

**National STEM Consortium  
Reviewer Form**

NSC Certificate Area				
Composite Materials Technology	Cyber Technology	Electric Vehicle Technology	Environmental Technology	<b>Mechatronics</b>
Title of Course: <b>MEC CAPSTONE</b>				
<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>				
<i>Name of Reviewer:</i> Marilyn Barger <i>Date of Review:</i> 6/30/2014				

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

(i) Industry Relevance:

The expectations of a skilled worker with an industry recognized credential center on that person's skills as related to the narrow but intense perspective of the earned credential. This set of skills could be extensive and acquiring the set only accomplished after a rigorous course of study that includes hands-on verification. The National Association of Manufacturers' (NAM) Manufacturing Institute (MI) has also connected mechatronics related credential skill sets required in industrial maintenance, and machine operations. Thus, a capstone course that has as its prerequisite a demonstration of these skills has industry relevance because it speaks directly to manufacturers' production requirements. However, student completion of a capstone course and, by inference, completion of the two-year technical degree addresses a higher issue also relative to a manufacturers' success.

As industry recognized credentials contribute to a manufacturers' production so does the two year technical degree raise a manufacturers' productivity. The distinction is real and emphasized to avoid an unfair demand being placed on the credentialed worker, and an under appreciation of the technician with a technical degree. Credentialed workers must be ready to address the operation, troubleshooting, and maintenance of the equipment and perhaps processes related to the specific credential held by that worker. The technician with the technical degree should meet those expectations as well as the skill, aptitude, attitude, and desire to deal with issues that transcend specific equipment or equipment sets. These workers will provide positive, corrective, and innovative input to manufactures that address credential skill related manufacturing issues as well as improvements at a multiple level in the manufacturer process. These higher-level skills are identified and shaped as the student progresses through a capstone experience course.

The materials provided within the MEC Capstone course address the expended performance expectation of manufacturer floor personnel that must deal with production and productivity issues. The course is structured around 4 lesson plans that include: Topics, Lesson Goals, Competencies, Objectives, Strategies, Evaluations, References, Materials, Class Exercises, Lab Exercises, Homework, Handouts, and Class Assessment. The plans also include a general education outcomes section that indicates goals for cross academic activities.

The first Lesson deals with safety and teamwork. This Lesson Plan provides suggestions grouped as listed above. The Lesson Outline includes; Controllers and Software, Instantiation and Adjustments of a Mechatronic Module(s), Troubleshooting a Mechatronic System and Hands-On Trainer Exercises. The Lesson 2 Outline uses the same categories as in Lesson 1 however, the suggested topics are related to; Robot programming, PLC language and communication, interfaces, system networking. Lesson 3 deals with maintenance of operations including troubleshooting a multiple station system and diagnostic techniques and approaches while Lesson 4 covers final assessment instruments (CAAP, ATMAE, etc.) and certifications attached to course or Program (MSSC, Siemens, etc.).

The course provides assessment guidelines. A grading scheme is provided. The assessment is based on the course's focus on the application of previous concepts, theories, and practices needed to complete a modular system from assembly to operation. There is a generous and useful supply of course materials that are primarily manuals and information content available from book and equipment vendors. The course also provides a selection of capstone activities/projects. While the author developed some of these applications, most are provided via vendors with supporting hardware.

#### (ii) Standards Relevance:

The MEC Capstone course relevance to industry recognized standards must be put into perspective. It is not the role of a capstone course to meet the requirements of an industry standard. In fact, student introduction to if not acquisition of standards related set of skills should be a prerequisite for a capstone experience. However, the capstone experience does provide the opportunity for students to integrate standards related skills. This blend of skills and knowledge is the essence and distinction between workers that can support production vs. those that contribute to both production and productivity as well as improve the novice technician's troubleshooting skills and strategies. This course is structured to produce this production and

productivity-orientated worker. An instructor with the background required will find this course a good instrument to accomplish this task.

**(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 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 Capstone course developed through the National STEM Consortium Curriculum Development Project has many of the characteristics of a “best in class” course. “Best in class” typically 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.

A “Best in Class” characterization of this course is merited with the understanding that it is not the primary responsibility of this course to focus on the delivery of nationally portable 1-year certificates. In fact, if that were the primary intent of the course, it would be a very poor representation of a capstone course in Mechatronics. However, this course which integrates skills from a number of separate skill sets (and certificate courses) will also be good review and preparation for the Siemens Level I certification which is the target industry credential for the STEM MEC Mechatronics 1-year academic certificate.

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

The nature, intent, and structure of the MEC Capstone course dictates that it will be a challenge to quickly disseminate this independent course to other community colleges throughout the United States and almost fundamentally suggests that it can not receive the highest rating in the ease of dissemination category. This is not a flaw of the course nor is it a deficiency in the course author's background. On the contrary, a capstone course must connect to the curriculum that preceded it and this course accomplishes that mission. Thus, if other colleges adopt the entire MEC course and degree program, this capstone course will be a quick and easy fit into that program.

The course does have other attributes that will make it hard to disseminate. In the set of files that were provided for review, there was an extensive amount of duplication in the Lesson Outlines as related to: Controllers and Software, Installation and Adjustments of Mechatronic Module(s), Troubleshooting a Mechatronic System, and Hands-On Trainer Exercise. If this was not just a file mix-up relative to the review package, this almost exact repetition of Lesson Outline

materials will generate, at best, confusion for an instructor in a different institution or program attempting to adopt or adapt this course.

In addition, the capstone activities are primarily supplied from specific education equipment providers. Ease of dissemination is conditioned on access to these equipment suites. If these two conditions were met, 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. The extensive use of copy write restricted manuals will limit translation of these references into other languages however, it is likely that many vendors will already have translations of these materials.

#### **OVERALL QUALITY RATING**

<b>MEC CAPSTONE - COURSE REVIEW CRITERIA</b>	<b>SCORE (1-3, 3 highest)</b>
(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	3
(c) Can be disseminated quickly and widely to colleges in the US	1