

I. COURSE DESCRIPTION:

This course introduces the student to AC and DC solid state motor drives and associated equipment. Theory will be supported by lab exercises that will provide the students with hands-on experience with typical commercial AC and DC motor drives.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. *Connect, test and analyze single and polyphase diode rectifier circuits.*

Potential Elements of the Performance:

- Describe and demonstrate the operation of single-phase half wave and full wave rectifiers.
- Describe and demonstrate the operation of three-phase star (half wave) and full wave rectifiers.
- Describe and demonstrate transformer connections for, and operation of, six-phase star (half wave) rectifiers.

2. *Connect, program and test DC motor drive systems.*

Potential Elements of the Performance:

- Identify the major components of a DC drive system.
- Describe the relationship between firing angle, load voltage, CEMF, and motor speed.
- Describe four-quadrant control of a DC motor.
- Describe open and closed loop DC speed control systems and describe their characteristics.
- Describe the operation and Application of encoders, resolvers, and tachogenerators as feedback devices.
- Explain the operation of a DC chopper drive controller.

- Connect a commercially available SCR speed controller to a DC motor, properly calibrate the controller for the motor and confirm its operation.
- Describe and demonstrate the procedure for testing the output SCR's of a DC motor control system for proper operation.

3. *Connect, program and test AC motor drive systems.*

Potential Elements of the Performance:

- Identify the major components on a commercially available AC Variable Speed Drive including rectifiers, power supply components, and inverter components.
- Describe the operation of a three-phase AC Variable Speed Drive Controller.
- Connect, calibrate and confirm the operation of a commercially available AC Variable Speed Drive Controller.
- Explain the procedure to test, remove, and replace if necessary, the output transistors in a variable speed drive.
- Define harmonics and describe their causes and effects on AC Systems.
- Explain the operation of reactors and their application to AC Variable Speed and DC Motor Drive Systems as a method used to control harmonics on AC Power Systems.
- Explain the principle of operation of serial communication.
- Identify common serial communication hardware and protocols.

III. TOPICS:

1. Diode Rectifiers.
2. DC Motor Drives.
3. AC Motor Drives.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

- Industrial Control Electronics: Devices, Systems & Applications by Bartelt (Current Edition)
- Electronics for Industrial Electricians by Herman (Current Edition)
- Notes supplied by instructor
- Hand tools
- Safety Glasses

V. EVALUATION PROCESS/GRADING SYSTEM:

Tests	60%
Shop activities and associated reports:	40%

If a student misses a test/lab he/she must have a valid reason (i.e. medical or family emergency – documentation may be required). In addition, the instructor **must** be notified **prior** to the test or lab sitting. If this procedure is not followed the student will receive a mark of zero on the test/lab with no make-up option. Students may not submit lab reports for labs in which they were not in continuous attendance. Lab reports not submitted by the assigned deadline will receive a grade of 0.

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

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

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.

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.

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*. 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.

Class/Lab Conduct:

Attendance to scheduled lab activities is compulsory, unless permission has been granted by the instructor. Lab attendance and final grade 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 required 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 is absent, arrives late for, or is not continuously present and actively participating at (scheduled breaks excepted), a scheduled lab class he/she will be 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...) during class or lab time is strictly prohibited. Cell phones/PDAs must be silenced during regular class and lab times and 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.

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 through the Sault College email system (as well as sharing other important information).

Any request 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.

VII. 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.

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

VIII. LAB REQUIREMENTS:

1. All lab reports are to be computer generated (circuit diagrams may be neatly hand drawn).
2. All lab reports are to include a title page with the following information:
 - Lab title and number
 - Due date
 - Date submitted
 - Course number
 - Names of group members
 - Instructor's name
3. Lab reports are to include all procedures, observations and data listed in the order they were performed/taken and numbered to match the lab handout. Incomplete lab reports and/or improperly formatted lab reports will result in substantial deductions (up to 100%) of the lab mark.
4. . When required, a lab summary is to be a minimum 1 page (double spaced, Arial size 12 font, maximum 1 inch margins) in length and is to be an analysis of the results. The summary is not to be a regurgitation of the results. It is expected that students will use course notes, library resources and Internet research to assist in writing lab summaries. Labs submitted with a substandard summary will receive a grade of 0.
5. One lab report submission per group. Instructor must approve all groups.
6. Lab reports are due at the beginning of class 1 week after the scheduled period in which it was done. Late submissions will receive a grade of 0.
7. Students are not permitted to work on live equipment outside of regular class time. If a student misses all or part of a lab class he/she will not be permitted to submit the corresponding lab report.
8. Students must supply their own hand tools and safety glasses. Students will not be permitted in the lab without safety glasses and must wear the safety glasses whenever working on or around live equipment. Students must never work alone in the lab. Unsafe work habits will not be tolerated. Student responsibilities include maintaining a clean and safe lab environment.
9. ELR821 labs will require the use of college computers and microprocessor controlled equipment (programmable controllers and solid state drives). Students may not change set-up configurations of such equipment without faculty permission. Unauthorized tampering with equipment will result in the student's expulsion from the lab.
10. Students must sign and provide the instructor with a copy of this page before being permitted to work in the lab.

I have read and understand the above requirements:

Name (print): _____ Signature: _____

Date: _____