

**LANEY COLLEGE**

**Electrical/Electronic Technology**

**E/ET221 Class Syllabus**

2010 Spring Semester

**Course:** Motors and Drives

**Course Number/code:** E/ET 221 (Class code 20421)

**Units:** 2 units.

**Time:** Mon. and Wed, 5:30PM – 6:50 PM

**Location:** B120 (lab), B130 (lecture)

**Duration:** Jan. 25 through May 26, 2010

**Instructor:** John Warhus

**Office:** B120

**Office Hours:** 4:15-5:15 pm Mon. and Wed.

**Cell Phone:** 510-502-5448

**email:** jwarhus@peralta.edu

**Course Description:** This course introduces the student to electrical controls, motors, and motor drives used in commercial and industrial applications. It will introduce students to a variety of motor types, including DC motors and 1-phase and 3-phase AC motors, motor drives and control applications, including variable-frequency drives for improved control and energy savings. The main focus of the course material is on AC motors, controls, and drives.

**Goals and Learning Outcomes:** Students will:

1. Be able to explain the theory of operation of 1-phase and 3-phase AC motors.
2. Analyze simple motor control circuits and explain the sequence of operations and the functions performed by the control components
3. Demonstrate that they can commission a Variable Frequency Drive (VFD) with a 3-phase motor, and program it to be operated with remote controls
4. Demonstrate that they can identify and apply the requirements of the National Electric Code, Article 430, that are relevant to the safe installation and operation of motors and motor controls circuits.
5. Demonstrate knowledge and understanding of the use and selection of overload protection devices that protect motors from overheating due to overload
6. Demonstrate an understanding of basic troubleshooting applied to basic motor and motor control circuits using standard troubleshooting techniques

**Prerequisites:** ECT 11, Mechanical and Electrical Devices

**Recommended preparation:** Reading and writing in English, basic mathematics, knowledge of basic electricity is very helpful.

**Text Book and other class material:**

1. “**Electrical Motor Controls for Integrated Systems**” 4th edition, By Gary Rockis and Glen Mazur, American Technical Publishers, Inc. Students must purchase this book.
2. Variable Frequency Drive User’s Manuals. Will be provided by instructor and must be returned at end of semester.
3. Excerpts from the National Electric Code. Will be provided by instructor and must be returned at end of semester..

**Tools and Supplies Needed:**

Classroom: Textbook and handout materials, pencils, pens, notepad, and scientific calculator

Laboratory: (suggested items)

1. Safety glasses or goggles
2. Medium flat blade and phillips screwdrivers
3. Adjustable wrench; one 6” or 8”
4. Combination wire cutter, stripper and crimper
5. One roll of electrical tape
6. Digital multi-meter
7. Scientific calculator
8. Tool box or bag.

Simple DC Motor Laboratory supplies: (required items)

1. Small ceramic magnet , 1 each
2. Large paper clips, 2 each
3. Large rubber band, 1 each
4. D-cell Battery, 1 each

**Lecture:** Chapter 1 thru 12 of the text book will be covered during the semester; material in all chapters but 11 and

12 will be covered in lectures. In addition, handout material covering article 430 of the National Electric Code

(NEC) and Variable Frequency Drives will be covered in Lectures. Lectures will concentrate on the following areas:

1. Basic electricity and electrical instrumentation review
2. Electrical grounding and safety
3. Motor control circuits and devices, their application and troubleshooting
4. Theory of operation of AC and DC Motors

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5. Introduction to AC motor drives
6. Introduction to NEC Article 430
7. Variable Frequency Drive (VFD) commissioning and programming

**Laboratory:** Lab assignments are intended to broaden your understanding of material covered in lectures and

reading assignments. Students will: (1) build and test a simple DC motor, (2) work with simple motor control circuits and evaluate overload protection requirements for both bimetallic and electronic overloads for an installed motor, (3) commission a VFD with a three-phase motor, and (4) program and operate a VFD using remote controls.

- Lab assignments (with the exception of lab 1) will be completed by teams of 3 to 5 students.
- Lab assignments should be completed during scheduled lab time
- Each student team is required to submit the written portion of the lab assignment to the instructor on dates indicated in class schedule.

**Homework:** Assignments are designed to support and broaden your understanding of lecture and laboratory material and include reading assignments, answering questions based on reading and lecture content, and problem solving exercises.

- Assignments are graded and included in your overall class grade.
- Assignments are due as indicated in class schedule below,
- Assignments will be reviewed in the class session following the due date. You must give your homework to the instructor before the review session begins to receive full credit for the assignment

**Grading Policy:**

1. First Exam 15%
2. Midterm Exam 15%
3. Final Exam 20%
4. Homework 10%
5. Lab Participation 10%
6. Laboratory Assignments 30%

**Attendance:** Attendance and participation in lectures and laboratories is important for your success. You may be dropped by the instructor if you miss more than 4 class sessions. Please communicate with me, as soon as possible if you are having or expect to have attendance issues

**Add/Drop Policy:**

To Add this class to your program

- If class is open for enrollment, students must add class by enrolling. The last day to add E/ET 221 is

February 6, 2010

- If class is closed for enrollment, students must add by obtaining an Add Card and the instructors signature

and then enroll by February 6, 2010.

To Drop this class from your program

- Students are responsible for dropping class by using the Passport System or in person at Admissions Office
- Instructor's signature not required to drop a class

- If you drop on or before February 16, 2010, there will be no notation in your academic record
- If you drop after February 16, 2010, a “W” will be recorded in your academic record
- If you fail to officially withdraw from this class by April 30, 2010, a “D” or an “F” may be recorded in your academic record

**Other Rules:**

1. Be respectful of classmates and instructor, do not interrupt the class with conversations with your neighbor
2. No MP3 players or iPods in use in classroom or laboratory
3. In laboratory sessions, now shorts or sandals allowed.
4. Cell phones turned OFF or to silent-mode during class times. If you must answer, leave the classroom before doing so.
5. Clean up after yourself at the end of each class or lab session. Pick up any trash and dispose, reorganize furniture, cleanup any mess, etc.

**E/ET221, Motors and Drives, Spring 2010 Class Schedule**

**Date Class Content Homework (HW) HW**

**Due**

- 1/25 Introductions, Course Overview, Chapter 1 (Ch1) Lecture: Review of Basic Electrical Quantities, Components, Circuits HW1: Read Ch1, answer even numbered questions 2/3
- 1/27 Continue Ch1 Lecture HW2: Complete handout (HO1) circuit problems, Read Ch2 and answer even numbered questions 2/3
- 2/1 Finish chapter 1 lecture; begin Ch2 Lecture: Overview of Electrical Tools and Test Equipment
- 2/3 Ch3 Lecture: Electrical Safety Overview HW3: Read Ch3, answer even numbered questions 2/10
- 2/8 Review HW1 & HW2, discuss handout problems; Begin Ch4 lecture: Electrical Symbols and Diagrams HW4: Read Ch4, answer even numbered questions 2/17
- 2/10 Finish Ch4 Lecture; begin Ch5 Lecture: Control Logic HW5: Read Ch5, answer even numbered questions 2/22
- 2/15 No Classes
- 2/17 Review HW3; Ch5 Lecture: Control Logic HW6: Complete (HO2) Line diagram analysis 2/24
- 2/22 Review HW4; Finish Ch5 Lecture; begin Ch6 Lecture: Solenoids, DC Generators, and DC Motors HW7: Read Ch6, answer even numbered questions 3/10
- 2/24 Review HW5; Ch6 Lecture: Solenoids, DC Generators and DC Motors
- 3/1 **TEST 1 (Chapter 1-5)**
- 3/3 Lab 1: Build and operate a simple DC motor (HO3) HW8: Complete Lab 1 worksheet (HO3) 3/15
- 3/8 Cont. Ch6 Lecture
- 3/10 Complete Lab 1: Observe effects of direction of magnetic field and current

flow on a simple DC motor

3/15 Review HW7; Finish Ch6 Lecture: Solenoids, DC Motors and Generators HW9:

Read Ch7, answer even numbered questions and

solve handout problems on transformers (HO4) 3/24

3/17 Review HW8; Begin Ch7 Lecture: AC Transformers, Generators and Motors

3/22 Continue Ch7 lecture

3/24 Ch7 Lecture; Continued

3/29 Review HW9; Begin Ch8 Lecture: Power Distribution Systems HW10: Read Ch8,  
answer even numbered questions

and solve problems on voltage imbalance (HOx) 4/12

3/31 Finish Ch8 Lecture; begin Ch9 lecture: Contactors and Motor Starters HW11: Read

Ch9, answer even numbered questions 4/19

4/5 No Classes -- Spring break

4/7 No Classes -- Spring break

4/12 Cont. Ch9 Lecture: Contactors and Motor Starters

4/14

Review HW10; Lab2: Motor Drive Station introduction and orientation (HO6)

and Overload selection/setup for motor starters with bimetallic and electronic  
overloads (HOy)

HW12: Handouts (HO5, HOy) problems and lab on

selecting motor overloads 4/21

4/19 Review HW11; Finish Ch9 Lecture; begin Ch10 lecture HW13: Read Ch10, answer  
even numbered questions 4/28

4/21 Finish Lab2 HW14: Read Ch11 and Ch12, answer even numbered  
questions in both chapters 4/28

4/26 Finish Ch10 Lecture; Review HW12; Review and Q&A on Ch11 and Ch12:

Control Devices and Reversing Circuits; begin Review of NEC Article 430

HW15: Read National Electric Code handout material

(HO7), answer handout questions (HO8) 5/5

4/28 **TEST 2 (chapters 6-10)** HW16: Read Variable Frequency Drive (VFD)

handout material (HO9) and Lab 3 (HO10)

5/3 Review HW13 and HW14; finish Review of National Electric Code article 430

5/5 Lab 3: Commissioning and Testing a VFD (HO10) HW17: Complete all steps in  
HO10 and obtain

instructor approval at completion of each step 5/12

5/10 Review HW15; Lecture: Introduction to VFD Programming

5/12 Finish Lab 3: Commissioning and Testing a VFD

5/17 Lab 4: Interfacing for remote control of VFD functions (HO11) HW18: Complete  
all steps in HO11 and obtain

instructor approval at completion of each step 5/24

5/19 Review HW16; Continue Lab 4:

5/24 Finish Lab4: Interfacing for remote control of VFD functions

5/26 **Final Exam (covers material chapters 1-12 in textbook and all handout  
material)**