National STEM Consortium
Reviewer Form

NSC Certificate Area

Composite Materials Technology	Cyber Technology	Electric Vehicle Technology	Environmental Technology	**Mechatronic**s

Title of Course**: MEC ELECTRICAL SYSTEMS**

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.

Criteria:

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

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

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

Name of Reviewer: *Marilyn Barger*
Date of Review: *03/13/2014*

(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 workers skilled in electrical systems and subsystem in industrial facilities of many kinds with different focused advanced technologies. The National Association of Manufacturers' Manufacturing Institute (MI) has defined this need to include industrial maintenance technicians, which includes the mechatronics skill set and all of its components. The materials provided within the MEC Electrical Systems course address the specific need for an understanding and skills attainment of the basics of electrical circuits. The instruction package for this course includes visual presentations, standard content text book references as well as student and instructor reference materials. Student demonstrations and hands-on activities reinforce industrial applications for electrical and motor systems. The course content has a basic

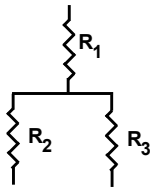
introduction of the background physics and mathematical manipulations necessary to understand the elements of electronic ``subsystem'' components that will become part of complex motor systems. The lessons include basic electrical safety, functions and physical properties of electrical components as well as reading documentation including data sheets, schematics and, system specifications.

Course instruction follows the use of AMATROL training systems. The first set of lessons addresses Ohm's law as well as fundamental electrical components and concludes with troubleshooting simple direct current (DC) circuits. The second lesson set covers basic series and parallel circuits as applied to DC and alternating current (AC) as well as important electrical components that are used in these circuits. Lessons are connected to hands-on activities and demonstrations of Personal Protection Equipment and training equipment related safety, and proper usage. The remaining lessons deal with both AC and DC motors where and how they work and are used particularly in mechatronic systems applications.

As the course progresses, the technician knowledge and skill expectations are built based on a physics and mathematics STEM platform that includes precise measurements and subsequent calculation to determine current, resistance, voltage and, ultimately, power. Hands-on exercises provide practice for skill building in proper use of various electrical meters as well as initial practice troubleshooting various simple circuits. The Lesson Plans for all lessons are provided and some PowerPoint presentations,

Lesson 1 Powerpoints MEC_Electrical Systems _L01_ElectricSafetyQuantitiesUnits- 7slides provides introduction lesson points for electrical safety
Lesson 2 Powerpoints MEC_Electrical Systems _L02_QuantitiesUnits- 12 slides provides introduction lesson points for number representation and electric quantities.
Lesson 8 Powerpoints MEC_Electrical Systems _Parallel Circuits- 27slides provides introduction lesson points for parallel circuit calculation
Lesson 9 Powerpoints MEC_Electrical Systems _ACmotor- 28 slides provides introduction lesson points for simple motor operation
Lesson 9 Powerpoints MEC_Electrical Systems _ACmotorControl- 16 slides provides lesson point for simple motor control.
Lesson 10 Powerpoints MEC_Electrical Systems Transformer- 36 slides provides photo's of various transformers and some lesson points
are included.

The curriculum includes tests, laboratory exams, and other assessment tools. However, the circuit diagram drawings provided would benefit from additional editing. Simple resistor circuits should be redrawn at a better resolution. Sometimes the ends of the conductors are not connected to the ends of the resistors. The drawing of the circuit elements provided on the right would be expected of the students. For example, the three resistors drawing in the Laboratory Final should be redrawn. The other resistor network drawings in various tests provided also need graphic editing.



(ii) Standards Relevance:

The course address skills associated with several industry standards. Electrical safety practices are integrated into course content throughout the curriculum as appropriate and developed as required skills during the progress through the hands-on and lecture based activities. In addition, the Association for Packaging and Processing Technologies offers industry credentials (PMMI, http://www.pmmi.org/Education/) that include two individual certifications in industrial electronics systems (level 1 and level 2). Typically, individual certifications act as PMMI credential components. The Electrical Systems course of the National Stem Consortium (NCS) Mechatronics certificate aligns well with the PMMI Industrial Electronics I certificate. Additionally, the Electrical Systems course covers similar topics to those in the Siemens Level I Mechatronics Certification course titled "Mechanical Components and Electrical Drives", and should, therefore, initiate student preparation for the Siemens Level I Mechatronics Certification (target credential of the NSC STEM Consortium mechatronics program, http://www.siemens-certifications.com/).

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

The NSC Mechatronics Team college partners have defined specific local and regional industry needs for electrically skilled technicians. These high skill and high wage jobs are attractive to students, unemployed, and underemployed workers because of the intrinsic hands-on nature of the work, continuous lifelong learning opportunities, and strong career advancement potential. This workforce development requires curricula that address industry needs. The structure of a course that delivers this content is optimal when it meets "best in class" characteristics. This 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. "Best in class" courses have excellent lesson plan structures with specific lessons clearly connected to lesson plan topics. This course has an excellent lesson plan structure with some specific lessons. Any qualified instructor could build their course from this structure.

The Electrical Systems course content can be delivered by any competent instructor familiar with circuits, motors, fundamental power distribution and the AMATROL trainers. The course has a complete curriculum for an introductory course about electrical components and fundamental circuit structure and performance. Information from this course will be used by students in most sectors of manufacturing, supply chain technology, energy production, chemical and biological processing and material processing. The topics in the course address the national need for skilled workers in industrial facilities.

The course materials that are provided are good. The lesson plans are well written and appropriate for the Electrical Systems course. The course provides specific capstone experience based on AMATROL equipment. Learning outcomes are provided. Many appropriate resources are identified for each topic, and at least one approach to delivering the material is suggested. The course has suggested web access lessons notes, handouts, and activity materials, laboratory experiences based on AMATROL equipment, and reference list. The course packet includes tests as well as a final assessment that could be use if the materials were taught as outlined or could be used a guide for developing a new test or final assessment. The lessons are flexible user friendly

for any educational institution anywhere that has a standard set of bench based electrical components and setups but particularly easy to implement if the AMATROL suite of training stations is available. The course documentation also specifies the expected background knowledge for student success and how critically important personal and interpersonal skills are as well as their integration into this technical course by using work team environments. The course integrates student target knowledge and skill attainment with an expectation that the instructor will implementation best teaching and learning strategies for topic mastery by most learning styles.

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

The structure of this course, MEC Electrical Systems, is based on presentations, hands-on activities/labs and Internet resources. The use of a course text is possible but a specific book is not integrated into these materials. The course resources can be implemented in a similar program anywhere in the United States. However, that faculty would have to generate additional presentation materials to meet their target needs. Subject to AMATROL license constraints, the content is also conducive to language translation to facilitate course delivery globally. The course is a combined lecture and laboratory hands-on practice. Fifteen Lessons are outlined. The lessons provided, subject to equipment constraints, would also work in short-term non-credit courses. The course package, as delivered to me via zip file would be very easy for an instructor to implement quickly provided he/she had the appropriate laboratory background and training equipment. The enrichment components for this course, supporting presentation and connecting lessons and activities, will have to be generated or adapted from auxiliary resources.

OVERALL QUALITY RATING

ELECTRICAL SYSTEMS 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	3
(c) Can be disseminated quickly and widely to colleges in the US	2