National STEM Consortium
Reviewer Form

NSC Certificate Area

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

Title of Course**: MEC Introduction to PLC Basics (PLC Beginner EET 111)**

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: *03/15/2014*

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

(i) Industry Relevance:

The national need for skilled workers in industrial facilities relative to controls and control systems centers on the programmable logic controller. The National Association of Manufacturers' (NAM), Manufacturing Institute (MI) has defined this need to include programmable controller installation, programming and operation trouble shooting as related to the expected performance of industrial maintenance technicians. The materials provided within the MEC Introduction to PLC Basics course presents the initial concepts needed for understanding and skills attainment in the operation of a PLC. The instruction package for this course includes outlines for lecture presentations, visual presentations, suggestions for a textbook, student and instructor reference materials, demonstrations, and student hands-on activities with a PLC trainer. The course initially provides the operational knowledge of how a PLC works, is programmed and is put into its run mode. Instruction proceeds with the

distinction among digital and analog I/O modules. These concepts including timers and counters are connected to specific course objectives. The course has both instructor based and online activity based modes for learning with the on-line materials originating from WISC-online and Tooling U sources.

As the course progresses, the technician knowledge and skill expectations are built based on worksheet and hands-on related activities. Initial efforts focus on the structure of the PLC and its computer characteristics. The course stresses the binary nature of the technology to emphasize proper use of the I/O instructions as well as the expectation performance of timers and counters. As an example, the last lessons, Lesson 12 and Lesson 13, before the course Final Review in Lesson 14, covered timers and counters and included the programming and operation of a BCD counter using the AMATROL PLC training station.

The course is driven by an AMATROL PLC training system. The course outline provides details as to what materials provided by AMATROL are to be integrated into this course. The AMATROL content included with their training systems covers the binary mathematics, programming techniques, and trouble-shooting skills expected for successful completion of the exercises AMATROL provides. The MEC Introduction to PLC Basics is completely structured around the AMATROL resource. The course instructor must be familiar with that equipment set.

Plans for all lessons are provided and are extensive and comprehensive. Some PowerPoint presentations,

Lesson 1 Powerpoints MEC_IntroPLCs_Basic- 77slides provides introduction lesson points for overview of PLC and PLC components and simple applications
Lesson 1 Powerpoints MEC_IntroPLCs_BasicsOFPLCs- 67 slides provides same introduction lesson points for PLCs as the presentation above..
Lesson 12 Powerpoints MECIntroPLCs_ProgrammableControllersIntroduction- 82 slides provides introduction lesson points similar to the two powerpoints above as well as additional lesson points for very simple timer and counter configurations.

are provided. Although several lessons provided assessment and support materials, a single lesson plans word document was the only file provided for lessons 3, 5, 8, 11, and 14. No materials for Lesson 7 were included in the zip folder sent to this reviewer. The curriculum includes tests, laboratory exams, and other assessment tools.

(ii) Standards Relevance:

The course address skills associated with several industry standards. Safety practices although not emphasized in the lesson plans are integrated, via the AMATROL resources, 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 (PMMI, http://www.pmmi.org/ Education/) offers separate industry credentials in the mechatronics disciplines including one for PLC's: Programmable Logic Controllers I. Typically, this PMMI certification would not be used in isolation, but as one component of the multi-certificate PMMI mechatronics credential. The MEC Introduction to PLC Basics course supports concepts and skills expected within the PMMI Programmable Logic Controller I certificate. However, an instructor adapting this course for

their institution would benefit greatly from a table outlining these connections with the lesson provided. Additionally, the Introduction to PLC Basics course covers similar topics to those in the Siemens Level I Course 4 of the Siemens Mechatronics Certification titled " Digital Fundamentals and Programmable Logic Controllers", and should, therefore, specifically help prepare students for the Siemens Level I Mechatronics Certification (target credential of the NSC STEM Consortium mechatronics program, http://www.siemens-certifications.com/). In summary, there are strong connections among the contents of this course and related industry standards however; these alignments would be magnified if these connections could be clearly indicated within the curriculum content or an alignment table of the standards skills and the student learning outcomes was provided.

(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 have defined specific local and regional industry needs for PLC and controls related industrial systems technicians as well as mechatronics technicians in their original grant application. These high skill and high wage jobs attract students, unemployed, and underemployed workers who are drawn 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 industry needs. The structure of a course that delivers this introductory PLC related content is optimal when it meets "best in class" characteristics. The MEC Introduction to PLC Basics course developed through this National STEM Consortium Curriculum Development Project has characteristics that, if developed would move the course to "best in class". "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 or attention to the instructional details needed to support knowledge transfer. This course has an excellent lesson plan structure with some specific lessons, assessment tools, and detailed student activities as directed information included in the AMATROL PLC training system resource. Any competent instructor familiar PLC concepts and the AMATROL trainer can deliver the course content. Laboratory activities are structured around the AMATROL equipment suite.

Information in this course is to be used by students as the basis for PLC training that will be of use in most sectors of manufacturing, supply chain technology, energy production, chemical and biological processing, etc. The National Association of Manufacturers (NAM), through its Manufacturing Institute (MI) has defined these PLC skills as requirements of controls and industrial maintenance technicians both of which are a subset of the mechatronics skill set. Additionally, the NSC Mechatronics Team college partners defined regional workforce needs. That exercise defined specific local and regional industry needs for maintenance technicians as well as mechatronics technicians in their original grant application. These high skill and high wage jobs 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 in a number of industries across the country.

The course materials provided cover details of key PLC concepts and components. The lesson plans are well written and appropriate for the PLC Basics course. 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, activity materials, laboratory experiences based on AMATROL equipment, and reference list. The course packet includes tests as well as a final assessment instrument that could be use if the materials were taught as outlined or could be used as a guide for developing a new test or final assessment. The lesson plans are user friendly and support flexible lesson delivery. They also specify the expected background knowledge needed to be successful and how critically important personal and interpersonal skills are as well as their integration into the technical course by using work team environments. The course integrates student target knowledge and skill attainment with an expectation that the instructor will implement the 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, Introduction to PLC Basics, 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 actually integrated into these materials. The course resources that include the AMATROL elements 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. The content that is not copy protected by AMATROL is also conducive to language translation to facilitate course delivery globally. The course has a combined lecture and laboratory hands-on practice format. Thirteen lessons are outlined individually, but the master syllabus appears to be incomplete. The first deals with course and PLC introduction elements while the course terminates with a programming and practical process application activity. The lessons provided would also work in short-term non-credit courses if license requirements for use of the AMATROL related content have been satisfied.

OVERALL QUALITY RATING

INTRODUCTION TO PLC BASICS COURSE REVIEW CRITERIA	SCORE (1-3, 3 highest)
(a) Meets industry standards and needs (Identify relevant Industry Standards and Needs: technical, personal and interpersonal).	1
(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