Course: *Metalworking: Welding and Assembly* **Unit #***3: Welding*	**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
https://www.nj.gov/education/standards/ela/Docs/2016NJSLS-ELA_Companion9-10.pdf
https://www.nj.gov/education/standards/ela/Docs/2016NJSLS-ELA_Companion11-12.pdf

- **Unit Standards:**
  - ***Content Standards***
    - 9.3.MN.6 Demonstrate workplace knowledge and skills common to manufacturing.
    - 9.3.MN-LOG.2 Demonstrate proper handling of products and materials in a manufacturing facility.
    - 9.3.MN-MIR.1 Demonstrate maintenance skills and proficient operation of equipment to maximize manufacturing performance.
    - 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
    - 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
    - 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.
    - 9.3.MN-PRO.5 Demonstrate the safe use of manufacturing equipment.
  - ***21st Century Life & Career Standards***
    - All curriculum writers/revisionists need to include standards that apply to “Career Readiness, Life Literacies, and Key Skills”. This should include a brief description of the standard and the standard number. Document only those standards and practices that apply to each unit. Use the following link to assist you [see pages of 31-36; 41-42; 53-56 for specific standard #’s and strands] https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-CLKS.pdf
  - ***English Companion Standards***

- Grade 9-10 Companion 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
- Grade 11-12 Companion Standards:
  - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
  - NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

- ***Interdisciplinary Content Standards***
  - List any standards from other content areas that apply to this unit.

- ***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 select the best welding method and technique in order to weld material of a given type and joint.

As aligned with LRHSD Long Term Learning Goal(s):https://www.lrhsd.org/Page/6163

- communicate and collaborate using appropriate technical terms to describe, analyze, interpret, and judge their work and the work of others.
- 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 Students will understand that. . .	*Essential Questions*
EU 1 proper planning and preparation is required prior to welding and that all metals have unique material properties that need to be considered in order to be fused with other metals.	*EU 1* ● What role do technical drawings play in the welding process? ● What preparations are needed prior to welding? ● How does the condition of the material impact the preparation necessary to begin welding? ● How do chemical and mechanical properties of a given material influence the ability to weld it? ● How do the thickness of two materials, relative to one another, affect the ability to weld them together?
EU 2 basic coding and programming functions can be used to maneuver a self compliant articulating arm to a linear or curved path.	*EU 2* ● How will robots impact the welding industry in the future? ● How would a company decide whether or not to invest in using robotic welding equipment? ● Outside of welding, what other tasks can robotic arms assist with in the role of the metalworking industry?
EU 3 welding of metals can be done using a variety of methods.	*EU 3*

	● How does the method of transferring heat to the metal affect a weld? ● What factors should be taken into consideration when selecting electrodes or filler metals when fusing to a parent metal? ● How would one go about selecting a welding system for your own needs? ● Are different methods of shielding a weld appropriate for different applications?
<u>Knowledge</u> *Students will know . . .* *EU 1:* • a variety of workholding procedures to secure parts for proper setup (9.3.MN.6) • how to electrically ground the equipment for safe operation. (9.3.MN.6) • how to manipulate the heat settings of the welding equipment based on a metals physical and chemical properties.(9.3.MN.6) *EU 2* ● basic robotic arm pathways for welding end effectors to follow. (9.3.MN-PPD.2) ● how to code a robotic arm to weld (9.3.MN-PPD. 2)	*<u>Skills</u>* *Students will be able to. . .* *EU 1* ● read and interpret technical drawings and prints in relation to welding operations. (9.3.MN.6) ● select and apply appropriate chemical preparation methods based material to be welded. (9.3.MN-LOG.2, 9.3.MN-PPD.5) ● select and apply appropriate mechanical preparation methods based material to be welded. (9.3.MN-LOG.2, 9.3.MN-PPD.5) *EU 2* • plan coordinate points on a cartesian workspace for the desired robotic arm pathways for a self-compliant articulating arm.(9.3.MN-MIR.4) • program and code positions on the cartesian workspace to perform linear, curved and circular pathways for a self-compliant articulating arm.(9.3.MN-PPD.5, 9.3.MN-MIR.4)

EU 3 ● the advantages and disadvantages of using an electric arc welding system. (9.3.MN-PPD.2) ● techniques that are used to successfully join pieces with oxyacetylene welding. (9.3.MN-MIR.1, 9.3.MN- PPD.1) ● methods and appropriate application of electric arc (stick) welding. (9.3.MN-MIR.1, 9.3.MN- PPD.1) ● Metal Inert Gas (MIG) welding procedures and applications. (9.3.MN-MIR.1, 9.3.MN- PPD.1) ● Tungsten Inert Gas (TIG) welding procedures and uses. (9.3.MN-MIR.1, 9 .3.MN-PPD.1)	● simulate and activate repetitive welding pathways for the Scorbot robot.(9.3.MN-PPD.5, 9.3.MN- MIR.4) *EU 3* ● successfully shield welds from oxidation during the welding process. (9.3.MN-MIR.1) ● properly secure work while still being able to properly ground the work when welding. (9.3.MN-MIR.1, 9.3.MN-PRO.5) ● weld using a variety of methods. (9.3.MN-MIR.1, 9.3.MN-PPD.1)
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.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. 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*

- Introduction to metal properties such as tensile/compressive strengths, ductility, hardness, brittleness, fusibility, elasticity, melting points, electrical conductivity, and thermal conductivity. (A, EU1)
- Introduction to types of welding joints and reading technical drawings to be able to interpret the welding symbols on a schematic and how to prepare the edges based on specifications from the technical drawings. (A, EU1)
- Metal part preparation including layout, edge preparation, and joint dimensioning (M, T, EU1)
- Filler metal characteristics including electrode types and nomenclature (A, EU3)
- Demonstration of types of welding including electric arc (stick), MIG, TIG, and oxyacetylene and student generated welding samples for each type of welding. (A, M, T, EU3)
- Demonstration for work holding and securing work pieces in jigs, fixtures and student projects based on work holding (A, M, T EU1)
- Demonstration of programming positions for a self compliant articulating robotic arm for the purpose of simulating welding a bead on a preset object for a manufacturing setting. (M, T, EU2)
- Demonstrations for the safe setup and operational techniques for Stick, MIG, TIG and Torch welding processes. (M, EU3)
- Introduction to equipment settings for proper heat transfer and feed rate for running a fully penetrating welding bead to adjoin two metals based on metal thickness, material, and thermal capacity. (T,EU3)
- Student journaling (M,T EU1,EU2, EU3)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Safety	40
2	Mechanical Fasteners	30
3	Welding, Soldering and Brazing	110

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.