standards
- Employability Skills for Career Readiness Standards
- Career Technical Student Organizations (CTSO)
- Curriculum Framework
- CTE Assessments:
 - Workplace Readiness Skills Assessment
 - End-of-Program Technical Assessment
- Certificate of Skill Attainment
- CTE Endorsement on a High School Diploma
- CTE College Credit

**NEVADA DEPARTMENT OF EDUCATION
CURRICULUM FRAMEWORK FOR
MANUFACTURING TECHNOLOGIES**

PROGRAM TITLE:	MANUFACTURING TECHNOLOGIES
STATE SKILL STANDARDS:	MANUFACTURING TECHNOLOGIES
STANDARDS REFERENCE CODE:	MANUF
CAREER CLUSTER:	MANUFACTURING
CAREER PATHWAY:	PRODUCTION
PROGRAM LENGTH:	3 LEVELS (L1, L2, L3C)
PROGRAM ASSESSMENTS:	MANUFACTURING TECHNOLOGIES WORKPLACE READINESS SKILLS
CTSO:	SKILLSUSA
GRADE LEVEL:	9-12
AVAILABLE INDUSTRY CERTIFICATIONS/LICENSES PROVIDERS:	OHSA 10-HOUR / OHSA MT-1 / MANUFACTURING SKILLS INSTITUTE

PROGRAM PURPOSE

The purpose of this program is to prepare students for postsecondary education and employment in the Manufacturing Technologies industry.

The program includes the following state standards:

- Nevada CTE Skill Standards: Manufacturing Technologies
- Employability Skills for Career Readiness
- Nevada Academic Content Standards (alignment shown in the Nevada CTE Skill Standards):
 - Science (based on the Next Generation Science Standards)
 - English Language Arts (based on the Common Core State Standards)
 - Mathematics (based on the Common Core State Standards)
- Common Career Technical Core (alignment shown in the Nevada CTE Skill Standards)

CAREER CLUSTERS

The National Career Clusters™ Framework provides a vital structure for organizing and delivering quality CTE programs through learning and comprehensive programs of study (POS). In total, there are 16 Career Clusters in the National Career Clusters™ Framework, representing more than 79 Career Pathways to help students navigate their way to greater success in college and career. As an organizing tool for curriculum design and instruction, Career Clusters™ provide the essential knowledge and skills for the 16 Career Clusters™ and their Career Pathways.*

*Cite: National Association of State Directors of Career Technical Education Consortium. (2012). Retrieved from <http://www.careertech.org/career-clusters/glance/careerclusters.html>

PROGRAM OF STUDY

The program of study illustrates the sequence of academic and career and technical education coursework that is necessary for the student to successfully transition into postsecondary educational opportunities and employment in their chosen career path. (NAC 389.803)

PROGRAM STRUCTURE

The core course sequencing provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. Complete program sequences are essential for the successful delivery of all state standards in each program area.

MANUFACTURING TECHNOLOGIES Core Course Sequence	
MANUFACTURING TECHNOLOGIES	LEVEL
Manufacturing Technologies I	L1
Manufacturing Technologies II	L2
Manufacturing Technologies III	L3C

The core course sequencing with the complementary courses provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. A program does not have to utilize all of the complementary courses in order for their students to complete their program of study. Complete program sequences are essential for the successful delivery of all state standards in each program area.

MANUFACTURING TECHNOLOGIES Core Course Sequence with Complementary Courses	
MANUFACTURING TECHNOLOGIES	LEVEL
Manufacturing Technologies I	L1
Manufacturing Technologies II	L2
Manufacturing Technologies II LAB*	L2L
Manufacturing Technologies III	L3C
Manufacturing Technologies III LAB*	L3L
Manufacturing Technologies Advanced Studies*	AS

*Complementary Courses

STATE SKILL STANDARDS

The state skill standards are designed to clearly state what the student should know and be able to do upon completion of an advanced high school career and technical education (CTE) program. The standards are designed for the student to complete all standards through their completion of a program of study. The standards are designed to prepare the student for the end-of-program technical assessment directly aligned to the standards. (Paragraph (a) of Subsection 1 of NAC 389.800)

EMPLOYABILITY SKILLS FOR CAREER READINESS STANDARDS

Employability skills, often referred to as “soft skills”, have for many years been a recognizable component of the standards and curriculum in career and technical education programs. The twenty-one standards are organized into three areas: (1) Personal Qualities and People Skills; (2) Professional Knowledge and Skills; and (3) Technology Knowledge and Skills. The standards are designed to ensure students graduate high school properly prepared with skills employers prioritize as the most important. Instruction on all twenty-one standards must be part of each course of the CTE program. (Paragraph (d) of Subsection 1 of NAC 389.800)

CURRICULUM FRAMEWORK

The Nevada CTE Curriculum Frameworks are organized utilizing the recommended course sequencing listed in the Program of Study and the CTE Course Catalog. The framework identifies the recommended content standards, performance standards, and performance indicators that should be taught in each course.

CAREER AND TECHNICAL STUDENT ORGANIZATIONS (CTSOS)

To further the development of leadership and technical skills, students must have opportunities to participate in one or more of the Career and Technical Student Organizations (CTSOS). CTSOs develop character, citizenship, and the technical, leadership and teamwork skills essential for the workforce and their further education. Their activities are considered a part of the instructional day when they are directly related to the competencies and objectives in the course. (Paragraph (a) of Subsection 3 of NAC 389.800)

WORKPLACE READINESS SKILLS ASSESSMENT

The Workplace Readiness Skills Assessment has been developed to align with the Nevada CTE Employability Skills for Career Readiness Standards. This assessment provides a measurement of student employability skills attainment. Students who complete a program will be assessed on their skill attainment during the completion level course. Completion level courses are identified by the letter “C”. (e.g., Level = L3C) (Paragraph (d) of Subsection 1 of NAC 389.800)

END-OF-PROGRAM TECHNICAL ASSESSMENT

An end-of-program technical assessment has been developed to align with the Nevada CTE Skill Standards for this program. This assessment provides a measurement of student technical skill attainment. Students who complete a program will be assessed on their skill attainment during the completion level course. Completion level courses are identified by the letter “C”. (e.g., Level = L3C) (Paragraph (e) of Subsection 1 of NAC 389.800)

CERTIFICATE OF SKILL ATTAINMENT

Each student who completes a course of study must be awarded a certificate which states that they have attained specific skills in the industry being studied and meets the following criteria: A student must maintain a 3.0 grade point average in their approved course of study, pass the Workplace Readiness Skills Assessment, and pass the end-of-program technical assessment. (Subsection 4 of NAC 389.800)

CTE ENDORSEMENT ON A HIGH SCHOOL DIPLOMA

A student qualifies for a CTE endorsement on their high school diploma after successfully completing the following criteria: 1) successful completion of a CTE course of study in a program area, 2) successful completion of academic requirements governing receipt of a standard diploma, and 3) meet all requirements for the issuance of the Certificate of Skill Attainment. (NAC 389.815)

CTE COLLEGE CREDIT

CTE College Credit is awarded to students based on articulation agreements established by each college for the CTE program, where the colleges will determine the credit value of a full high school CTE program based on course alignment. An articulation agreement will be established for each CTE program designating the number of articulated credits each college will award to students who complete the program.

CTE College Credit is awarded to students who: (1) complete the CTE course sequence with a grade-point average of 3.0 or higher; (2) pass the state end-of-program technical assessment for the program; and (3) pass the Workplace Readiness Assessment for employability skills.

Pre-existing articulation agreements will be recognized until new agreements are established according to current state policy and the criteria shown above.

Please refer to the local high school's course catalog or contact the local high school counselor for more information. (Paragraph (b) of Subsection 3 of NAC 389.800)

ACADEMIC CREDIT FOR CTE COURSEWORK

Career and technical education courses meet the credit requirements for high school graduation (1 unit of arts and humanities or career and technical education). Some career and technical education courses meet academic credit for high school graduation. Please refer to the local high school's course catalog or contact the local high school counselor for more information. (NAC 389.672)

**CORE COURSE:
RECOMMENDED STUDENT PERFORMANCE STANDARDS**

COURSE TITLE:	Manufacturing Technologies I
ABBR. NAME:	MANUF TECH I
CREDITS:	1
LEVEL:	L1
CIP CODE:	15.0613
PREREQUISITE:	None
CTSO:	SkillsUSA
COURSE DESCRIPTION	
<p>This course introduces students to the fundamentals of manufacturing technologies. Areas of emphasis include lab safety, print reading, measuring techniques, power systems, basic mechanical systems, and basic electricity. Students will gain experience in technical processes associated with metal, wood, and composites.</p>	

TECHNICAL STANDARDS

CONTENT STANDARD 1.0 : IDENTIFY LAB ORGANIZATION AND SAFETY PROCEDURES

Performance Standard 1.1 : Demonstrate General Lab Safety Rules and Procedures

Performance Indicators : 1.1.1-1.1.19

Performance Standard 1.2 : Identify and Utilize Hand Tools

Performance Indicators : 1.2.1-1.2.5

Performance Standard 1.3 : Identify and Utilize Power Tools and Equipment

Performance Indicators : 1.3.1-1.3.5

CONTENT STANDARD 3.0 : APPLY FUNDAMENTAL ENGINEERING SKILLS

Performance Standard 3.1 : Demonstrate Print Reading Practices

Performance Indicators : 3.1.1-3.1.4

Performance Standard 3.2 : Utilize Mathematical Operations and Measuring Techniques

Performance Indicators : 3.2.1-3.2.3

Performance Standard 3.3 : Demonstrate Spatial Reasoning and 3D Modeling Techniques

Performance Indicators : 3.3.4

CONTENT STANDARD 4.0 : APPLY FUNDAMENTAL POWER SYSTEM PRINCIPLES

Performance Standard 4.1 : Identify Power Systems

Performance Indicators : 4.1.5-4.1.6

Performance Standard 4.2 : Identify and Utilize Basic Mechanical Systems

Performance Indicators : 4.2.1-4.2.4

Performance Standard 4.3 : Identify and Utilize Basic Electrical Systems

Performance Indicators : 4.3.1-4.3.2, 4.3.4

CONTENT STANDARD 6.0 : APPLY FUNDAMENTAL ELECTRONIC AND INSTRUMENTATION PRINCIPLES

Performance Standard 6.1 : Demonstrate Analog and Digital Electronic Principles

Performance Indicators : 6.1.1

Performance Standard 6.3 : Demonstrate Diagnostic and Troubleshooting Practices

Performance Indicators : 6.3.4-6.3.5

EMPLOYABILITY SKILLS FOR CAREER READINESS STANDARDS**CONTENT STANDARD 1.0 : DEMONSTRATE EMPLOYABILITY SKILLS FOR CAREER READINESS**

Performance Standard 1.1 : Demonstrate Personal Qualities and People Skills

Performance Indicators : 1.1.1-1.1.7

Performance Standard 1.2 : Demonstrate Professional Knowledge and Skills

Performance Indicators : 1.2.1-1.2.10

Performance Standard 1.3 : Demonstrate Technology Knowledge and Skills

Performance Indicators : 1.3.1-1.3.4

ALIGNMENT TO THE NEVADA ACADEMIC CONTENT STANDARDS*

English Language Arts: Reading Standards for Literacy in Science and Technical Subjects
Writing Standards for Literacy in Science and Technical Subjects
Speaking and Listening

Mathematics: Mathematical Practices

* Refer to the Manufacturing Technologies Standards for alignment by performance indicator

**CORE COURSE:
RECOMMENDED STUDENT PERFORMANCE STANDARDS**

COURSE TITLE:	Manufacturing Technologies II
ABBR. NAME:	MANUF TECH II
CREDITS:	1
LEVEL:	L2
CIP CODE:	15.0613
PREREQUISITE:	Manufacturing Technologies I
CTSO:	SkillsUSA

COURSE DESCRIPTION

This course is a continuation of Manufacturing Technologies I. This course provides intermediate manufacturing technologies students the ability to further their skills and knowledge levels. Areas of emphasis include spatial reasoning, 3D modeling, additive/subtractive manufacturing processes, joining/fastening processes, and basic instrumentation principles. The appropriate use of technology and industry-standard equipment is an integral part of this course.

TECHNICAL STANDARDS**CONTENT STANDARD 2.0 : ANALYZE PROFESSIONAL PRACTICES**

Performance Standard 2.2 : Investigate Career Opportunities

Performance Indicators : 2.2.1-2.2.4

CONTENT STANDARD 3.0 : APPLY FUNDAMENTAL ENGINEERING SKILLS

Performance Standard 3.1 : Demonstrate Print Reading Practices

Performance Indicators : 3.1.5

Performance Standard 3.2 : Utilize Mathematical Operations and Measuring Techniques

Performance Indicators : 3.2.4-3.2.5

Performance Standard 3.3 : Demonstrate Spatial Reasoning and 3D Modeling Techniques

Performance Indicators : 3.3.1-3.3.3, 3.3.5

Performance Standard 3.4 : Utilize Manufacturing Communication Tools

Performance Indicators : 3.4.1, 3.4.3

CONTENT STANDARD 4.0 : APPLY FUNDAMENTAL POWER SYSTEM PRINCIPLES

Performance Standard 4.3 : Identify and Utilize Basic Electrical Systems

Performance Indicators : 4.3.3, 4.3.5-4.3.8

CONTENT STANDARD 5.0 : IDENTIFY AND APPLY MANUFACTURING PROCESSES

Performance Standard 5.1 : Identify Basic Manufacturing Systems

Performance Indicators : 5.1.3-5.1.4

Performance Standard 5.3 : Apply Additive Manufacturing Processes

Performance Indicators : 5.3.1, 5.3.3-5.3.4

Performance Standard 5.4 : Demonstrate Subtractive Manufacturing Processes

Performance Indicators : 5.4.1-5.4.5, 5.4.7, 5.4.9-5.4.10

Performance Standard 5.5 : Utilize Joining and Fastening Manufacturing Processes

Performance Indicators : 5.5.1-5.5.9

Performance Standard 5.6 : Research Business Operations and Quality Control

Performance Indicators : 5.6.6

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CONTENT STANDARD 6.0 : APPLY FUNDAMENTAL ELECTRONIC AND INSTRUMENTATION PRINCIPLES

Performance Standard 6.1 : Demonstrate Analog and Digital Electronic Principles

Performance Indicators : 6.1.2-6.1.12

Performance Standard 6.2 : Demonstrate Control Technology And Automation Principles

Performance Indicators : 6.2.1-6.2.3, 6.2.10-6.2.15

Performance Standard 6.3 : Demonstrate Diagnostic and Troubleshooting Practices

Performance Indicators : 6.3.1-6.3.3, 6.3.9-6.3.10

EMPLOYABILITY SKILLS FOR CAREER READINESS STANDARDS**CONTENT STANDARD 1.0 : DEMONSTRATE EMPLOYABILITY SKILLS FOR CAREER READINESS**

Performance Standard 1.1 : Demonstrate Personal Qualities and People Skills

Performance Indicators : 1.1.1-1.1.7

Performance Standard 1.2 : Demonstrate Professional Knowledge and Skills

Performance Indicators : 1.2.1-1.2.10

Performance Standard 1.3 : Demonstrate Technology Knowledge and Skills

Performance Indicators : 1.3.1-1.3.4

ALIGNMENT TO THE NEVADA ACADEMIC CONTENT STANDARDS*

English Language Arts: Reading Standards for Literacy in Science and Technical Subjects
Writing Standards for Literacy in Science and Technical Subjects
Speaking and Listening

Mathematics: Mathematical Practices
Algebra-Creating Equations
Algebra-Reasoning with Equations and Inequalities
Functions-Linear, Quadratic, and Exponential Models

* Refer to the Manufacturing Technologies Standards for alignment by performance indicator

**CORE COURSE:
RECOMMENDED STUDENT PERFORMANCE STANDARDS**

COURSE TITLE:	Manufacturing Technologies III
ABBR. NAME:	MANUF TECH III
CREDITS:	1
LEVEL:	L3C
CIP CODE:	15.0613
PREREQUISITE:	Manufacturing Technologies II
PROGRAM ASSESSMENTS:	MANUFACTURING TECHNOLOGIES WORKPLACE READINESS SKILLS
CTSO:	SkillsUSA
COURSE DESCRIPTION	
<p>This course is a continuation of Manufacturing Technologies II. This course provides advanced manufacturing technologies students the ability to further their skills and knowledge levels. Areas of emphasis include product development, marketing, quality control, automation, and diagnostic/troubleshooting practices. The appropriate use of technology and industry-standard equipment is an integral part of this course. Upon successful completion of this course, students will have acquired entry-level skills for employment and be prepared for postsecondary education.</p>	

TECHNICAL STANDARDS

CONTENT STANDARD 2.0 : ANALYZE PROFESSIONAL PRACTICES

Performance Standard 2.1 : Research the History of Manufacturing

Performance Indicators : 2.1.1-2.1.4

Performance Standard 2.3 : Analyze Ethical Professional Practices

Performance Indicators : 2.3.1-2.3.3

CONTENT STANDARD 3.0 : APPLY FUNDAMENTAL ENGINEERING SKILLS

Performance Standard 3.4 : Utilize Manufacturing Communication Tools

Performance Indicators : 3.4.2

CONTENT STANDARD 4.0 : APPLY FUNDAMENTAL POWER SYSTEM PRINCIPLES

Performance Standard 4.1 : Identify Power Systems

Performance Indicators : 4.1.1-4.1.4, 4.1.7-4.1.8

Performance Standard 4.4 : Identify and Utilize Basic Fluid Systems

Performance Indicators : 4.4.1-4.4.9

CONTENT STANDARD 5.0 : IDENTIFY AND APPLY MANUFACTURING PROCESSES

Performance Standard 5.1 : Identify Basic Manufacturing Systems

Performance Indicators : 5.1.1-5.1.2

Performance Standard 5.2 : Identify Material Properties and Science

Performance Indicators : 5.2.1-5.2.6

Performance Standard 5.3 : Apply Additive Manufacturing Processes

Performance Indicators : 5.3.2, 5.3.5

Performance Standard 5.4 : Demonstrate Subtractive Manufacturing Processes

Performance Indicators : 5.4.6, 5.4.8

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Performance Standard 5.6 : Research Business Operations and Quality Control

Performance Indicators : 5.6.1-5.6.5, 5.6.7-5.6.8

CONTENT STANDARD 6.0 : APPLY FUNDAMENTAL ELECTRONIC AND INSTRUMENTATION PRINCIPLES

Performance Standard 6.1 : Demonstrate Analog and Digital Electronic Principles

Performance Indicators : 6.1.13

Performance Standard 6.2 : Demonstrate Control Technology And Automation Principles

Performance Indicators : 6.2.4-6.2.9

Performance Standard 6.3 : Demonstrate Diagnostic and Troubleshooting Practices

Performance Indicators : 6.3.6-6.3.8

EMPLOYABILITY SKILLS FOR CAREER READINESS STANDARDS

CONTENT STANDARD 1.0 : DEMONSTRATE EMPLOYABILITY SKILLS FOR CAREER READINESS

Performance Standard 1.1 : Demonstrate Personal Qualities and People Skills

Performance Indicators : 1.1.1-1.1.7

Performance Standard 1.2 : Demonstrate Professional Knowledge and Skills

Performance Indicators : 1.2.1-1.2.10

Performance Standard 1.3 : Demonstrate Technology Knowledge and Skills

Performance Indicators : 1.3.1-1.3.4

ALIGNMENT TO THE NEVADA ACADEMIC CONTENT STANDARDS*

English Language Arts: Reading Standards for Literacy in Science and Technical Subjects
Writing Standards for Literacy in Science and Technical Subjects
Speaking and Listening

Mathematics: Mathematical Practices

* Refer to the Manufacturing Technologies Standards for alignment by performance indicator

COMPLEMENTARY COURSE(S):

Programs that utilize the complementary courses can include the following courses. The Advanced Studies course allows for additional study through investigation and in-depth research.

COURSE TITLE:	Manufacturing Technologies Advanced Studies
ABBR. NAME:	MANUF TECH AS
CREDITS:	1
LEVEL:	AS
CIP CODE:	15.0613
PREREQUISITE:	Manufacturing Technologies III
CTSO:	SkillsUSA
COURSE DESCRIPTION	
<p>This course is offered to students who have achieved all content standards in a program whose desire is to pursue advanced study through investigation and in-depth research. Students are expected to work independently or in a team and consult with their supervising teacher for guidance. The supervising teacher will give directions, monitor, and evaluate the students' topic of study. Coursework may include various work-based learning experiences such as internships and job shadowing, involvement in a school-based enterprise, completion of a capstone project, and/or portfolio development. This course may be repeated for additional instruction and credit.</p>	

TECHNICAL STANDARDS

Students have achieved all program content standards and will pursue advanced study through investigation and in-depth research.

EMPLOYABILITY SKILLS FOR CAREER READINESS STANDARDS

Students have achieved all program content standards and will pursue advanced study through investigation and in-depth research.

SAMPLE TOPICS

- Participate in individual/team competitions
- Participation in an internship or job shadowing opportunities
- Explore college and career opportunities
- Complete a capstone project

**COMPLEMENTARY COURSE(S):
RECOMMENDED STUDENT PERFORMANCE STANDARDS**

Programs that utilize the complementary courses can include the following courses. The lab courses allow additional time to be utilized in developing the processes, concepts, and principles as described in the classroom instruction. The standards and performance indicators for each lab course are shown in the corresponding course listed in the previous section.

COURSE TITLE:	Manufacturing Technologies II LAB
ABBR. NAME:	MANUF TECH II L
CREDITS:	1
LEVEL:	L2L
CIP CODE:	15.0613
PREREQUISITE:	Concurrent enrollment in Manufacturing Technologies II
CTSO:	SkillsUSA
COURSE DESCRIPTION	
This course is designed to expand the students' opportunities for applied learning. This course provides an in-depth lab experience that applies the processes, concepts, and principles as described in the classroom instruction. The coursework will encourage students to explore and develop advanced skills in their program area. The appropriate use of technology and industry-standard equipment is an integral part of this course.	

COURSE TITLE:	Manufacturing Technologies III LAB
ABBR. NAME:	MANUF TECH III L
CREDITS:	1
LEVEL:	L3L
CIP CODE:	15.0613
PREREQUISITE:	Concurrent enrollment in Manufacturing Technologies III
CTSO:	SkillsUSA
COURSE DESCRIPTION	
This course is designed to expand the students' opportunities for applied learning. This course provides an in-depth lab experience that applies the processes, concepts, and principles as described in the classroom instruction. The coursework will encourage students to explore and develop advanced skills in their program area. The appropriate use of technology and industry-standard equipment is an integral part of this course.	