



INSTRUCTIONAL PACKAGE

EEM-221
DC/AC Drives

Effective Term
Fall 2023/Spring 2024/Summer 2024

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Part I: Course Information

Effective Term: Spring 2023/Spring 2024/Summer 2024

COURSE PREFIX: EEM-221

COURSE TITLE: DC/AC Drives

CONTACT HOURS: 5

CREDIT HOURS: 3

RATIONALE FOR THE COURSE:

This course introduces students to dc and ac motor control devices. Students will learn how to interpret variable speed and frequency drive device signals used to control AC and DC motor speed and torque. This course also teaches students those skills necessary to maintain, troubleshoot, and repair AC and DC drive systems.

COURSE DESCRIPTION:

This course covers the principles of operation and application of DC drives and AC drives.
3.000 Credit hours
2.000 Lecture hours
3.000 Lab hours.

PREREQUISITES/CO-REQUISITES:

((ACCUPLACER Reading Comp 056 and ACCUPLACER Sentence Skills 058) or (New ACCUPLACER Reading Comp 235 and New ACCUPLACER Sentence Skills 235) or (COMPANION Reading 056 and COMPANION Sentence Skills 058) or (SAT Critical Reading 380) or (ACT Reading 14 and ACT English 12) or (Multiple Measures English 1) or (Credit level [ENG 032](#) Minimum Grade of C* or Credit level [ENG 100](#) Minimum Grade of C* or Credit level [ENG 155](#) Minimum Grade of C or Credit level [ENG 155](#) Minimum Grade of TC or Credit level [ENG 101](#) Minimum Grade of C or Credit level [ENG 101](#) Minimum Grade of TC)) and (Credit level [MAT 032](#) Minimum Grade of C* or Credit level [MAT 155](#) Minimum Grade of C or Credit level [MAT 155](#) Minimum Grade of TC or Credit level [MAT 101](#) Minimum Grade of C or Credit level [MAT 101](#) Minimum Grade of TC) or (ACCUPLACER Elementary Algebra 040 or ACCUPLACER Arithmetic 024 or New ACCUPLACER Arithmetic 220 or New ACCUPLACER Adv Algebra 200 or SAT Mathematics 400 or New SAT Mathematics 350 or ACT Math 13 or Multiple Measures Math 1)

***Online/Hybrid** courses require students to complete the DLI Online Student Orientation prior to completing an online course. The DLI Online Student Orientation can be found in WaveNet, under the My Student tab.

REQUIRED MATERIALS:

Please visit the [BOOKSTORE](#) online site for most current textbook information. Use the direct link below to find textbooks.

Enter the semester, course prefix, number and section when prompted and you will be linked to the correct textbook.

ADDITIONAL REQUIREMENTS:

The following lists additional course requirements.

Scientific Calculator (TI 36X Pro or equivalent)

USB/Thumb Drive approx. 1 GB

¼" ruled graph paper

TECHNICAL REQUIREMENTS:

Access to Desire2Learn (D2L), HGTC's learning management system (LMS) used for course materials.

Access to myHGTC portal for student self-services.

College email access – this is the college's primary official form of communication.

STUDENT IDENTIFICATION VERIFICATION:

Students enrolled in online courses will be required to participate in a minimum of one (1) proctored assignment and/or one (1) virtual event to support student identification verification. Please refer to your Instructor Information Sheet for information regarding this requirement.

CLASSROOM ETIQUETTE:

As a matter of courtesy to other students and your professor, please turn off cell phones and other communication/entertainment devices before class begins. If you are monitoring for an emergency, please notify your professor prior to class and switch cell phone ringers to vibrate.

NETIQUETTE: is the term commonly used to refer to conventions adopted by Internet users on the web, mailing lists, public forums, and in live chat focused on online communications etiquette. For more information regarding Netiquette expectations for distance learning courses, please visit [Online Netiquette](#).

Part II: Student Learning Outcomes

COURSE LEARNING OUTCOMES and ASSESSMENTS*:

This course provides students with the following outcomes and assessments:

1. Students will describe the function of an Oscilloscope.
2. Students will describe the four components of an electrical waveform.
3. Students will describe the common Oscilloscope controls and their functions.
4. Student will be able to describe and practice the nine Oscilloscope safety rules.
5. Students will be able to use an oscilloscope to make amplitude, period, frequency, and floating measurements as well as floating measurements and measurements that require oscilloscope triggering.

6. Students will be able to describe motion control fundamental principles to include block diagram interpretation.
7. Students will be able to describe armature and field control principles to achieve constant torque and horsepower.
8. Students will be able to describe control techniques used to achieve bi-directional operation of a DC motor.
9. Students will be able to describe the operation of silicon controlled rectifier devices.
10. Students will be able to describe the operation of SCR circuits to include: half-wave rectifiers and a variety of SCR timing circuits.
11. Students will be able to describe and verify, the four quadrant operation of a DC Drive.
12. Students will be able to describe the function, construction, and operation of full-range spindle drives.
13. Students will be able to connect and operate a DC full-range drive.
14. Students will be able to describe the function and operation of motor field, voltage, and velocity control circuits of a DC full-range spindle drive.
15. Students will be able to describe terms associated with IR compensation circuits of a full-range spindle drive.
16. Students will be able to describe the function, construction, and operation of IR compensation circuits of a full-range spindle drive.
17. Students will be able to describe the importance of calibrating a full-range spindle drive and perform calibration of the drive.
18. Students will be able to describe the basic function, construction, and operation of the DC Base-speed drive.
19. Students will be able to describe the basic function, construction, and operation of the Velocity Feedback Control loop of a DC Axis drive.
20. Students will be able to describe the basic function, construction, and operation of the Current Feedback Control loop of a DC Axis drive.
21. Students will be able to calibrate a DC Base-speed drive.
22. Students will be able to describe the construction and operation and installation requirements of a DC pulse width modulation drive.
23. Students will be able to describe the function, construction and operation of a switching logic circuit in a DC PWM drive.
24. Students will be able to describe the function, construction, and operation of a power bridge circuit in a DC PWM drive.
25. Students will be able to describe the function of the voltage feedback loop; the current feedback control loop; and the voltage feedback control loop in a DC PWM drive
26. Students will be able to calibrate a DC PWM drive.
27. Students will be able to describe how to troubleshoot DC PWM, DC axis, DC spindle, and DC PWM drives using manufacturer's documentation.
28. Students will be able to describe and explain the operation of basic AC Drives.

29. Students will be able to connect, program, and operate a variable frequency drive for 2 and 3-wire control applications.
30. Students will be able to connect, program, and operate a variable frequency ac drive for Motor Jogging.
31. Students will be able to connect, program, and operate a circuit to control motor speed using a variable frequency ac drive.
32. Students will be able to connect, program, and operate a variable frequency drive to drive a motor speed above its base speed.
33. Students will be able to program and operate a Variable Frequency AC Drive to Provide Low Speed Boost.
34. Students will be able to explain the relationship between Volts per Hertz Ratio and the Torque Capabilities of a Motor.
35. Students will be able to explain how ramping is accomplished using a variable frequency ac drive.
36. Students will be able to program and operate a variable frequency ac drive to ramp a motor to its rated speed and to a motor stop.
37. Students will be able to describe how a Variable frequency drive can accelerate a motor past its rated speed.
38. Students will be able to describe S-curve acceleration and explain how it is used.
39. Students will be able to program and operate a variable frequency ac drive to ramp a motor past its rated speed and to provide S-curve acceleration.
40. Students will be able to describe six common faults that can be detected by a variable frequency drive.
41. Students will be able to troubleshoot a circuit containing a variable frequency drive, to include the parameter settings of the drive.
42. Students will be able to program a variable frequency drive to automatically clear and reset faults.

****Students – please refer to the Instructor’s Course Information sheet for specific information on assessments and due dates.***

GENERAL EDUCATION OUTCOMES:

This course fulfills the following General Education Outcomes through the EEM 221 assessment. Upon completion of this course, students will be able to:

- Communicate effectively;
- Think critically;
- Self and professional development.

Part III: Grading and Assessment

EVALUATION OF REQUIRED COURSE MEASURES/ARTIFACTS*:

Students' performance will be assessed and the weight associated with the various measures/artifacts are listed below.

EVALUATION*

Tests	30%
Labs	30%
Shop Practice	10%
Class Participation	10%
Final Exam	20%
	<hr/>
	100%

****Students, for the specific number and type of evaluations, please refer to the Instructor's Course Information Sheet.***

GRADING SYSTEM:

Please note the College adheres to a 10 point grading scale A = 100 – 90, B = 89- 80, C = 79 – 70, D = 69 – 60, F = 59 and below.

Grades earned in courses impact academic progression and financial aid status. Before withdrawing from a course, be sure to talk with your instructor and financial aid counselor about the implications of that course of action. Ds, Fs, Ws, WFs and Is also negatively impact academic progression and financial aid status.

The Add/Drop Period is the first 5 days of the semester for **full term** classes. Add/Drop periods are shorter for accelerated format courses. Please refer to the [academic calendar](#) for deadlines for add/drop. You must attend at least one meeting of all of your classes during that period. If you do not, you will be dropped from the course(s) and your Financial Aid will be reduced accordingly.

Part IV: Attendance

Horry-Georgetown Technical College maintains a general attendance policy requiring students to be present for a minimum of 80 percent (80%) of their classes in order to receive credit for any course. Due to the varied nature of courses taught at the college, some faculty may require up to 90 percent (90%) attendance. Pursuant to 34 Code of Federal Regulations 228.22 - Return to Title IV Funds, once a student has missed over 20% of the course or has missed two (2) consecutive weeks, the faculty is obligated to withdraw the student and a student may not be permitted to reenroll. **Instructors define absentee limits for their class at the beginning of each term; please refer to the Instructor Course Information Sheet.**

For online and hybrid courses, check your Instructor's Course Information Sheet for any required on-site meeting times. Please note, instructors may require tests to be taken at approved testing sites, and if you use a testing center other than those provided by HGTC, the center may charge a fee for its services.

Part V: Student Resources



THE STUDENT SUCCESS AND TUTORING CENTER (SSTC):

The SSTC offers to all students the following **free** resources:

1. **Academic tutors** for most subject areas, **Writing Center support**, and **college success skills**.
2. Online **tutoring** and academic support resources.
3. Professional and interpersonal communication **coaching** in the EPIC Labs.

Visit the [Student Success & Tutoring Center](#) website for more information. To schedule tutoring, contact the SSTC at sstc@hgtc.edu or self-schedule in the Penji iOS/Android app or at www.penjiapp.com. Email sstc@hgtc.edu or call SSTC Conway, 349-7872; SSTC Grand Strand, 477-2113; and SSTC Georgetown, 520-1455, or go to the [Online Resource Center](#) to access on-demand resources.



STUDENT INFORMATION CENTER: TECH Central

TECH Central offers to all students the following **free** resources:

1. **Getting around HGTC:** General information and guidance for enrollment!
2. Use the [Online Resource Center \(ORC\)](#) including scheduled technology training, Office 365 support, password resets, and username information.
3. **Drop-in technology support or scheduled training** in the Center or in class.
4. **In-person workshops, online tutorials and more services** are available.
5. **Chat with our staff on TECH Talk**, our live chat service. TECH Talk can be accessed on the student portal and on TECH Central's website, or by texting questions to (843) 375-8552.

Visit the [Tech Central](#) website for more information. Live Chat and Center locations are posted on the website. Or please call (843) 349 – TECH (8324) Option #1.



HGTC LIBRARY:

Each campus location has a library where HGTC students, faculty, and staff may check out materials with their HGTC ID. All three HGTC campus libraries are equipped with computers to support academic research and related school work; printing is available as well. Visit the [Library](#) website for more information or call (843) 349-5268.

STUDENT TESTING:

Testing in an **online/hybrid** course and in **make-up exam** situations may be accomplished in a variety of ways:

- Test administered within D2L
- Test administered in writing on paper
- Test administered through Publisher Platforms (which may have a fee associated with the usage)

Furthermore, tests may have time limits and/or require a proctor.

Proctoring can be accomplished either face-to-face at an approved site or online through our online proctoring service. To find out more about proctoring services, please visit the [Online Testing](#) section of the HGTC's Testing Center webpage.

The **Instructor Information Sheet** will have more details on test requirements for your course.

DISABILITY SERVICES:

HGTC is committed to providing an accessible environment for students with disabilities. Inquiries may be directed to HGTC's [Accessibility and Disability Service webpage](#). The Accessibility and Disability staff will review documentation of the student's disability and, in a confidential setting with the student, develop an educational accommodation plan.

Note: It is the student's responsibility to self-identify as needing accommodations and to provide acceptable documentation. After a student has self-identified and submitted documentation of a

disability, accommodations may be determined, accepted, and provided.

STATEMENT OF EQUAL OPPORTUNITY/NON-DISCRIMINATION STATEMENT:

Horry-Georgetown Technical College prohibits discrimination and harassment, including sexual harassment and abuse, on the basis of race, color, sex, national or ethnic origin, age, religion, disability, marital or family status, veteran status, political ideas, sexual orientation, gender identity, or pregnancy, childbirth, or related medical conditions, including, but not limited to, lactation in educational programs and/or activities.

TITLE IX REQUIREMENTS:

All students (as well as other persons) at Horry-Georgetown Technical College are protected by Title IX—regardless of their sex, sexual orientation, gender identity, part- or full-time status, disability, race, or national origin—in all aspects of educational programs and activities. Any student, or other member of the college community, who believes that he/she is or has been a victim of sexual harassment or sexual violence may file a report with the college’s Chief Student Services Officer, campus law enforcement, or with the college’s Title IX Coordinator, or designee.

*Faculty and Staff are required to report incidents to the Title IX Coordinators when involving students. The only HGTC employees exempt from mandatory reporting are licensed mental health professionals (only as part of their job description such as counseling services).

INQUIRIES REGARDING THE NON-DISCRIMINATION/TITLE IX POLICIES:

Student and prospective student inquiries concerning Section 504, Title II, Title VII, and Title IX and their application to the College or any student decision may be directed to the Vice President for Student Affairs.

Dr. Melissa Batten, VP Student Affairs

Title IX, Section 504, and Title II Coordinator
Building 1100, Room 107A, Conway Campus
PO Box 261966, Conway, SC 29528-6066
843-349-5228

Melissa.Batten@hgtc.edu

Employee and applicant inquiries concerning Section 504, Title II, and Title IX and their application to the College may be directed to the Vice President for Human Resources.

Jacquelyne Snyder, VP Human Resources

Affirmative Action/Equal Opportunity Officer and Title IX Coordinator
Building 200, Room 205B, Conway Campus
PO Box 261966, Conway, SC 29528-6066
843-349-5212

Jacquelyne.Snyder@hgtc.edu