



**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%

While marks are not given for attendance, marks may be deducted for classes missed. See Special Notes section.

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

| <b>Grade</b> | <b><u>Definition</u></b>   | <i>Grade Point Equivalent</i> |
|--------------|--|-------------------------------|
| 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:

### 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 professor and/or the Special Needs office. Visit Room E1101 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.

If a student misses a test or a lab he/she must have a valid reason (i.e. medical or family emergency – documentation will be required). In addition, the instructor **must** be notified **prior** to the test sitting or lab class. If this procedure is not followed the student will receive a mark of zero on the test or lab with no make-up option.

If a student arrives late for a lab class he/she will be considered absent for the entire class.

Students must wear safety glasses in the lab when working on or around live circuits and equipment. Any student not doing so will be asked to leave the lab immediately. Unsafe conduct in the lab will not be tolerated.

**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.

**IX. LAB REQUIREMENTS:**

1. All lab reports are to be computer generated. Hand written reports will not be accepted.
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 and observations listed in the order they were performed/taken and numbered to match the lab handout.
4. Every lab report is to conclude with an analysis (whether requested in the lab document or not). The analysis is not to be a summary of the procedures and results. It is expected that students will use course notes, library resources and Internet research to assist in writing up the lab.
5. One lab report submission per group. Maximum 2 members per group.
6. Lab reports submitted with grammatical and/or spelling errors will receive a grade of 0. Word processors have spell check, it is expected students will use it.
7. 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.
8. 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.
9. 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.

I have read and understand the above requirements:

Name (print): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_