

## Electric Motors and Controls

Spring, 2006

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**Basic Course Description:** ET 55 is a one-semester course in electric motors, motor controls, motor drives, and the basics of industrial control. An **algebra-level** math background as well as a strong reading ability will be very helpful. Completion of ELET B1 – Basic Electronics (DC and AC) is required; completion of ELET B9 – Solid State Electronics is recommended.

This course covers the electromechanical and electronic knowledge needed by those who work in industrial electronics, automation, materials/food/petroleum processing, and related industries. It is also recommended for those seeking employment in industrial maintenance and HVAC systems.

**Instructor:** Mr. Caras Office Phone: 395-4393 (during class hours)  
E-Mail: [scaras@bakersfieldcollege.edu](mailto:scaras@bakersfieldcollege.edu)  
Webpage: <http://www2.bakersfieldcollege.edu/scaras>

**Class Times:** M,W 6:30-9:36pm Room IT6  
Students can also make up labs when the instructor is teaching his other classes by simply arranging it with the instructor.

**Textbook:** Stephen L. Herman, **Industrial Motor Control**, Thomson/Delmar Learning, Fifth Edition, 2005, ISBN# 1-4018-3802-2

**Lab Manual:** None Required. The instructor will furnish all lab booklets/materials.

**Materials Needed:** *Scientific Calculator, Non-programmable.* (If your calculator has computer number conversion abilities, it will not be allowed during certain tests and the final exam.)  
*Circuit Breadboard (DIP board), Diagonal Cutters, Wire Strippers (for small gage wire), long-nosed pliers.*

**Please purchase alligator clips: Radio Shack# 270-375**

**Note:** All test equipment will be available for use in the Electronics lab.

**Instructor Office Hours:** Students are encouraged to come in during regularly scheduled office hours when they need assistance with the course assignments and content. **Mr. Caras' office hours are posted outside his office door**, and usually begin ½ hour before each class time, and ½ hour after each class time. (In other words, you can come in early before class, stay after class, or come in before another course's class time.)

## Student Success and Student Responsibilities

**You are enrolled in a college course that is meant to prepare you for the workforce.** Our goal is to provide you with organized lecture, lab activities, and resources that will help you successfully learn the material we present. In return, **we expect you to take responsibility for your success in this course.** The class is certainly challenging, but we feel that you will find it interesting, fun, rewarding, and worthwhile – as long as you take your responsibility as a student seriously.

Make sure these things are true for you as a student:

1. I am adequately prepared for the academic needs of this course:
  - I have taken a recent math course of **at least pre-algebra level**, or have the ability to perform this level of math without help.
  - I have the ability to **read and understand technical-level reading materials**, beyond a basic understanding of English and a basic reading level.
  - I have the ability to **write clearly and take adequate notes in class**.
2. **If I have academic difficulties in one or more of the areas listed above, I am willing to do what is needed to overcome these difficulties, such as:**
  - Seek tutoring assistance from the Learning Center.
  - Take needed Academic Development courses in: study skills, reading, writing, and note taking.
  - Take advantage of math tutorial computer programs in the Learning Center or Math Lab.
  - Ask the professor for suggestions on improving their academic abilities.
3. I can and will set aside uninterrupted study time of at least three hours per week or more as needed if I find the material extra-challenging.
4. I will ask questions in class for clarification if I don't understand.
5. I will strongly consider organizing or participating in a study group outside of class.
6. I will ask questions of the professor during office hours if extra help is needed.
7. I will keep up with reading assignments, worksheets, and written materials each week – not wait until just before they are due to complete them.
8. I will view studying for each test as an ongoing process – not something that is done a day or two before the test. I will try to read assignments before they are covered in classroom lecture.
9. I will actively participate in lab work, and share responsibilities equally with my lab partner.
10. I will take notes during lecture, and especially note anything that I have not already studied or that I don't fully understand.
11. I am able to focus on the class and meet their responsibilities as a student without being overly-challenged by the needs of school, work, and family.

12. If I have outside issues and challenges that interfere with my learning, I will do what is necessary to minimize their impact on my learning. This can include:
- Develop time management skills for outside issues.
  - Develop a support network for outside issues.
  - Assess honestly the amount of time I devote to class.
  - Discuss with the professor the interfering issues if appropriate.

### Student Responsibilities

As a student, you are being prepared for a career, and it makes perfect sense that we expect the same things from you that an employer would. Please read these responsibilities carefully. We want you to remain in this course for the entire semester and experience success. Not meeting your responsibilities will put your enrollment and success at risk!

Make sure you are willing to accept these responsibilities a student:

1. I will **demonstrate a great work ethic** while I am in this course. This includes:
  - **Being here and ready to work when the class begins**, because I understand that continued lateness – other than unavoidable job-related issues – could mean I will be dropped from the course. I also understand that my instructor is not responsible to warning me about absences before I am dropped.
  - **Keeping absences to a minimum**, because I understand that more than two weeks of absences will result in a drop from a class or the assignment of a failing grade regardless of my actual scores.
  - **Actively participating and focusing on the tasks at hand**. This means avoiding cell-phone interruptions (except for work or family emergencies), sleeping or inattention in class, or using distracting items such as music players and laptops during lecture.
2. I will **purchase the needed items** such as the textbook (if assigned), course materials packs, solderless breadboard, basic hand tools, and alligator clips, **and come to class prepared with these items**.
3. I will **do my own work**, including assignments and lab response sheets. I understand that turning in material that I have copied from someone else is plagiarism, and will result in a failing grade on that assignment, and continuing to do so will jeopardize my enrollment in this course.
4. I will **be in class on test days**, because I realize that there are no make-ups for missed tests. If I know I will be absent on a test day, I will make arrangements with my instructor prior to the absence.
5. I will **communicate with my instructor regarding work-related scheduling issues, absences for more than one class day in a row**,
6. I will **communicate with my instructor** if I feel that I am struggling in class, have issues that interfere with my continuing on in the class, or before I decide to drop the class because I am discouraged or worried about my grade.
7. I will **assume the responsibility of going on-line and dropping myself** from the course if I cannot continue in the class. I will not assume that I will be automatically dropped by the instructor if I simply stop showing up to class.
8. I will **complete a minimum of 85% of my lab assignments, in the presence of my instructor** during assigned or make-up lab time, because I understand that if this requirement is not met, I will not receive a grade higher than an “F” for the course.

9. I will **interact with other students in the course during lab time**, because I realize that all employees in this technical field must be able to work with others. I understand, however, that this includes staying focused on the activity at hand, and not merely socializing. I also understand that doing this makes it easier for me to be successful in lab.
10. I will **properly care for the equipment, materials, and workstations** that I use.

### **Students With Disabilities**

Bakersfield College will make reasonable accommodations and/or academic adjustments to ensure that students with disabilities have an equal opportunity to participate in the college's courses, programs and activities, including extracurricular activities. Students with disabilities who are requesting academic accommodations or auxiliary aids should contact Supportive Services at (661) 395-4334. Participation by students with disabilities in Supportive Services is voluntary. Any student choosing not to participate in the program may elect an alternate path for support services through the office of the Dean of Learning Support Services.

### **Estudiantes Incapacitados**

Bakersfield College proveerá servicio y/o arreglos académicos para asegurar que estudiantes incapacitados tengan oportunidades iguales para participar en las clases de esta escuela, incluyendo actividades extraescolares. Tales estudiantes que piden arreglos o aparatos auxiliares deben llamar a Supportive Services a 661-395-4434. Participación es voluntaria. Estudiantes que no desean participar en este programa pueden ponerse en contacto con la oficina del Decano de Aprendizaje/Servicios Auxiliares.

### **Important Dates**

Last day to drop the class without a "W" is: Friday, February 23<sup>rd</sup>.

Last day to drop the class with a "W" (and not an "F") is: Friday, March 24<sup>th</sup>.

**After this date, neither you nor your instructor can drop you from the class!**

### **Holidays**

Monday, January 16 – Martin Luther King Jr. Holiday – No Classes Held

Friday, February 17<sup>th</sup> – Lincoln's Day Holiday – No Classes Held

Monday, February 21<sup>st</sup> – Washington's Day Holiday – No Classes Held

Monday, April 10 through Friday, April 14 – Spring Break Holiday

### **Returned Work Policy:**

It is the policy of the instructor to not return graded lab materials until the end of the course. This is to discourage copying of lab work from other people in the class. Assignments that are turned in prior to the applicable test may not be returned until the test has been completed. All students must turn in their own copy of each assignment and lab sheet. Please do not put yourself in a bad situation by copying from another person's work, even if it is your partner.

<b>Grade Calculation:</b>	Section Tests	50%
	Work Packets	15%
	Lab Assignments	25%
	Final Exam	10%

<b>Assignment of Course Grade by Total Percentages:</b>	A = 90% and Above
	B = 80% - 89%
	C = 70% - 79%
	D = 60% - 69%
	F = Below 60% and/or failure to complete 85% of assigned labs.

## **Bakersfield College Electronics Program Student Learning Outcomes and Core Course Competencies**

### **Student Learning Outcome 1**

Students will demonstrate an understanding of course-specific electronic theory and applications in the following circuit types: analog, digital, industrial, and electronic communications.

### **Student Learning Outcome 2**

Students will demonstrate the ability to properly use basic electronic test equipment for measurement and troubleshooting purposes.

### **Student Learning Outcome 3**

Students will demonstrate the ability to read, interpret, create, and utilize schematic diagrams for circuit fabrication and troubleshooting purposes.

### **Student Learning Outcome 4**

Students will demonstrate essential employment-seeking and workplace skills for a technical/customer-oriented work environment.

## **ELET B55 Student Learning Outcomes**

1. Students will correctly identify, describe the function of, and wire in an appropriate lab activity the various types of AC and DC motors, including: stepper, synchronous, wound rotor, shaded pole, universal motors, and other types found in industrial applications.
2. Students will correctly explain the use, applications, and functions of manual starters, magnetic starters, solid-state starters, motor control circuits, and other common control devices found in industrial applications.
3. Students will correctly explain the use, applications, functions, and correctly wire and program motor drives, including Variable Frequency Drives.
4. Students will correctly identify, explain the use, applications, and functions of input devices, relays, pilot devices, control circuits, and other industrial electronic components and devices commonly found in industrial applications.
5. Students will correctly use electronic test equipment and problem-isolation methods to make measurements, and determine, within the laboratory applications, the cause and solution of motor, controls, and drive circuits.
6. Students will accurately read and interpret ladder diagrams and wiring diagrams appropriate for industrial electronics circuits.

**Please Note:** The instructor reserves the right to change the assignments to fit the needs of the class. Tests are usually scheduled for Wednesdays.

Week #	Week Of	Topic	Assignment	Lab Topic
1	Jan 16	<i>Monday Holiday – No Class</i> Course Orientation		No Labs This Week
2	Jan 23	DC Motors and Generators DC Motor Controls	Section 5	Lab Familiarization DC Motors
3	Jan 30	Control Circuits, Ladder and Wiring Diagrams, Control System Installation	Section 3	DC Motors
4	Feb 6	Basic Control Circuits <b>Test #1 (Wed.) – DC Motors and Control Circuit Basics – Packet #1 Due</b>	Section 4	DC Motors
5	Feb 13	AC Motor Controls, Three Phase Power, Three Phase AC Motors	Section 6	Three Phase Motors
6	Feb 20	<i>Monday Holiday – No Class</i> Solid State Devices	Section 1	Single Phase Motors
7	Feb 27	Motor Starters and Pilot Devices	Section 2	Single Phase Motors
8	Mar 6	Motor Drives	Section 7	Variable Frequency Drives
9	Mar 13	<b>Test #2 (Wed.) – AC Motors, Three Phase Power, and Solid State Devices Packet #2 Due</b>		Variable Frequency Drives
10	Mar 20	Solid State Motor Control	Section 8	Motor Control Labs
11	Mar 27	Advanced Motor Drives	Handouts	Motor Control Labs
12	Apr 3	Advanced Motor Drives	Handouts	Motor Control Labs
	Apr 10	<b><i>Spring Break – No Classes Held</i></b>		
13	Apr 17	<b>Test #3 (Wed.) – Motor Drives and Solid State Motor Control - Packet #3 Due</b>	(To Be Announced)	(To Be Announced)
14	Apr 24	(To Be Announced)	(To Be Announced)	(To Be Announced)
15	May 1	(To Be Announced)		
16	May 8	<b>Final Exam: Wednesday May 10, 6:30-8:30pm</b> (No class on Monday, May 8.)		

Note on Lab Activities: Each lab group will rotate through the AC Drives Trainer activities. When it is your group's turn, you will finish the current lab you are working on, and then spend three lab days on the assigned lab work. When finished, your group will go back to the next lab in the sequence.