SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: Programmable Logic Controllers

CODE NO. : ELR824   **SEMESTER:** FOUR

PROGRAM: CONSTRUCTION & MAINTENANCE/INDUSTRIAL ELECTRICIAN APPRENTICESHIP

AUTHOR: R. Allen

DATE: JAN 2010   **PREVIOUS OUTLINE DATED:** JAN 2009

APPROVED: *"Corey Meunier"*
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                 CHAIR   **DATE**

TOTAL CREDITS: 5

PREREQUISITE(S):

HOURS/WEEK: 4

I.   COURSE DESCRIPTION:

The student will develop an understanding of the hardware and software associated with the Allen Bradley 5 family PLCs. PLC programming techniques using RS logic 5 software will be used to design, document and commission basic to intermediate PLC lab assignments.

II.   LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1.   *Describe the function and basic operation of a PLC and understand the related terminology including numbering system*

Potential Elements of the Performance:
- Describe the function of a PLC and state its applications
- State the majour advantages of a typical logic controller(PLC) over conventional hardware relay systems
- Identify the four majour components of a typical PLC and describe the functions of each
- Identify the two distinct types of memory
- Understand decimal, binary, octal, hexadecimal, binary coded decimal (BCD) numbering systems
- Perform conversions from one system to another

2.   *Understand the I/O addressing and hardwiring requirements.*

Potential Elements of the Performance:
- Define the term discrete and the term analog
- Describe the I/O section of a PLC
- Define the term Interposing relay
- Define the term Optical Isolation
- Relate the I/O addressing to physical location
- Describe the proper wiring connections for input/output devices and their corresponding modules
- Describe how basic AC and DC input and output modules work and identify a hard-wiring diagram

3. ***Develop and demonstrate basic programming techniques for AB 5 PLC's using RS Logix Software***

Potential Elements of the Performance:
- Describe basic programming techniques
- Understand the Examine ON, OFF timers, counters, move, limit test, sequencers and Internal Storage instructions
- Describe the Force On and Off features and hazards that could be associated with both
- Program basic PLC functions offline
- Program PLC's to contrl
- Hard-wire PLCs to field equipment and input/output cards
- Create documentation to add to a PLC program

4. ***Demonstrate the ability to write basic PLC programs to control various electrical equipment in the lab and run the programs on a PLC***

Potential Elements of the Performance:
- Download a program to a PLC which is interfaced to a PC
- Download a program to a PLC from a remote PC over Ethernet through a gateway server to Data Highway and then to a particular PLC in the Lab
- Edit online programs
- Upload a program to a PC from a PLC
- Program basic PLC functions online
- Program PLCs to control Motors, Traffic lights
- Download a program to a local PLC and run a program
- Download a program to a remotely located PLC from room B1035 to room B1050 over the Ethernet network to a gateway server to the AB Data Highway to a particular PLC and run a program

5. ***Demonstrate the ability to connect PLCs to control various electrical equipment in the lab and run the programs in a PLC in the lab***

Potential Elements of the Performance:
- Hard-wire PLCs to field equipment and I/O cards
- Hardwire PLCs to control motors and traffic lights
- Troubleshoot PLC control systems

III.   TOPICS:

   1.   Overview of PLC terminology and principles
   2.   Overview of Industrial controls and automation hardware/software
   3.   Overview of RS Logix 5 software
   4.   Overview of PLC/PC networking
   5.   Basic PLC programming and troubleshooting

IV.   REQUIRED RESOURCES/TEXTS/MATERIALS:
          Instructor will indicate this in the first theory class

V.   EVALUATION PROCESS/GRADING SYSTEM:

Test 1	15 marks	15%
Practical Test 1	15 marks	15%
Test 2	25 marks	25%
Practical Test 2	20 marks	20%
Lab demonstrations	5 marks	5%
Lab write-ups/Class Participation and Quizes	20 marks	20%
Totals	100 marks	100%

The following semester grades will be assigned to students:

Grade	Definition	Grade Point Equivalent
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00

CR (Credit)	Credit for diploma requirements has been awarded.
S	Satisfactory achievement in field /clinical placement or non-graded subject area.
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.
X	A temporary grade limited to situations with extenuating circumstances giving a

	student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

VI.   SPECIAL NOTES:

Course Outline Amendments:
The professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Retention of Course Outlines:
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Prior Learning Assessment:
Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question. Please refer to the Student Academic Calendar of Events for the deadline date by which application must be made for advance standing.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.

Substitute course information is available in the Registrar's office.

Disability Services:
If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Communication:
The College considers **WebCT/LMS** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the **Learning Management System** communication tool.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Code of Conduct*. A professor/instructor may assign a sanction as defined below, or make recommendations to the Academic Chair for disposition of the matter. The professor/instructor may (i) issue a verbal reprimand, (ii) make an assignment of a lower grade with explanation, (iii) require additional academic assignments and issue a lower grade upon completion to the maximum grade "C", (iv) make an automatic assignment of a failing grade, (v) recommend to the Chair dismissal from the course with the assignment of a failing grade. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Student Portal:
The Sault College portal allows you to view all your student information in one place. **mysaultcollege** gives you personalized access to online resources seven days a week from your home or school computer. Single log-in access allows you to see your personal and financial information, timetable, grades, records of achievement, unofficial transcript, and outstanding obligations. Announcements, news, the academic calendar of events, class cancellations, your learning management system (LMS), and much more are also accessible through the student portal. Go to https://my.saultcollege.ca.

Electronic Devices in the Classroom:
Students who wish to use electronic devices in the classroom will seek permission of the faculty member before proceeding to record instruction. With the exception of issues related to accommodations of disability, the decision to approve or refuse the request is the responsibility of the faculty member. Recorded classroom instruction will be used only for personal use and will not be used for any other purpose. Recorded classroom instruction will be destroyed at the end of the course. To ensure this, the student is required to return all copies of recorded material to the faculty member by the last day of class in the semester. Where the use of an electronic device has been approved, the student agrees that materials recorded are for his/her use only, are not for distribution, and are the sole property of the College.

Attendance:
Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

 It is the departmental policy that once the classroom door has enclosed, the learning process has begun. Late arrivers will not be granted admission to the room.

Class/Lab Conduct:
Attendance to scheduled lab activities is compulsory, unless permission has been granted by the instructor. Lab attendance and final grades are directly related . **Students must continuously wear all Sault College required personal protective equipment (PPE) during lab activities. Failure to do this will result in expulsion from the lab activity and a grade of zero being assigned. Students are expected to be wearing their PPE prior to entering the lab. The instructor will advise what specific PPE is required (safety glasses will definitely be required).** Unsafe conduct in the lab will not be tolerated.

If a student arrives late for, or is not continuously present and actively participating at (scheduled breaks excepted) a scheduled lab class he/she will considered absent for the entire class and will not be permitted to submit the associated lab report.

Use of cell phones/PDAs for any form of communication (voice text/internet) during class is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and <u>must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 being assigned.</u>

Students may not wear earphones of any kind(i.e. for play back of recorded music/voice) during lab activities or test sittings. This does not include hearing aids required for hearing impaired.

Students are expected to maintain an active Sault College email account. They are required to check this email account daily. The instructor may announce details of lab and test requirements and scheduling though the Sault College email system (as well as sharing other important information).

Any requests to deviate from the aforementioned course outline requirements must be made to the instructor in writing or via Sault College email. If permission is granted it must also be granted in writing or via Sault College email. Verbal requests/permissions are not acceptable. It is the student's responsibility to maintain a copy of all such requests and associated permissions.