Course: *Metal Fabrication* **Unit #3: Machining**	**Year of Implementation:** 2023-2024

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2020/
https://www.nj.gov/education/standards/clicks/Docs/2014_9.3_21LifeAndCareers.pdf

- **Unit Standards:**
  - ***21st Century Life & Career Standards***
    - 9.3.MN.4 - Describe career opportunities and means to achieve those opportunities in each of the Manufacturing Career Pathways.
    - 9.3.MN.6 - Demonstrate workplace knowledge and skills common to manufacturing.
    - 9.3.MN-PPD.3 - Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
    - 9.3.MN-QA.1 - Evaluate production operations for product and process quality.
  - ***English Companion Standards***
    - WHST.9-10.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
  - ***Interdisciplinary Content Standards***
    - RI.9-10.7. Analyze various perspectives as presented in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account.
    - NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content
  - ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***http://www.njamistadcurriculum.net/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***

A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to mill, turn, drill, and separate a piece of material to create a final design to a particular shape and size.

As aligned with LRHSD Long Term Learning Goal(s):

- acquire, integrate, and apply design processes and essential technical skills to solve problems, create products, and improve the quality of life for our local and global community

Enduring Understandings	*Essential Questions*
Students will understand that. . . *EU 1* machining is a prototyping and manufacturing process that creates the desired shape by removing material from a given object. *EU 2* material prep and machining techniques contribute to creating parts with a low tolerance of error.	*EU 1* ● What is an advantage of using CAM equipment in the mass production process? ● What ways can material be removed from a given object? ● What are the benefits and drawbacks of using different types of materials? ● How do machining techniques change based on the type of material being used? *EU 2* ● When would a subtractive process be more beneficial than an additive process.? ● How can the machining techniques be combined and used together in the fabrication process?

	• What factors contribute to the needed tolerance specifications of a part?
Knowledge *Students will know . . .* *EU 1* • milling processes (9.3.MN-QA.1) • turning processes (9.3.MN-QA.1) • drilling processes (9.3.MN-QA.1) • finishing processes (9.3.MN-QA.1) *EU 2* • how to prep the surface for a layout considering the desired tolerance. (9.3.MN-PPD.3) • subtractive and additive processes. (9.3.MN-PPD.3) • cutting processes. (9.3.MN.6) • grinding processes. (9.3.MN.6) • boring processes. (9.3.MN-PPD.3) • part finishing. (9.3.MN.6)	*Skills* *Students will be able to. . .* *EU 1* • mill a piece of material to a desired size based on a technical drawing. (9.3.MN-QA.1) • turn a piece of round stock to a desired shape. (9.3.MN-QA.1) • drill a piece of material using the correct size bit and/or tooling. (9.3.MN-QA.1) • finish a piece of material to give it a desired look. (9.3.MN-QA.1) *EU 2* • Process a part to within a specified tolerance (9.3.MN-PPD.3) • identify the different ways to separate or cut material. (9.3.MN-PPD.3) • choose the correct grinding wheel/tool for the correct process. (9.3.MN.6) • create bore and blind holes. (9.3.MN.6) • apply the appropriate finish to the exterior edges. (9.3.MN.6)
Stage Two - Assessment	

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.** *The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

- Measure the given material and create a technical drawing of the designed piece (A, EU2)
- Create a technical drawing that is fully dimensioned including measurements and tolerances (A, EU2)
- Mill a piece of material to size (M, EU1)
- Use the lathe to turn a piece of metal (M, EU1)
- Use the machining tool to drill a hole, bore, or counter sink (M, EU1)
- Test the effect fit of the designed part prior to fabrication (M,T, EU1)
- Create a setup using the Tool Library to safely and effectively machine the part (T, EU2)
- Fabricate the product using a CAM system (M, T, EU1)
- Safety check and evaluate the part during production and post production (T, EU2)
- Finish the piece of material to give it a look that is aesthetically pleasing (M, EU1)
- Group discussion and evaluation of products (T, EU2)
- Peers will evaluate the products based on form and function (M, T, EU2)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Safety	30
2	CAD/CAM	40
3	Machining	70
4	Molding/Forming	40

Instructional Materials

Fully equipped metal shop

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.