NORTHEASTERN TECHNICAL COLLEGE
COURSE OUTLINE

<table>
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<tr>
<th>COURSE: EEM 251</th>
<th>PREFIX NO. 251</th>
<th>EFFECTIVE DATE SUMMER 2015</th>
<th>NEXT REVIEW DATE SUMMER 2016</th>
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<tr>
<th>TITLE: PROGRAMMABLE CONTROLLERS</th>
<th>CREDITS 3.0</th>
<th>CONTACTS CLASS - LAB - TOTAL 2.0 3.0 3.0</th>
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COREQUISITES: EEM 151

DESCRIPTION: This course is an introduction to programmable control systems with emphasis on basic programming techniques. A variety of input/output devices and their applications are covered.

TEXTBOOK(S) OR ALTERNATIVE: PROGRAMMABLE LOGIC CONTROLLERS by Frank Petruzzella

MATERIALS (specifying those to be purchased by student): Materials provided are course outline and lab equipment. Students will provide textbook, lab manual, paper, pencils, and a scientific calculator.

COLLATERAL READING:

CLASS MANAGEMENT ACTIVITIES (Attendance, tardies, testing, etc.):

Academic dishonesty: Students are expected to do their own work. Please refer to the NETC Student Code and Grievance Procedure for definition of academic dishonesty and an outline of disciplinary action that may occur.

Attendance: Students are expected to attend all scheduled classes, however, up to 10 hours of absence are allowed for unavoidable hardships such as illness or car trouble. A student missing more than 10 hours of class for any reason will be dropped from the course for excessive absences. A grade of "W" will be assigned if a student drops, or is dropped from a class prior to mid-term. After mid-term, a grade of "WF" is assigned unless there are extenuating circumstances and the student is passing the course at the time of withdrawal.

Tardies: A student is considered tardy if he or she arrives for class after the roll has been taken. Three tardies constitute 1 hour of absence.

Assigned Work: If a student is absent the day an assignment (test and/or homework) is due, he or she is required to complete the work on the first day back in class.
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Classroom Etiquette: An integral part of an education is developing a sense of integrity and responsibility not only toward ourselves but also toward others. In the classroom, as on the job or in your home, exhibiting appropriate behavior reflects on your maturity. Arriving on time to class, being prepared, and considerate of others as they are talking has a positive effect on others. Please be considerate.

Student ID: It is mandatory that every student wear his or her student ID at all times. Instructors are required to dismiss students without ID from class. The student may get his/her ID (or a new one from Student Services for $3.00) and return to class before the midpoint of the class. If the student cannot get his/her ID and return to class by the midpoint, the instructor will record the absence.

Disabilities Statement: Students with disabilities are encouraged to contact the Dean of Student Services to discuss needs or concerns as they pursue an academic program and participate in campus life. The Dean of Student services will provide guidance regarding official documentation of disabilities and/or accommodation of needs. (See College Catalog)

RESOURCES (A-V, persons, tools/equipment): Allen-Bradley SLC500 PLC and the associated software. PLC video tapes by Tel-a-Train.

COURSE TOPICAL OUTLINE (List topics and sub-topics of course) and Calendar or approximate length of time devoted to topic.

CHAPTER 1 PROGRAMMABLE LOGIC CONTROLLERS  
a. Overview Video 
b. Principles of Operation  
c. Videotape #1 "Automatic Control Systems"

CHAPTER 2 PLC HARDWARE COMPONENTS  
a. I/O Section 
b. CPU  
c. Memory Design  
d. Programming Devices  
e. Videotape #2 "Control Devices"  
f. Lab #1 "Introduction to PLCs"

CHAPTER 3 NUMBER SYSTEMS AND CODES  
a. Binary System  
b. Hexadecimal System  
c. Encoding and Decoding  
d. Videotape #5 "Number Systems"  
e. Lab #2 "Entering a Program"
COURSE TOPICAL OUTLINE: (continued)

CHAPTER 4  FUNDAMENTALS OF LOGIC
  a. Binary Concept
  b. Logic Gates
  c. Boolean Algebra

CHAPTER 5  BASICS OF PLC PROGRAMMING
  a. Processor Memory
  b. Programming Languages
  c. Instruction Set
  d. Types of Communication Video
  e. Ladder Diagram
  f. Videotape #3 "PC Hardware & Ladder Logic"
  g. Lab #3 "Ladder Programming, Part 1"

CHAPTER 6  WIRING DIAGRAMS AND LADDER PROGRAMS
  a. Control Devices
  b. Relay Ladder Diagrams
  c. Ladder Diagram Programming of a PLC Video
  d. PLC Ladder Programs
  e. Videotape #4 "PLCs: Specialized Computers"
  f. Lab #4 "Ladder Programming, Part 2"
  g. Statement List Programming of a PLC Video

CHAPTER 7  PROGRAMMING TIMERS
  a. Timer Instructions
  b. ON-DELAY/OFF-DELAY
  c. Retentive Timers
  d. Lab #5 "Timers"

CHAPTER 8  PROGRAMMING COUNTERS
  a. Counter Instructions
  b. Up/down Counters
  c. Cascading Counters
  d. Lab #6 "Counters"

CHAPTER 9  PROGRAM CONTROL INSTRUCTIONS
  a. MCR
  b. Jump
  c. Forcing I/O

CHAPTER 10  DATA MANIPULATION INSTRUCTIONS
  a. Data Transfer
  b. Data Compare
  c. Data Manipulation
  d. Set-point Control
COURSE TOPICAL OUTLINE: (continued)

CHAPTER 11  MATH INSTRUCTIONS
   a. Math Instructions
   b. Add/Subtract
   c. Multiply/Divide

CHAPTER 12  SEQUENCER INSTRUCTIONS
   a. Sequencer Instructions
   b. Sequencer Program
   c. Lab #7 “Drum Timer”

CHAPTER 13  PLC TROUBLESHOOTING
   a. Electrical Noise
   b. Grounding
   c. Program Editing
   d. Preventive Maintenance
   e. Videotape #6 “Troubleshooting, Part 1”
   f. Videotape #7 “Troubleshooting, Part 2”
   g. Lab #8 “Troubleshooting”

LEARNING OUTCOMES/OBJECTIVES OF COURSE: Upon completion of this course the student will have demonstrated the ability to:

1. Identify the parts of a PLC and describe their functions.
2. Describe the basic purpose and applications for discrete and analog I/O.
3. Develop fundamental PLC ladder programs for relay logic, timers, counters, MCR, and sequencers.
4. Perform preventive maintenance and basic troubleshooting on PLCs.
5. Enter and print a PLC program using the appropriate computer software.
6. Document a PLC ladder program using both rung and instruction comments.

INSTRUCTIONAL METHODS TO COMPLETE OUTCOMES/OBJECTIVES: Classroom lectures, demonstrations, videotapes, textbook assignments and lab experiments.

EVALUATIVE METHODS TO APPRAISE OUTCOMES/OBJECTIVES: Eight or more unit tests will be given. The unit average will constitute 80% of the course grade with 20% assigned to labs.

GRADING SCALE:
   94 - 100 = A
   86 - 93 = B
   78 - 85 = C
   70 - 77 = D
   Below 70 = F