WARREN COUNTY SCHOOL DISTRICT

Welding Technology Program of Study

Course Title: Welding Technology

Course Number: 00910 (AM) - 00960 (PM)

Suggested Educational Level(s): 10-12

Suggested Periods Per Week: 15 **Length of Period**: 42 minutes

Suggested Length Of Course: 3 years

Units Of Credit (If Appropriate): 3 per year

Date Written: December 16, 2008 **Date Approved**:

Date Reviewed: **Implementation Year**: 2009 - 2010

Teacher Certification Required: Vocational – Welding Technology

Standards Addressed:
Career, Education and Work – 13.1.11A, C, D, 13.2.11A, B, G
Science and Technology – 3.04.10B, 3.04.12B, 3.07.10A
Math – 2.01.08A, 2.02.08B, 2.03.08C, 2.03.11C, 2.04.11E
Reading – 1.2.11
American Welding Society (AWS) Standards

13.1.11A – Analyze career options based on student interest, abilities, aptitudes, and accomplishments.
13.1.11C – Evaluate opportunities for career preparation.
13.2.11B – Analyze and evaluate complex technical tasks using sophisticated processes.
13.2.11G – Analyze the need for manipulative/motor skills.
13.1.11A – Analyze work habits needed to advance within a career.
3.04.10B – Analyze energy sources and transfers of heat.
3.04.12B – Apply and analyze energy sources and conversions and their relationships to heat and temperature.
3.07.10A – Identify and safely use a variety of tools, basic machines, materials, and techniques to solve problems and answer questions.
2.03.08C – Measure angles in degrees and determine relations of angles.
2.03.11A – Select and use appropriate units and tools to measure to the degree of accuracy required in particular measurement situations.

2.04.11E – Demonstrate mathematical solutions to problems.
2.01.08A – Represent and use numbers in equivalent forms.
2.02.08B – Add, subtract, multiply, and divide different kinds of forms of rational numbers.
1.2.11 – Read and understand essential content of informational texts and documents in all academic areas.

Prerequisites: Students must be in at least the tenth grade level.

Special Requirements: Students entering the Welding Technology Program must be able to follow all safety instruction and have good eye/hand coordination. Basic mathematic skills will be needed in everyday shop activities. Students are expected to have a very good work ethic. Personal Protective Welding Equipment is required for the Welding Technology Program.

Writing Team Members: Nate McNett, Welding Technology Instructor, Mark Lindberg, Teacher Coach, Kathleen Johnson, Instructor.

COURSE DESCRIPTION:

Outline of Content Sequence and Recommended Time:
Students in the Welding Technology Program will learn: Occupational Orientation and Safety Principles of Welding, Welding Drawing and Weld Symbol Interpretation, Visual Examination, Inspection and Testing, Shielded Metal Arc Welding, Gas Metal Arc Welding (GMAW, Flux Cored Arc Welding (FCAW), Flux Cored Arc Welding (FCAW), Submerged Arc Welding (SAW), Gas Tungsten Arc Welding (GTAW), Manual Oxy Fuel Gas Cutting (OFC), Mechanized Oxy Fuel Gas Cutting (OFC), Manual Plasma Arc Cutting (PAC), Manual Air Carbon Arc Cutting (CAC-A), Brazing and Soldering, and Job Seeking/Job Keeping. All instruction and student learning activities are aligned with the American Welding Society (AWS) Standards. Following AWS Standards, some students are expected to perform guided bend tests. These standards and procedures are commonly used in local and national industries. Students will need to pass these types of tests in order to gain employment in industry. Students learn all the theories related to the above-mentioned welding processes, as well as an introduction to welding symbols.

Welding Technology is a competency-based program, in which students extend their welding process skills and performance each successive year. When students have successfully completed the program, they are able to safely perform essential skills associated with the welding processes.

Professional attitudes will be developed through the **SKILLS USA** and class activities.

Outline of Content Sequence and Recommended Time: (36 Weeks/Year - 108 Weeks/3 Years)
Over the three years of this course, individual instruction and student activity are on-going and developmental in the welding processes given below:

Occupational Orientation and Safety (4 Weeks)
101 Prepare and mark time or job sheet, reports or records.
102 Perform housekeeping duties daily.

103 Follow verbal instructions to complete work assignments and rules.
104 Follow written instructions to complete work assignments and rules.
105 Demonstrate proper use and inspection of Personal Protection Equipment (PPE).
106 Demonstrate proper work area operation.
107 Demonstrate proper use of ventilation equipment.
108 Discuss proper Hot Zone operation.
109 Understand proper work actions for working in confined spaces.
110 Understand MSDS sheets and precautionary labeling.
111 Demonstrate proper use and inspection of equipment used for each required welding and thermal cutting process.
112 Display familiarity with industrial and OSHA safety standards.
113 Demonstrate knowledge of oxy fuel safety procedures.
114 Demonstrate knowledge of arc welding safety procedures.
115 Demonstrate emergency action plan (all inclusive).

200 Principles of Welding (3 Weeks)
201 Identify major types of metals (ferrous and non-ferrous) used in welding.
202 Describe the basic principles of heat, expansion and contraction as it relates to metals.
203 Select appropriate welding technique, equipment and supplies for a given metal or process.
204 Describe the industry accepted welding codes, standards and procedures and their use.
205 Identify various joint designs (joint geometry).
206 Clean and prepare materials for welding and/or cutting.
207 Use hand tools and power equipment.
208 Use standard measuring and layout tools.
209 Calculate materials lists and costs.

300 Welding Drawing and Weld Symbol Interpretation (3 Weeks)
301 Interpret basic elements of a drawing or sketch.
302 Interpret welding symbol information.
303 Fabricate parts from a drawing or sketch.
304 Identify structural metals used in the Metal Fabrication field.
305 Demonstrate knowledge of basic metric conversion.
306 Calculate materials lists and costs.

400 Visual Examination, Inspection and Testing (2 Weeks)
401 Evaluate cut surfaces and edges of prepared base metal parts for testing.
402 Identify and evaluate weld discontinuities as per accept/reject criteria.

500 Shielded Metal Arc Welding (SMAW) (18 Weeks)
501 Perform safety inspections of SMAW equipment and accessories.
502 Make minor external repairs to SMAW equipment and accessories.
503 Set up and operate SMAW equipment.
504 Make fillet welds in all positions.
505 Make groove welds in all positions.
506 Perform pipe welds in all positions.
507 Pass performance test in all positions.
508 Perform qualification test.

600 Gas Metal Arc Welding (GMAW) (19 Weeks)
601 Perform safety inspections of GMAW equipment and accessories.
602 Make minor external repairs to GMAW equipment and accessories.
603 Set up and operate GMAW equipment.
604 Make fillet welds in all positions.
605 Make groove welds in all positions.
606 Perform pipe welds in all positions.
607 Pass performance test.

700 Flux Cored Arc Welding (FCAW) (19 Weeks)
701 Perform safety inspections of Flux Cored Arc equipment and accessories.
702 Make minor external repairs to Flux Cored Arc equipment and accessories.
703 Set up and operate FCAW equipment.
704 Make fillet welds in all positions.
707 Pass performance test.

800 Submerged Arc Welding (SAW) (3 Weeks)
801 Perform safety inspections of SAW
802 Make minor external repairs to SAW
803 Setup and operate SAW equipment
804 Make groove welds, flat and horizontal positions
805 Pass performance test

900 Gas Tungsten Arc Welding (GTAW) (18 Weeks)
901 Perform safety inspections of GTAW equipment and accessories.
902 Make minor external repairs to GTAW equipment and accessories.
903 Set up and operate GTAW equipment.
904 Make fillet welds, in all positions, on ferrous materials.
907 Pass performance test on ferrous materials.
908 Set up and operate GTAW on nonferrous materials.
909 Make fillet welds on nonferrous materials.
911 Pass performance test on nonferrous materials.

1000 Manual Oxy Fuel Gas Cutting (OFC) (4 Weeks)
1001 Perform safety inspections of OFC equipment and accessories.
1002 Make minor external repairs to OFC equipment and accessories.
1003 Set up for manual OFC operations on steel.
1004 Operate manual OFC equipment.
1005 Perform straight cutting operations on steel.
1006 Perform shape cutting operations on steel.
1007 Perform bevel cutting operations on steel.
1009 Perform piercing operations on steel.

1100 Mechanized Oxy Fuel Gas Cutting (OFC) (4 Weeks)
1101 Perform safety inspections of mechanized OFC equipment and accessories.
1102 Make minor external repairs to mechanized OFC equipment and accessories.
1103 Set up and operate OFC equipment on steel.
1104 Perform straight cutting operations on steel.
1105 Perform bevel cutting operations on steel.

1200 Manual Plasma Arc Cutting (PAC) (2 Weeks)
1201 Perform safety inspections of PAC equipment and accessories.
1202 Make minor external repairs to PAC equipment and accessories.
1203 Set up and operate manual PAC operations on ferrous and nonferrous materials.
1204 Perform shape cutting operations on ferrous and nonferrous materials.

1300 Manual Air Carbon Arc Cutting (CAC-A) (4 Weeks)
1301 Perform safety inspections of CAC-A equipment and accessories.
1302 Make minor external repairs to CAC-A equipment and accessories.
1303 Set up and operate manual CAC-A gouging and cutting operations on steel.
1304 Perform gouging and scarfing operations, to remove base and weld metal, on steel.

1400 Brazing and Soldering (2 Weeks)
1401 Set up and operate oxy fuel brazing and soldering equipment.
1402 Perform brazing and soldering operations.

1500 Job Seeking/Job Keeping (3 Weeks)

1501 Apply effective speaking and listening skills used in a job interview.
1502 Apply research skills in searching for a job; i.e.,CareerLinks, Internet (O-NET), networking, newspapers, professional associations, resource books (Occupational Outlook Handbook, PA Career Guide).
1503 Develop and assemble, for career portfolio placement, career acquisition documents, such as, but not limited to: job application, letter of appreciation following an interview, letter of introduction, postsecondary education/training applications, request for letter of recommendation, resume.
1504 Analyze, revise and apply an individualized career portfolio to chosen career path.
1505 Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans With Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, self-advocacy, scheduling/time management, team building, technical literacy, technology.
1506 Evaluate personal attitudes and work habits that support career retention and advancement.
1507 Evaluate team member roles to describe and illustrate active listening techniques: clarifying, encouraging, reflecting, restating, summarizing.
1508 Evaluate conflict resolution skills as they relate to the workplace: constructive criticism, group dynamics,
managing/leadership, mediation, negotiation, problem solving.
1509 Develop a personal budget based on career choice, such as, but not limited to: charitable contributions, fixed/variable expenses, gross pay, net pay, other income, savings, and taxes.
1510 Evaluate time management strategies and their application to both personal and work situations.
1511 Evaluate strategies for career retention and advancement in response to the changing global workplace.
1512 Evaluate the impact of lifelong learning on career retention and advancement.
1513 Analyze entrepreneurship as it relates to personal career goals and corporate opportunities.
1514 Analyze entrepreneurship as it relates to personal character traits.
1515 Develop a business plan for an entrepreneurial concept of personal interest and identify available resources, such as, but not limited to: community-based organizations (Chambers of Commerce, trade/technical associations, Industrial Resource Centers), financial institutions, school-based career centers, small business administration services (SCORE, small business development centers, entrepreneurial development centers), venture capital.

The instruction outlined above corresponds with AWS Industry Standards.

Formative Assessments:

- Students complete a Competency Checklist as they progress through a skill.
- Quizzes, Tests, and Writing Assignments

Summative Assessments:

- Guided bend tests in all positions are conducted.
- Final written exam
- Writing assignments
- NOCTI (National Occupational Competency Testing Institute)

Required/Approved Textbooks and Materials:

Book Title: Welding, 6E, Principles and Applications
Publisher: Thomson Delmar Learning
ISBN #: 13:978-1-4180-5275-1
Copyright: 2008
Date of Adoption: 2009

Book Title: Welding, 6E, Principles and Applications Study Guide/Lab Manual
Publisher: Thomson Delmar Learning
ISBN # - 10:1418052779
Copyright: 2008
Date of Adoption: 2009

Required Materials: All consumables, components, materials and equipment needed for students to successfully complete the following welding processes: Oxy-Acetylene Welding and Cutting, Shielded Metal Arc Welding, Gas Tungsten Arc Welding, Gas Metal Arc Welding, Flux Cored Arc Welding, Pipe Welding, and some Plastic Welding.

Safety Program for Welding Technology:

Materials Needed: Safety videos, textbooks, power points, safety rules handout, safety posters, and Personal Protective Equipment.

Content Presentation:
1. Present the welding safety rules. Students will receive a handout.
2. Discuss each rule and the reason for each.
3. Present safety videos to the students.
4. Discuss and reinforce key points in each video.
5. Provide Safety Reinforcement throughout Welding Lab Time.

Additional Procedures:
1. Review safety rules.
2. Allow question and answer time.
3. After students understand and agree to follow the rules, they will sign the "Welding Shop Safety Rules" handout.
4. Students will take the above named handout home for parent signature.
5. Handout will be returned to the instructor.

Application: Students will work safely in the welding shop, following all safety rules, and always wearing all personal protective equipment.

Assessment/Evaluation:
1. Students will be observed during welding lab work. All welding class and welding lab rules will be adhered to with instructor feedback.

Accommodations/Adaptations:
- Follow Student IEP's