# NORTHEASTERN TECHNICAL COLLEGE
## COURSE OUTLINE

<table>
<thead>
<tr>
<th>COURSE:</th>
<th>PREFIX NO.</th>
<th>EFFECTIVE DATE</th>
<th>NEXT REVIEW DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEM</td>
<td>252</td>
<td>Spring 2014</td>
<td>Spring 2016</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>TITLE:</th>
<th>CREDITS</th>
<th>CONTACTS</th>
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<tbody>
<tr>
<td>Programmable Controllers Applications</td>
<td>3.0</td>
<td>2.0 3.0 3.0</td>
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| PREREQUISITES: | EEM 251 |

**DESCRIPTION:** This course covers the application of programmable controller theories and operation procedures. Topics such as interfacing data manipulation, and report generation are covered. Programmable controller projects are constructed, operated, and tested.

**TEXTBOOK(S) OR ALTERNATIVE:** Programmable Controller Circuits, by Roger M. Bertrand and Programmable Logic Controllers by Petruzella

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

**COLLATERAL READING:** Reference Books – Electric Motor Controls by Mazur.

**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 result.

- **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/she is required to complete the work on the first day back in class.

- **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 being 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. During the first week of classes, the instructor will issue a reminder to wear the ID. This reminder is a warning.

Then 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 SLC 500.

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

**TENTATIVE**

**SECTION 1:** ADVANCE PLC INSTRUCTIONS (Chapters 9-13 in PLC’s by Petruzella)
A. Program Control Functions
B. DATA Manipulation
C. Math
D. Sequencer and Shift Register
E. Installation Practices, Editing and Troubleshooting

**SECTION 2:** PLC PROGRAMMING
A. Review of SLC 500 Programming using RS-Logic
B. Stop-Start
C. Latch/Unlatch
D. Run and Jog

**SECTION 3:** PROJECTS
A. Bag Conveyor
B. Forward/Reverse
C. Bottle Count
D. Electric Break
COURSE TOPICAL OUTLINE (Continued)

SECTION 4: SPECIAL PROJECTS
A. Press Cycle  
B. Multi-Speed Motor  
C. Conveyor System  
D. Log Kicker

SECTION 5: ADVANCE PROJECTS  
A. Stop Light Control  
B. Robotic CIM Cell  
C. Fluid Process Control Cell  
D. Sequencer Controlled Car Wash

LEARNING OUTCOMES/OBJECTIVES OF COURSE: Upon completion students will be able to:

1. Program a PLC with a CRT programmer.
2. Develop Programs for control of industrial machines.
3. Install PLC controllers on industrial machines.
4. Troubleshoot system controlled by PLC's.

INSTRUCTIONAL METHODS TO COMPLETE LEARNING OUTCOMES/OBJECTIVES:
Lectures, individual and group discussion, demonstrations, and project assignments.

EVALUATIVE METHODS TO APPRAISE LEARNING OUTCOMES/OBJECTIVES:
The final grade will be determined by a combination of chapter test averages and proper completion of lab projects. Chapter test will count 1/3 of the final grade and lab projects the other 2/3.

Lab project grades will be determined using the grading scale listed below. Successful completion of each project includes proper documentation and demonstrating that your simulation works according to the project guidelines. Lab projects will be completed in teams of 2 to 3 students. Each student will have to demonstrate active participation in each project to receive full credit.

GRADING SCALE:
A 30 Projects plus Both Robots and CIM Cell project**
B 30 Projects plus One Robot CIM Cell project**
C 30 Projects**
D 23 Projects**
F Below 23 Projects

**These grades may also require individual successful completion of a mid-term and final exam.
Guidelines for Completing Chapters in
PROGRAMMABLE LOGIC CONTROLLERS
By
Frank D. Petruzella

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

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

CHAPTER 12 SEQUENCER INSTRUCTIONS
a. Sequencer Instructions
b. Sequencer Program

CHAPTER 13 PLC TROUBLESHOOTING
a. Electrical Noise
b. Grounding
c. Program Editing
d. Prevention Maintenance
e. Video tape #6 “Troubleshooting, Part 1”
f. Video tape #7 “Troubleshooting, Part 2”

Guidelines for Completing Lessons in
PROGRAMMABLE CONTROLLER CIRCUITS
By
Roger M. Bertrand

Complete each experiment for the projects listed below by:

1. Develop a ladder logic diagram
2. Wire the circuit
3. Having your instructor check out and test the circuit
4. Complete a project sheet with the following:
a. PLC ladder logic diagram
b. Terminal wiring diagram
c. Input/Output listing
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Project #6 Stop-Start (PLC)
  6.0 Stop-Start
  6.1 Sequence Start
  6.2 Latch/Unlatch
  6.3 Master Control Reset
  6.4 Hand-Auto
  6.5 Non-Sequential Lights

Project #7 Run & Jog
  7.0 Run & Jog
  7.1 Selector Jog
  7.2 Bit Moving-MOV and MVM instructions only

Project #8 Bag Conveyor
  8.0 Bag Conveyor
  8.1 Timed Motor Sequence
  8.2 Timed Press Circuit
  8.3 Cycle Timer
  8.4 Non-Sequential Starts

Project #9 Forward/Reverse (Off-Delay)
  9.0 Forward/Reverse
  9.1 For-Rev Low-High

Project #10 Up-Down Counter
  10.0 Up-Down Counter
  10.1 Bottle Count 1
  10.2 Bottle Count 2

Project #11 Forward & Reverse (Sequence)
  11.0 Forward & Reverse
  11.1 Electric Brake
  11.2 Reset to Park

Project #12 Press Cycle
  12.0 Press Cycle
  12.1 Temperature Conversion 1
  12.2 Barbecue Sauce

Project #14 Multi-Speed Motor
  14.1 Sequence Lights

Project #16 Conveyor System
  16.0 Conveyor System
  16.1 Box Conveyor

Project #18 Log Kicker
  18.0 Log Kicker

Advance Projects not found in Textbook.
  Project A  Robotic CIM Cell