

**National STEM Consortium
Reviewer Form**

NSC Certificate Area				
Composite Materials Technology	Cyber Technology	Electric Vehicle Technology	Environmental Technology	Mechatronics
Title of Course: MEC WELDING				
<p>Please provide a qualitative analysis of the NSC Certificate program course materials based on the three criteria below (approximately one page per criterion). At the end of each review please use a scale of 1-3 (1=low; 2=medium; 3=high) to rate the overall quality of the materials in relation to that criterion.</p> <p>Criteria:</p> <p style="margin-left: 40px;">(A) Meets industry standards and needs (Identify relevant Industry Standards and Needs: technical, personal and interpersonal).</p> <p style="margin-left: 40px;">(B) Represents “best in class,” nationally portable, one-year certificate programs that are in demand by workers and employers.</p> <p style="margin-left: 40px;">(C) Can be disseminated quickly and widely to community colleges throughout the United States.</p>				
Name of Reviewer: <i>Marilyn Barger</i> Date of Review: <i>06/30/2014</i>				

(A) Meets industry standards and needs (Identify relevant Industry Standards and Needs: technical, personal and interpersonal).

(i) Industry Relevance:

There is a national need for skilled workers to begin to address the installation and operation of automated production and fabrication systems in many industrial facilities of all kinds that use different focused advanced technologies. The National Association of Manufacturers’ (NAM) Manufacturing Institute (MI) has defined this need to include industrial maintenance, machine operations and metal fabrication including welding. All of these are important skills supporting operation, troubleshooting and maintenance of mechatronic systems. Industries across the country are rapidly adding robotic welding systems to their production facilities and their needs for skilled workers in this area are increasing equally as fast. Well-rounded mechatronics technicians should understand and be able to perform basic skills in all automated production and fabrication processes including welding.

The materials provided within the MEC Welding course address the introductory knowledge and skills required of employees working in a production environment that includes welding. This could include the front-line material handlers, machine operators, metal fabricators, welders, welding technicians and multi-skilled maintenance technicians. The MEC Welding course meets this need with solid and comprehensive instructional package for instructors, teachers and faculty. The materials reference current resources and include state of the art information about welding fundamentals. Course materials also map to the current Department of Labor Competency Model for Advanced Manufacturing.

The course introduces and reinforces the fundamental science and technologies of welding. The course also develops skills in shielded metal arc welding (stick) and MIG welding techniques in all welding positions. Instructions provided also provide skills and expertise needed to pass the American Welding Society (AWS) certification test for MIG welding. It also covers blueprint reading and symbols relating to the welding field. The course culminates with a project requiring multiple skills learned and/or AWS certification testing.

The first module (20 hours) covers basic welding safety, AWS standards and credentials, the welding simulator, welding blueprint symbols, good weld characteristics, power requirements, and proper set up for simple TIG welding. The second 20-hour module covers temperature measurements and units, unit conversions between the metric and English systems, plasma arc cutting, acetylene and other cutting methods, large fillets, mechanical positioning support systems, and electrode selection for a particular process. Module three introduces basic manufacturing processes for cutting and fabricating difficult to work with stainless steels and high nickel content alloys, AWS qualifications and performance expectations for welders and welding operators, destructive and non-destructive testing and certification test review and practice.

In each of the 19 lesson plans the course package has detailed materials for up to four hours of teaching using the course materials. They include demonstration and practice strategies, lab objectives, methods, the aligned student learning outcomes and references to a textbook (only the textbook title is provided). No assessments, excepting some lab practical tests that prepare the students for AWS credentialing assessment are included in the course pack. Assessment guidelines or specific assessment tools would be extremely useful in this “hands-on” course.

(ii) Standards Relevance:

The MEC Welding course syllabus addresses the American Welding Society (AWS) certification skills (<http://www.aws.org>). Successful completion of the first certification level assessment would provide documentation that the holder of such had those specific (and desirable) skills. The AWS course does provide instruction for basic workplace skills that the Siemens Mechatronics Level 1 and 2 Certifications also cover in their assessment. However, there is no significant overlap of welding skills in this course with the overarching Mechatronics certification, Siemens Level 1 and 2. Therefore, it is appropriate that programs electing to use this elective course in their mechatronics program include the AWS welding certification.

(B) Represents “best in class,” nationally portable, one-year certificate programs that are in demand by workers and employers.

In addition to the identified need by NAM, the NSC Mechatronics Team college partners had defined specific local and regional industry needs for welders and welding operators as well as mechatronics technicians in their original grant application. These high skill and high wage jobs generally attract students, veterans, unemployed, and underemployed workers due to the intrinsic hands-on nature of the work, continuous lifelong learning opportunities as well as strong career advancement potential. The development of this workforce requires curricula that provide the knowledge and skills required to meet current industry needs. The structure of a course that delivers this content is optimal when it meets “best in class” characteristics. I believe that the MEC Welding course developed through the National STEM Consortium Curriculum Development Project has some of the characteristics of a “best in class” course. “Best in class” can be defined as providing state-of-the art and current content; formatted for flexible delivery options; and offer a comprehensive package of materials so a qualified faculty could offer the course with no additional materials.

The Welding course in the NSC Mechatronics Program is a fairly comprehensive introductory program of study of welding systems commonly used in a number of industry and business sectors. Additionally, the local and/or regional needs were defined by the NSC Mechatronics Team college partners had defined specific local and regional industry needs for welders and welding operators as well as mechatronics technicians in their original grant application.

The course materials provided are good, up to date, well written, organized and appropriate for the introductory course in Welding. Some references are provided particularly a textbook “Modern Welding”, virtual welding instructional materials and references, and AWS certification criteria. The course packet delivered is an inconsistent between the number of lesson plan files (19) provided and the lessons referred to in the master course syllabus (15). Additionally, the course packet as submitted, is lacking some important information about needed equipment and software resources and/or recommendations, assessments or assessment guidelines, links to online materials referenced, and presentation files or links to those.

Approximately 80% of this course is face to face and involves significant hands on labs. Each lesson includes a class period time guide, goals and objectives, methods, strategies, homework assignments, lab objectives, linked online content, well defined activities/labs, assessment guides, expected student learning outcomes, references, and a guideline of the estimated time that should be spent on each topic, lab or classroom activity. The master course syllabus provides a detailed scope and sequence. The lesson plans include suggestions for how to deliver the course in a blended environment, which will be helpful for those interested in offering portions of the course modules via an online platform.

Industry has made it clear that students must have the opportunity to work directly with related equipment, and this course provides multiple hands-on, project-based learning opportunities for students. It also specifies how expected background knowledge and how critically important personal and interpersonal skills are integrated into this technical course by using work team environments throughout the course lab activities. The course integrates and builds knowledge

and skill attainment throughout the modules and encourages implementation of the best teaching and learning strategies for mastery of topics in the course.

(C) Can be disseminated quickly and widely to community colleges throughout the United States.

The structure of the Welding course is based on a textbook, presentations (referred to but not supplied in this course pack), lab activities, demonstrations, instructor guides and online resources. All of the course materials would be easy for an education institution to implement as the same course anywhere in the United States by a faculty or instructor with a related technical background as long as a few more details about the references are provided. The content is also conducive to language translation to facilitate the course being delivered globally. The three distinct modules provide a lot of flexibility for anyone delivering the course material in various length college credit courses or in short-term non-credit courses/modules. More details about needed equipment and software would enhance this course package significantly. The MEC Welding course also recommends a textbook, but no publishing information is provided to identify the book. The course package, as delivered to me via zip file would be somewhat easy for an instructor to implement quickly provided he/she had the appropriate background, access to needed laboratory equipment, and could fill in the gaps noted in this review.

OVERALL QUALITY RATING

WELDING - COURSE REVIEW CRITERIA	SCORE (1-3, 3 highest)
(a) Meets industry standards and needs (Identify relevant Industry Standards and Needs: technical, personal and interpersonal).	3
(b) Represents “best in class”, nationally portable 1-year certificate that is in demand by workers and employers	2
(c) Can be disseminated quickly and widely to colleges in the US	1