SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE:	**AUTOMATIC ELECTRICAL SYSTEMS**		
CODE NO.:	**ELR 3200**	**SEMESTER:**	**Fall**
PROGRAM:	**ELECTRICAL TECHNOLOGY**		
AUTHOR:	**R. CHARTRAND**		
DATE:	**3/29/2007**	**PREVIOUS OUTLINE DATED:**	**08/2002**
APPROVED:			
	_____ **DEAN**		_____ **DATE**
TOTAL CREDITS:	**7**		
PREREQUISITE (S):	**ELR2230 and ELN 2300**		
HOURS/WEEK:	**6 hours per Week**		

I. COURSE DESCRIPTION:

The student will develop an understanding of control system integration, equipment such as different PLCs, HMIs, analog cards, communication interfaces for instrumentation and Basic Industrial Networks. Advanced PLC techniques using Allen Bradley PLC5 family and the Slick 500 family PLCs will be used to connect, commission and document individual sections and components of an automated control systems and a basic Industrial Network again using Allen Bradley equipment. The student will interface PLCs to form the bases to communicate to other PLCs and remote equipment such as industrial drives and process control loops.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Potential Elements of the Performance:

   Identify and list the equipment and components that make up a basic automated control system network

   Identify and state the function of components of the SLC 500 Family PLCs

   State the function, operation and set-up of analog cards used on PLC 5 and SLC 500 series PLC

   Discus the function, advantages, and limitations of PLCs in Industrial Process Control Loops.

   Discus the basic communication functions of PLC 5 and 500

   Discus the function of PID in the PLC software control blocks for the PLC 5 and SLC 500 series PLCs.

   State the difference between Remote I/O, Adaptor Mode, and Scanner Mode, Master/Slave operation of PLCs and their interfaced components

   Discus the function of Message block commands used in Peer-to-Peer Communications for PLC 5 and Slick 500 series PLCs.

2. Potential Elements of the Performance:

   Develop advance PLC 5 programs to control various electrical equipment

   Develop advance PLC Slick 500 programs to control various electrical equipment

   Program PLC 5 processors using RSlogic programming software

   Program PLC Slick-500 processors using RSlogic-500 programming software

   Configure PLC Analog input and output interfacing modules

   Configure PLC, PID software advance instructions

   Program a PLC to control a single loop process

   Configure and program PLC for both scanner and adaptor mode operations

   Configure and program PLC peer to peer communications for data exchange

3. Potential Elements of the Performance:

   Develop advance HMI programs for the PLC 5 to control various electrical equipment

   Develop advance HMI programs for the PLC 500 to control various electrical equipment

   Develop advance HMI programs for the PLC Analog input and output interfacing modules for both PLC 5 and Slick 500 PLC

   Develop HMI for PLC peer to peer communications and Remote Master Slave communications

III. TOPICS:

1. Introduction control terminology and principles.
2. Overview of industrial controls and automation hardware/software
3. Overview of AB PLC 5 and Slick 500 hardware.
4. Overview of AB PLC 5 and Slick 500 software.
5. Overview of AB PLC 5 and Slick 500 Analog.
6. Overview of AB PLC 5 and Slick 500 PID.
7. Advanced PLC programming
8. Introduction to HIM Programming and Software
9. Introduction to PLC Networking Communications and Troubleshooting

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Text and Material will be indicated by the instructor

The student will be informed of the material required to purchase along with the cost and availability at the beginning of the course or with a minimum of 2 weeks notice prior to requiring it for course study.

V. EVALUATION PROCESS/GRADING SYSTEM:

Written Test 1	**15 marks**	**10% overall**
Written Test 2	**25 marks**	**20% overall**
Practical Test	**25 marks**	**25% overall**
Lab Write-ups	**15 marks**	**15% overall**
Lab Demonstration	**15 marks**	**15% overall**
Class Participation & or Quiz	**5 marks**	**5 % overall**
	Total 100 marks	**100 %**

	Write-ups	Demonstration including HMI	
Lab # 1	0 marks	0 marks	0% overall
Lab # 2	1 marks	1 marks	2% overall
Lab # 3	1 marks	1 marks	2% overall
Lab # 4	0 marks	0 marks	0% overall
Lab # 5	0 marks	0 marks	0% overall
Lab # 6	1 marks	1 marks	2% overall
Lab # 7	1 marks	1 marks	2% overall
Lab # 8	1 marks	1 marks	2% overall
Lab # 9	2 marks	2 marks	4% overall
Lab #10	2 marks	2 marks	4% overall
Lab #11	2 marks	2 marks	4% overall
Lab #12	2 marks	2 marks	4% overall
Lab #13	2 marks	2 marks	4% overall
Total	**15 marks**	**15 marks**	**30% overall**

The following semester grades will be assigned to students in postsecondary courses:

Grade	Definition	Grade Point Equivalent
A+	90 - 100%	4.00
A	80 - 89%	3.75
B	70 - 79%	3.00
C	60 - 69%	2.00
F (Fail)	**59% 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:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493 so that support services can be arranged for you.

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.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Rights and Responsibilities*. Students who engage in "academic dishonesty" will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. 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.

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.

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

Course outline important points:

In order to maintain a passing grade the student must obtain a minimum **60%** average in all subject sections that the course may have, such as, the theory Tests section, Practical Tests section, Lab & Lab Write-ups and Demonstrations of Labs to Instructor section.

If a student misses a test he/she must have a valid reason (e.g. medical or family emergency). A Doctors Slip may be requested by the instructor it a test or deadline is missed due to a medical emergency. In addition, the school must be notified before the scheduled test sitting.

The student should contact the instructor involved. If the instructor cannot be reached leave a message with the Dean's office or the College switchboard. If this procedure is not followed the student will receive a mark of **zero** on the test with no rewrite option.

The Instructor, if time permits, will summarize the main points of this course outline in the first Lecture. Student's questions related to the course outline will be addressed at that time. The Instructor through out the course may also expand on particular items related to the course outline and the course requirements.

It is the responsibility of the student to read the course outlines and be aware of the course requirements.

General Information to include in course outlines

Special Accommodations:
If you have a special learning need or issue, it works to your advantage to notify your instructor immediately if special devices or assistance will help you in this class.

Classroom Etiquette:
Pagers and cell phones should be either turned off or set to vibrate mode during class. Please show courtesy to the class by restricting conversation to in-class topics, and raise your hand to gain attention when asking a question or raising a point of discussion.

Turning in Work:
Be sure to include your name and the course name and section on all work to be turned in.

Late Coursework:
All assignments are to be turned in on the due date. Students may be allowed to make up any late work at the instructor's discretion.

Term tests/quizzes
With the expectation that the student will attend all classes, there will be no make up tests for missed tests. There will be no rewrites for low-test scores.

POLICIES AND EXPECTATIONS FOR LEARNING ENVIRONMENT:

Attendance
Students' attendance and participation are required in all activities. If a student is absent from class, it is her/his responsibility to find out what was missed prior to the next class and complete any assigned work **before** the next class. Absence does not constitute a reason for missed work or late assignments.

Assignments
Any Chapter review questions (written in a Text) are designed to help the student review and consolidate the theory presented in each of the chapters. The chapters in an assigned text, computer programs demos, computer text files and the hand out material that the instructor may provide to the student, are designed as walk-through learning tools and must be read for understanding **ahead of class**. The hands-on projects are designed to allow the student to apply and practice the concepts introduced in ELR 3200 while providing an opportunity to reinforce skills learned previously.

All assignments including Student Assignments, Lab Exercises, and Lab demonstrations are due on or before the due date specified in class. Assignments handed in on the due date must be in the instructor's hands **before** the specified time. **Late assignments will not be graded or checked.** Students **must** complete all assignment in the required time, no extensions will be permitted, therefore, the due date will be strictly enforced to provide time for the instructor to mark the lab write-up material and return it to the student. No photocopies or mass produced documents will be accepted.

ADDITIONAL:
Since all work must be performed on a special network server located at the college, there will be little opportunity to work on the projects at home. The reading, review questions, and planning must be done outside of class time.
All student assignment materials that are not picked up by the student will be held for a maximum of two weeks after grading. After this time materials may be discarded or used at the professor's discretion. Attendance may be monitored. Regular absentia may be reported to OSAP at the college's discretion.

Lab Write-ups Requirements

Labs 1A and 1B require no write-ups
Lab # 2 through and including Lab #13 all require write-ups and demonstration as outlined below.

1) Labs shall have a ladder logic diagram print out including documentation for both the Emulation portion and the actual PLC running portion of the Lab.
2) Labs shall have a Hardwire Schematic Diagram completed in AutoCAD or an acceptable alternate software-drawing program.
3) Labs shall have an AutoCAD or other acceptable alternate software drawing program of a complete lab wiring diagram which will include all lab associated equipment, PLC processors, cards, racks along with lights, switches and wires were applicable
4) Labs shall have an I/O listing,
5) Labs shall have a brief description of operation and function described in the students own words and it shall be typed using a word processor program such as WordPerfect, Word etc.
6) All lab assignments must be turned in on hard copy and on computer disk(s) before or no later than the last lab class of the semester. The disk(s) will contain all program drawings, word-processor write-ups HMI files and PLC programs files
7) Labs that require tables shall be done in a spreadsheet or a word processor the can produce a table.
8) Each lab may have specific requirements which the instructor will inform the students during the lab period. These requirements may include changes to the equipment, procedure, write-ups, demonstrations or any other requirement that the instructor deem as necessary. So all students must attend the labs to obtain any of the specific requirements. These will only be given out on the day of the particular lab is scheduled
9) If the student is not clear on any of the lab requirements, it is his/her's responsibility to ask the instructor for clarification

NOTE:
Each student must demonstrate the lab to the instructor and turn in a write-up as outline. The student must obtain a passing mark (grade) in each area of the course sections as described below.

- Written Tests, and Practical test student must obtain 60%
- Write-up, student must obtain 60% and turn in a write-up for all 9 complusery labs (2 to 13) to obtain a grade in this portion of the course
- Demonstration, student must obtain 60% marks and the student must have demonstrated all 9 complusery labs (2 to 13), to obtain a grade in this portion of the course. Each student must demonstrate the assigned projects.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.

STUDENT COURSE AGREEMENT

I, _____ student ID # _____

(Please print)

with regards to the course known as

_____

COURSE CODE # **ELR 3200** have read and understood the course content, outline and expectations which clearly state the following:

1- Absolutely no make up tests or exams will be administered with the exceptions of personal illness, or death of an immediate family member both requiring written verification.

2- All labs (projects) must be handed in by the due date or a grade of 0 will be awarded.

3- Lab & lecture attendance are at the students discretion. Any lecture notes, lab assignments etc. missed will become the student's responsibility to retrieve from another student.

4- Lab or lecture quizzes can be presented at anytime without prior notification.

5- All Demonstrations must be completed during assigned Lab times unless prior approval is obtained form the instructor. Demonstration times will be at the discretion of the Instructor.

6- Students will be able to demonstrate the assigned projects only once at which time the instructor will grade project as complete or incomplete. Complete will result in full marks for that project, while incomplete will result in a 0 mark for that particular project. So each student must be sure that the lab is ready for demonstration.

7- In order to maintain a passing grade the student must obtain a minimum 60% average in all subject sections that the course may have, such as, the theory Tests section, Practical Tests section, Lab & Lab Write-ups and Demonstrations of Labs to Instructor section

_____

(Signature) (Date)

Student Lab Evaluation Sheet ELR 3200

Student's Name_____ Mark _____

NOTE: Each student must turn in his/her own sheet with each lab demonstration verified by the instructor signature. If the student does not turn the sheet with all labs signed by the instructor the write-up will not be accepted and the student will be assessed a mark of 0% resulting in an overall F (fail) grade for ELR 3200.

Lab #	Description NOTE: All labs are complusery unless state other wise	Demo Mark	Instructor=s Signature	Write-up Mark
1	LAB SET-UP & MOUNT HARDWARE BOTH AB-5 LAB #1A & SLC 500 SERIES LAB # 1B	No mark		No mark
2	SET-UP AB-5 ANALOG IN & OUT CARDS			
3	SET-UP ANALOG IN & OUT CARDS ALONG WITH THE PID BLOCK & PERFORM AN OPEN LAB ASSIGNMENT			
4&5	SMC / 1305 / 1336 optional	No mark		No mark
6	PROGRAM SLC 500s USING RS LOGIC 500 FROM B1050 TO CONTROL 3 MOTORS			
7	PROGRAM SLC 500s USING RS LOGIC 500 FROM B1050 TO CONTROL TRAFFIC LIGHT USING TIMERS LIMIT TEST & SEQUENCERS			
8	PROGRAM SLC 500s USING RS LOGIC 500 FROM B1050 TO CONFIGURE, SET-UP, OPERATE ANALOG IN / OUT CARDS			
9	PROGRAM SLC 500s USING RS LOGIC 500 WITH PID AND PERFORM AN OPEN LOOP LAB ASSINGMENT			
10	AB-5 REMOTE I/O AND ADAPTOR MODE			
11	AB-5 Remote I/O To SLC 500 Series PLC			
12	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR AB-5			
13	PEER TO PEER COMMUNICATION USING MESSAGE BLOCKS FOR SLC 500 PLCs			
	Total Marks			