Why Manufacturing As A Career?

What is Manufacturing?

How about jobs?

How Does Machine Technology and Manufacturing at Fullerton College support this Career?

What is Manufacturing?

- What do you think a career in the manufacturing industry entails?
  - If you said anything from machining to welding to assembly to fabrication to computer programming and sales, you're right. Everything we touch or use today is manufactured as a result of a machining method.
  - Some manufacturing jobs require certifications and some require degrees, but **all are equally important** to the sector.
- We here at Fullerton Community College Machine Shop have been dedicated to developing student knowledge and skill sets in a number of areas in Manufacturing for a number of years.

https://youtu.be/wk4SjFWD6tg?t=178

https://youtu.be/wk4SjFWD6tg

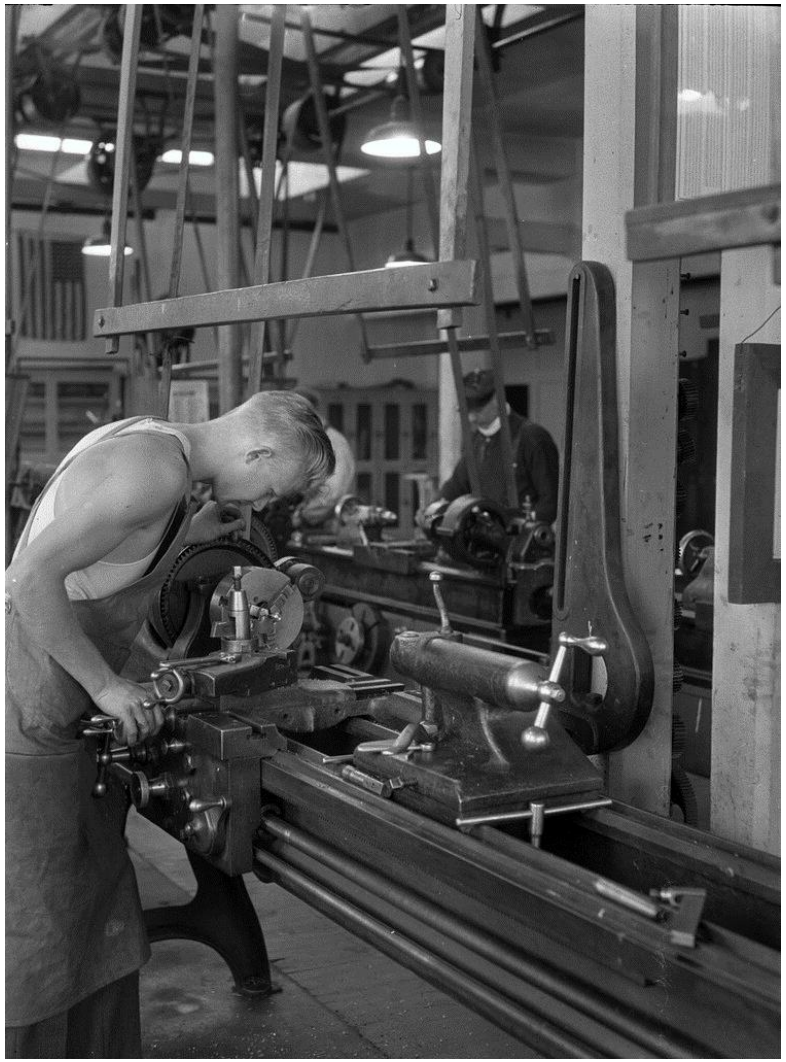
Machine Technology Then and Now

Machine Shop at Fullerton College-circa 1930-39

Machine Shop at Fullerton College-circa 2016

Machine Technology Then and Now

Machine Shop at Fullerton College-circa 1932



Machine Shop at Fullerton College-circa 2016

Machine Technology Then and Now

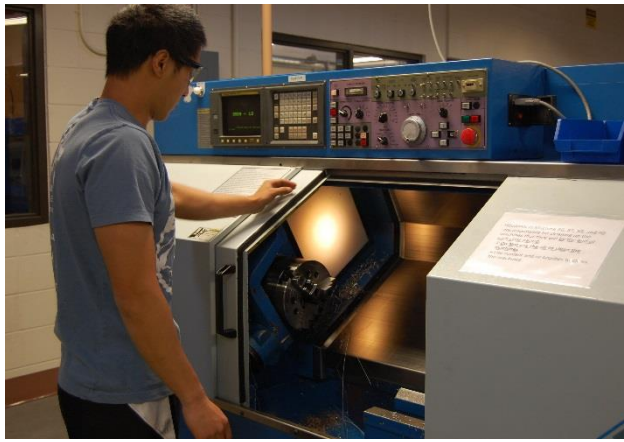
Machine Shop at Fullerton College-circa 1933

Machine Shop at Fullerton College-circa 2016

Machine Technology Then and Now

Machine Shop at Fullerton College-circa 1930-39

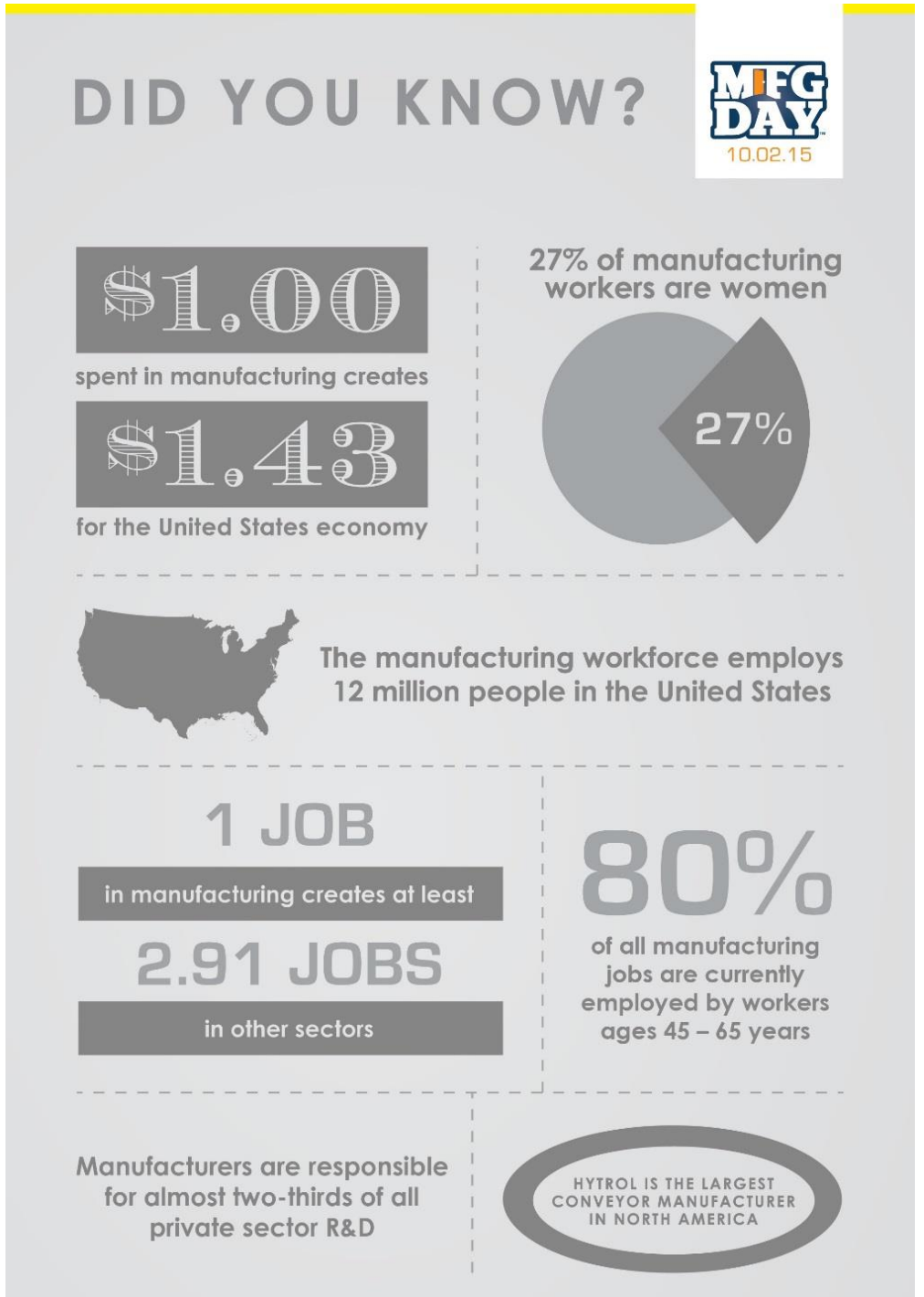
Machine Shop at Fullerton College-circa 2016



Did you Know?

Types of Jobs that our graduates have gone into:

- Machinist
- CNC Set-Up and Operator
- CNC Programmer
- Entry level Tool maker
- Entry level Die maker
- Entry level Mold maker
- QA/QC or Mfg. Inspector
- Entry level R&D Machinist
- Precision Grinder
- Lathe or Mill Operator
- Machine Set-Up Technician
- Fabrication Technician
- Other jobs that are related
  - Production Supervisor
  - Assembly/Production Technician
  - Mfg. Engineer
  - Production Planner



Information provide by the National Association of Manufacturers (NAM)

Did you Know?

- In 2013, the **average manufacturing worker earned around $77,000 annually including benefits**. That pay is $15,000 more than the average of all industries.
- Put simply, the United States economy relies on this sector. There are 17.6 million jobs in manufacturing in the United States; that's **1 of every 6 private sector jobs**. This isn't a run-of-the-mill career to be taken lightly—it's the foundation of economic stability and the ninth largest economy in the world.
- The median annual Machinist I salary in Fullerton area is $43,721 as of February 22, 2016. (Salary.com)

How Does Fullerton College Support Manufacturing?

- Machine and Manufacturing Technology-Building 900 Rm 905
  - Students are eligible to receive any of our five certificates after successfully completing the specified courses for each. We also offer an A.S. Degree in Manufacturing Technology with Machining as an area of specialization.
    - CNC Operator-Certificate
    - CNC -Certificate
    - Machine Technology Level II-Certificate
    - Master CAM-Certificate
    - Surf CAM-Certificate
    - Manufacturing Technology-A.S. Degree

Quick Facts

- We currently operate Monday through Saturday, with up to 20 students enrolled in each of our classes.
- We have a entry level 12 unit program which consists of our beginning machining (MACH 91 and 116), CNC Set Up and Operation (MACH 086), CNC Parts Programming (MACH 087), and our Advanced CNC Set Up and Operation (MACH 088) classes.
- The Machine Tool - Level II and CNC Certificates are earned when additional units are completed in more advanced courses.

Quick Facts

- Our extended day program runs from 6-10PM M-Th. Each extended day class has an average enrollment of 20 students. Class size varies depending on the topic being taught.
- We teach courses in conventional machining techniques, CNC machine set up and operation, manual programming for CNC machines (3, 4 and 5 axis), beginning and advanced levels of computer assisted parts programming using SurfCAM, and Mastercam.
- We also provide instruction in CAD using AutoCAD and Solidworks software, CAD/CAM, blueprint reading, geometric dimensioning and tolerancing (ANSI Y14.5), technical mathematics, metallurgy, and manufacturing processes.

Up Coming Programs and Courses

- Metrology/Inspection program/courses using up to date measuring tools and equipment such as a Coordinate Measuring Machine and Romer Arms. – coming Fall 2018.
  - Introduction to Metrology- Mach 180
  - Introduction to CMM and Romer Arms Inspection- Mach 182
  - Advanced CMM and Romer Arm Inspection-Mach 184
  - Inspection Applications Using Inspection Software– Mach 185

Machine Technology

- Location: 900 building (room/lab 903; 904; 905)
- Instructors
  - Dan O'Brien (**DObrien@fullcoll.edu**)
  - George Bonnand (**gbonnand@fullcoll.edu**)
    - 6 adjunct instructors
- Website: http://machine.fullcoll.edu/
- See also our Quarterly Newsletter

Courses to start with for a Degree or Certificate

- Machine 91 – Introduction to Machine Technology – 5 units
- Machine 116-Machine Technology-2 units-overview class
- Machine 086-3 units-CNC Set-Up and Operation

Note: Not all certificates are listed

MANUFACTURING TECHNOLOGY

Manufacturing Technology Associate in Science Degree

PROGRAM CODE: 2S03842

Curriculum leads to the **Associate in Science Degree**. The Manufacturing Technology Major incorporates courses from a number of departments within the Technology and Engineering Division. A student pursuing the Manufacturing Technology Major must take core courses from all of these departments in addition to a concentration in one or more of the major areas. The areas of concentration are: Drafting, Machine Technology, and Welding. Requires 24 units from courses listed.

Program Level Student Learning Outcomes

Outcome 1: *Demonstrate welding on 16-gage steel with inert gas welding equipment.*

Outcome 2: *Develop manufacturing procedure for metal sub-assemblies.*

Required Courses: (9 units)		**Units**
DRAF 171 F	Fundamentals of Drafting	2
MACH 116 F	Machine Tools	2
TECH 108 F	Manufacturing Processes	3
WELD 121AF	Introduction to Welding	2

Additional (15 units)	**Units**
Drafting Courses — Any drafting courses	
Machine Technology Courses — Any machine technology course	
Welding Courses — Any welding courses except WELD 095 F Welding Skills Lab.	
Technology-Related Courses —	
METL 192 F Fundamentals of Metallurgy (3)	
TECH 127 F Industrial Safety (1)	
Total Units	**24**

CNC Operator Skills Certificate

PROGRAM CODE: 2C00060

The **CNC Operator Certificate** Program requires a total of 14 units of which 14 units are in required courses with a minimum grade of "C" in each course taken. At least one-half of the units toward the certificate must be completed at Fullerton College. The goal of this certificate is to prepare students for entry-level employment as CNC (Computer Numerical Control) machine tool operators and to enhance the skills of machinists who are currently employed in the trade.

Program Level Student Learning Outcomes

Outcome 1: *Demonstrate the ability to set fixture offsets, tool length offsets, geometry and wear offsets to manufacture parts to blueprint specifications.*

Outcome 2: *Organize cutting tools, set-up documentation and numerical control programs to successfully set-up computer numerical controlled machinery.*

Required courses (14 units)		**Units**
MACH 091 F	Introduction to Machine Tools	5
MACH 086 F	CNC Machine Set-up & Operation	3
MACH 087 F	CNC Parts Programming	3
MACH 088 F	Advanced CNC Machining	3
Total Units		**14**

Machine Technology Level II Certificate

PROGRAM CODE: 2C10624

The **Machine Technology — Level II Certificate** Program requires the completion of 31-34 units of which 22-25 units are in required courses. An additional 9 units must be chosen from the restricted electives listed below. A minimum grade of "C" is required in each course taken. At least one half of the units toward the certificate must be completed at Fullerton College.

Program Level Student Learning Outcomes

Outcome 1: *Demonstrate basic procedures for the set-up and operation of engine lathes, milling machines, surface grinders and support equipment.*

Outcome 2: *Determine operational sequences, selection of machine tools, work-holding devices and cutting tools.*

Required Courses (22-25 units)		**Units**
DRAF 070 F	Blueprint Reading for the Metal Trades	2
DRAF 173 F	Geometric Dimensioning and Tolerancing	2
MACH 086 F	CNC Machine Set-up & Operation	3
MACH 091 F	Introduction to Machine Tools ***or***	5
MACH 116 F	Machine Tools	2
MACH 092 F	Intermediate Machine Tools	5
MACH 093 F	Advanced Machine Tools	5
TECH 081 F	Technical Mathematics I	3

Computer Numerical Control (CNC) Certificate

PROGRAM CODE: 2C08416

The **Computer Numerical Control (CNC) Certificate Program** requires the completion of 41-44 units of which 32-35 units are in required courses. An additional 9 units must be chosen from the restricted electives listed below. A minimum grade of "C" is required in each course taken. At least one half of the units toward the certificate must be completed at Fullerton College.

Program Level Student Learning Outcomes

Outcome 1: *Design and create work-holding devices to manufacture parts on computer numerical controlled milling and turning machines.*

Outcome 2: *Prepare CNC programs from blueprints for machines with four and five axis of control.*

Required Courses (32-35 units)		**Units**
DRAF 070 F	Blueprint Reading for the Metal Trades	2
DRAF 140 F	AutoCAD for Industry	2
DRAF 173 F	Geometric Dimensioning and Tolerancing	2
MACH 050 F	CNC Programming Using Mastercam	3
MACH 060 F	CNC Programming Using SURFCAM	3
MACH 052 F	Adv CNC Program w/ Mastercam ***or***	3
MACH 062 F	Advanced CNC Programming Using SURFCAM	3
MACH 086 F	CNC Machine Set-up & Operation	3
MACH 087 F	CNC Parts Programming	3
MACH 091 F	Introduction to Machine Tools ***or***	5
MACH 116 F	Machine Tools	2
METL 192 F	Fundamentals of Metallurgy	3
TECH 081 F	Technical Mathematics I	3
TECH 108 F	Manufacturing Processes	3

Sequence of Courses

- All courses are offered every semester depending on enrollment.
- If a course is not offered for any reason during one semester it will generally be offered the next semester.
- Hence students can start either in the Fall or Spring (classes are typically not offered during the Summer).

Sequence of Courses-Full time

- To be successful in the Manufacturing Technology and Machine Technology program the following sequence would be suggested:

For Full time students

- Start- Fall or Spring -1st Semester
  - Machine 91-5 units-Intro to Machine Tools (or Machine 116)
  - DRAF 70-2 units-Blueprint Reading
  - Tech 81-3 units-Technical Math
  - Machine 086-3 units-CNC Machine set-up and Operation
- 2nd Semester
  - Machine 92-5 units-Intermediate Machine Tools
  - Machine 087-3 units-CNC Parts Programming
  - DRAF 173-2 units-Geometric Dimensioning and Tolerancing
  - Tech 108-3 units-Manufacturing Processes
  - Machine 50-3 units-CNC Programming using Mastercam

Sequence of Courses –Full Time (continue)

- 3rd Semester
  - Machine 93-5 units-Advance Machine Tools
  - Machine 088-3 units-Advanced CNC Machining
  - METL 192-3 units-Fundamentals of Metallurgy
  - Machine 60-3 units-CNC Programming using Surfcam
  - DRAF 171- 2 units-Fundamentals of Drafting
- 4th Semester
  - Machine 52-3 units-Advanced CNC using MasterCam and/or Machine 62-3 units-Advanced CNC using Surfcam
  - DRAF 140-2 units-AutoCAD for Industry
  - Welding 121A-2 units-Introduction to Welding
  - Tech 127-1 unit-Industrial Safety
  - DRAF 944-3 units-Solid Works or any class in Machine; Drafting; or Welding to supplement the Certificate or A.S. degree

Note:

1. Depending on work load of student and scheduling conflicts other classes may be taken concurrent to any semester (except for pre-requisites).
2. Classes above will qualify for several of the Machine Technology certificates and Mfg. Technology A.S. Degree.

Sequence of Courses-Alternative

For Part-Time Students- Assuming 20-40 hour work week

- 1st semester
  - Machine 91-5 units-Intro to Machine Tools (or Machine 116)
  - DRAF 70-2 units-Blueprint Reading
  -
- 2nd semester
  - Tech 81-3 units-Technical Math
  - Machine 086-3 units-CNC Machine set-up and Operation
- 3rd semester
  - Machine 92-5 units-Intermediate Machine Tools
  - Machine 087-3 units-CNC Parts Programming
- 4th semester
  - DRAF 173-2 units-Geometric Dimensioning and Tolerancing
  - Tech 108-3 units-Manufacturing Processes
  - Machine 50-3 units-CNC Programming using Mastercam

Sequence of Courses-Part Time-Assuming 20-40 hour work week

- 5th semester
  - Machine 93-5 units-Advance Machine Tools
  - Machine 088-3 units-Advanced CNC Machining
- 6th semester
  - METL 192-3 units-Fundamentals of Metallurgy
  - Machine 60-3 units-CNC Programming using Surfcam
  - DRAF 171- 2 units-Fundamentals of Drafting
- 7th semester
  - Machine 52-3 units-Advanced CNC using MasterCam and/or Machine 62-3 units-Advanced CNC using Surfcam
  - DRAF 140-2 units-AutoCAD for Industry
- 8th semester
  - Welding 121A-2 units-Introduction to Welding
  - Tech 127-1 unit-Industrial Safety
  - DRAF 944-3 units-Solid Works or any class in Machine; Drafting; or Welding to supplement the Certificate or A.S. degree
  - Welding 121B-2 units-Fundamentals of Inert Gas welding

Note:

1. Depending on work load of student and scheduling conflicts other classes may be taken concurrent to any semester (except for pre-requisites).
2. Classes above will qualify for several of the Machine Technology certificates and Mfg. Technology A.S. Degree.

Beginning to Advance courses

CNC Operator Skills Certificate

The **CNC Operator Skills Certificate** program requires a total of 14 units of which 14 units are in required courses with a minimum grade of "C" in each course taken. At least one-half of the units toward the certificate must be completed at Fullerton College.

Required Courses (14 units)	
MACH 86 CNC Machine Set-up and Operation (3)	MACH 88 Advanced CNC Machining (3)
MACH 87 CNC Parts Programming (3)	MACH 91 Introduction to Machine Tools (5)

Machine Technology - Level II Certificate

The **Machine Technology - Level II Certificate** Program requires the completion of 31-34 units of which 22-25 units are in required courses. An additional 9 units must be chosen from the restricted electives listed below. A minimum grade of "C" is required in each course taken. At least one half of the units toward the certificate must be completed at Fullerton College.

Required Courses (22-25 units)	**Restricted Electives (9 units)**
DRAF 70 Blueprint Reading for Metal Trades (2)	DRAF 171 Fundamentals of Drafting (2)
DRAF 173 Geometric Dimen. & Tolerancing (2)	MACH 10 Machine Skills Lab (1)
MACH 86 CNC Machine Set-up & Operation (3)	MACH 40 CNC Wire EDM Prog.& Operations (3)
MACH 91 Introduction to Machine Tools (5) **or**	MACH 88 Advanced CNC Machining (3)
MACH 116 Machine Tools (2)	METL 192 Fundamentals of Metallurgy (3)
MACH 92 Intermediate Machine Tools (5)	TECH 108 Manufacturing Processes (3)
MACH 93 Advanced Machine Tools (5)	TECH 127 Industrial Safety (1)
TECH 81 Technical Mathematics I (3)	WELD 121A Introduction to Welding (2)

Computer Numerical Control (CNC) Certificate

The **Computer Numerical Control (CNC) Certificate** Program requires the completion of 41-44 units of which 32-35 units are in required courses. An additional 9 units must be chosen from the restricted electives listed below. A minimum grade of "C" is required in each course taken. At least one half of the units toward the certificate must be completed at Fullerton College.

Required Courses (32-35 units)	**Restricted Electives (9 units)**
DRAF 70 Blueprint Reading for Metal Trades (2)	DRAF 145 CAD/CAM (2)
DRAF 140 AutoCAD for Industry (2)	MACH 40 CNC Wire EDM Programs & Operations (3)
DRAF 173 Geometric Dimen. & Tolerancing (2)	MACH 88 Adv. CNC Machining (3)
MACH 50 CNC Programming using Mastercam (3)	MACH 92 Intermediate Machine Tools (5)
MACH 60 CNC Programming using Surfcam (3)	TECH 88 Technical Science (3)
MACH 52 Advanced CNC Programming using Mastercam (3) **or**	TECH 127 Industrial Safety (1)
MACH 62 Advanced CNC Prog. using Surfcam (3)	WELD 121A Introduction to Welding (2)
MACH 86 CNC Machine Set-up & Operation (3)	
MACH 87 CNC Parts Programming (3)	
MACH 91 Introduction to Machine Tools (5) **or**	
MACH 116 Machine Tools (2)	
METL 192 Fundamentals of Metallurgy (3)	
TECH 81 Technical Mathematics I (3)	
TECH 108 Manufacturing Processes (3)	

Advanced courses and A.S. Mfg. Tech Degree

Machine Technology - Level II Certificate

The **Machine Technology - Level II Certificate** Program requires the completion of 31-34 units of which 22-25 units are in required courses. An additional 9 units must be chosen from the restricted electives listed below. A minimum grade of "C" is required in each course taken. At least one half of the units toward the certificate must be completed at Fullerton College.

Required Courses (22-25 units)	**Restricted Electives (9 units)**
DRAF 70 Blueprint Reading for Metal Trades (2)	DRAF 171 Fundamentals of Drafting (2)
DRAF 173 Geometric Dimen. & Tolerancing (2)	MACH 10 Machine Skills Lab (1)
MACH 86 CNC Machine Set-up & Operation (3)	MACH 40 CNC Wire EDM Prog.& Operations (3)
MACH 91 Introduction to Machine Tools (5) **or**	MACH 88 Advanced CNC Machining (3)
MACH 116 Machine Tools (2)	METL 192 Fundamentals of Metallurgy (3)
MACH 92 Intermediate Machine Tools (5)	TECH 108 Manufacturing Processes (3)
MACH 93 Advanced Machine Tools (5)	TECH 127 Industrial Safety (1)
TECH 81 Technical Mathematics I (3)	WELD 121A Introduction to Welding (2)

Mastercam Skills Certificate

The **Mastercam Skills Certificate** requires a total of 6 units. Both classes must be completed with a grade of "B" or better.

Required Courses (6 units)
MACH 50 CNC Programming using Mastercam (3)
MACH 52 Advanced CNC Programming using Mastercam (3)

Surfcam Skills Certificate

The **Surfcam Skills Certificate** requires a total of 6 units. Both classes must be completed with a grade of "B" or better.

Required Courses (6 units)
MACH 60 CNC Programming using Surfcam (3)
MACH 62 Advanced CNC Programming using Surfcam (3)

MANUFACTURING TECHNOLOGY

Manufacturing Technology
Associate in Science Degree

PROGRAM CODE: 2503842

Curriculum leads to the **Associate in Science Degree**. The Manufacturing Technology Major incorporates courses from a number of departments within the Technology and Engineering Division. A student pursuing the Manufacturing Technology Major must take core courses from all of these departments in addition to a concentration in one or more of the major areas. The areas of concentration are: Drafting, Machine Technology, and Welding. Requires 24 units from courses listed.

Program Level Student Learning Outcomes

Outcome 1: *Demonstrate welding on 16-gage steel with inert gas welding equipment.*

Outcome 2: *Develop manufacturing procedure for metal sub-assemblies.*

Required Courses: (9 units)		**Units**
DRAF 171 F	Fundamentals of Drafting	2
MACH 116 F	Machine Tools	2
TECH 108 F	Manufacturing Processes	3
WELD 121AF	Introduction to Welding	2

Additional (15 units)	**Units**
Drafting Courses — Any drafting courses	
Machine Technology Courses — Any machine technology course	
Welding Courses — Any welding courses except WELD 095 F Welding Skills Lab.	
Technology-Related Courses —	
METL 192 F Fundamentals of Metallurgy (3)	
TECH 127 F Industrial Safety (1)	
Total Units	**24**