STRANDS AND STANDARDS
MECHANICAL DESIGN & ENGINEERING 3

Learning that works for Utah
CTE®

Course Description

The third in a sequence of courses that prepares individuals with an emphasis in developing technical knowledge and skills to develop working drawings in support of mechanical and industrial engineers, and related professionals. This includes instruction in the use of 3D Computer-Aided Design (CAD) software, threads & fasteners, welding symbols, geometric dimensioning & tolerancing, and assemblies.

Intended Grade Level	10-12
Units of Credit	0.5
Core Code	38.01.00.00.043
Concurrent Enrollment Core Code	38.01.00.13.043
Prerequisite	Mechanical Design & Engineering 2
Skill Certification Test Number	663
Skill Certification Cut Score	**74%**
Test Weight	0.5
License Area of Concentration	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Technology & Engineering
Endorsement 2	CAD Mechanical Design

STRAND 1

Portfolio and Resume

Standard 1

A student's notebook/portfolio records:

- the chronological account of all projects
- research and citations
- notes
- sketches
- test procedures and resulting data.

Standard 2

Resume and Cover Letter

Performance Skill

Create and maintain a digital Portfolio of work (hard copy can be used if necessary).
Create a digital Resume and Cover Letter with professional formatting (hard copy can be used if necessary).

STRAND 2

Fasteners

Standard 1

Define thread terminology.

- Major Diameter
- Minor Diameter
- Pitch Diameter
- Root
- Flank Angle
- Pitch
- Angle
- Crest
- Flank

Standard 2

Identify the following thread types.

1. Unified
2. Acme
3. Pipe
4. Square

Standard 3

Know the common uses of the thread types in Strand 2 Standard 2

Standard 4

Calculate thread pitch.

- TP = L/n
  - TP = Thread Pitch
  - L = Length of thread
  - n = Number of threads

Standard 5

Understand thread callout notes.

Standard 6

Draw screw threads using these three methods:

- Detailed
- Schematic
- Simplified

Standard 7

Compare common head types:

- Round
- Oval
- Pan
- Countersink
- Hex

Standard 8

Compare common drive types:

- Slotted
- Philips
- Square
- Hexagonal

Standard 9

Understand the hardness grading system:

- Metric
  a. Class 8.8
  b. Class 10.9
  c. Class 12.9
- SAE
  a. Grade 2
  b. Grade 5
  c. Grade 8

Performance Skill

Student can correctly place and label fasteners in their mechanical models and drawings.

STRAND 3

Welding Symbols

Standard 1

Understand, identify and specify welds on drawings.

1. Type
2. Size and length
3. Finish & contour
4. Field welds
5. Basic welding processes

Performance Skill

Student can correctly place a weld symbol on a mechanical drawing

STRAND 4

3D Printing

Standard 1

Successfully prepare a 3D printing strategy using slicing software.

1. File Types
   a. STL vs OBJ
   b. G-Code
2. Layer Height
3. Infill
4. Base Supports
   a. Raft
   b. Brim
   c. Skirt
5. Overhang Supports
   a. Breakaway
   b. Dissolvable

Standard 2

Identify each of the 3D printing materials and technologies.
FDM Fused Deposition Modeling (Filament)
SLA Stereolithography (Resin)

Standard 3

Understand commonly used 3D printing materials and their appropriate applications.
PLA
PETG
ABS
Filament
Resin
TPU

Standard 4

Identify the specific parts of a 3D printer.

1. Feeder
2. Extruder Assembly
3. Bed
   a. Heated
   b. Glass
   c. Flexible
4. X,Y, & Z Axes
5. Print Envelope
6. Spool/Reservoir
7. Control Board
8. Power Supply
9. Guide Tube

Performance Skill

A student will model, slice, and successfully print an object/prototype of their own design.

STRAND 5

Students will be able to demonstrate the ability to create a flat pattern development.

Standard 1

Understand and calculate bend allowance.

Performance Skill

Create a flat pattern development of a simple part to be made from sheet metal.

STRAND 6

Students will create assembly and working drawings.

Standard 1

Develop a set of working drawings of six or more parts of industry assembled parts.

1. Draw all necessary views of each part.
2. Draw only one part per sheet.
3. Dimension parts as per current ASME/ANSI standards.
4. Apply appropriate tolerances.
5. Apply necessary notes, material specifications, symbols, and other data.
6. Complete a parts list of the parts, which include, parts number, manufacturer's name, manufacturer's stock number, material specs, quantity of each part, and notes for assembly.
7. Complete an assembly drawing showing the relationship of the parts to each other.
8. Analyze center of mass, surface area, and volume of an assembly.
9. Include title block and border on each production drawing sheet.

Performance Skill

A student can create parts and assembly drawings. They can analyze the center of mass, surface area, and volume.

Skill Certification Test Points by Strand

Test Name	Test #	Number of Test Points by Strand										Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10		
Mechanical Design & Engineering 3	663	2	11	6	7	3	15					44	34