Course: Metalworking Unit #/ Unit Name: Unit #3 – Computer Aided Manufacturing/ Machine Programming	Year of Implementation: 2019-2020

Curriculum Team Members:
Jim Scott jscott@lrhsd.org x8807
Josh Smith joshuasmith@lrhsd.org x8910

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Stage One - Desired Results

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Link(s) to New Jersey Student Learning Standards for this course:

https://www.state.nj.us/education/cccs/2014/tech/82.pdf

https://www.state.nj.us/education/aps/cccs/career/

https://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf

Unit Standards:
8.2 Technology Education, Engineering, and Design: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

D. The designed world is the product of a design process that provides the means to convert resources into products and systems.

8.2.12.D.3 - Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

E. Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge

8.2.12.E.1 - Demonstrate an understanding of the problem-solving capacity of computers in our world.

8.2.12.E.3 - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). .

Career Ready Practices
CRP11: Use technology to enhance productivity.

Transfer Goal(s): Students will be able to independently use their learning to…
Students will be able to independently use their learning to simulate a machining process with a computer aided manufacturing software program and create a code that can communicate with a machine to process a part.

Enduring Understandings	Essential Questions
Enduring Understandings Students will understand that. . . *EU 1* computer aided programming allows for manufacturers to simulate machining processes from models designed in CAD programs. *EU 2* machines interpret specific code called G & M code to operate precise mechanical processes. *EU 3* CAM and machine programming is an essential tool to create a rapid prototype.	*Essential Questions* *EU 1* ● What problems can software simulation of machine processes solve? What problems can it create? *EU 2* ● How do geometric functions translate into G & M code? *EU 3* ● In what ways have rapid prototyping methods transformed the way products are made?
Knowledge Students will know. . . *EU 1* ● common CNC machines. ● common tools in software for CAM processing. ● feeds and speeds calculations. *EU 2* ● describe common G&M codes.	*Skills* Students will be able to. . . *EU 1* ● apply the steps of the design loop to create a product. *EU 2* ● determine the best procedure to process a part based on the properties of a material.

● specific actions will be performed given a command through machine code. *EU 3* ● basic tools to create a model using Computer-Aided Design (CAD) software. ● CAM simulation techniques. ● tool library setups. ● origin and object setup in CAM.	● interpret the actions that will be performed given a sample of machine code. *EU 3* ● create a model using Computer-Aided Design (CAD) software. ● create a product using a CNC milling machine.

Stage Two - Assessment

Other Evidence:

- Design Challenges
- Teacher observations
- Project rubric(s)
- Worksheets
- Quizzes/tests on mechanical design, CAM and CAD
- Design Prompts

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.**
- Teacher led discussions on the proper CAD sketching (A) (EU1)
- Teacher led discussions on machine code (A) (EU2)
- Teacher led discussions on CAM process (A) (EU3)
- Students design multiple CAD prototypes for CAM process by simulated software (EU1, EU2, EU3) (A, M)

- Students design CAD prototypes for CAM process by CNC milling (EU1, EU2, EU3) (A, M)
- Students create a working product through CAD and CAM (EU1, EU2, EU3) (T)