MELTEC 226

Motors, Controls, and Controllers - Course Syllabus

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Course scope

Motors, Controls, and Controllers – ELTEC 226 – is a course strongly oriented to the most general practical issues any technical person is going to face in the manufacturing environment related to standard AC electric motors and their control. Throughout the semester, many of the most common motor-control operations are going to be studied and implemented together with the study of the electrical characteristics of the most common electrical machines.

Student Learning Outcome

At the end of this course the student will be able to

1. Design, draw, and test a functioning ladder diagram for a given type of motor control system using appropriate control language, labeling, numbering, and symbology.
2. Analyze and interpret control language, identify control devices, and connect a properly functioning motor control circuit.

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Required

1. **Class Package - MELTEC 226 – Motors, Controls, and Controllers**. Technical articles from several sources compiled by Adrian DeAngelis. These articles are available free of charge in CANVAS and students will access the first day of class.

Recommended

To take this class, MELTEC 208 is required, and MELTEC 223 or 230 are recommended courses. However, during the initial weeks a good review and introduction of contents will be delivered. The next list shows good supporting texts that students can use and that will provide good complementary information even beyond the scope of this class.

1. **Electrical Field Reference Handbook**, NJACT, Thomson Delmar Learning
2. **Electrical Motor Controls,** Gary Rockis and Glen Mazur, ATP Publication
3. **Electric Motor Control,** Stephen L. Herman, Thomson – Delmar Learning
4. **Electric Motors and Control Techniques,** Irving M. Gottlieb, McGraw Hill.
5. **STALLCUP'S Generator, transformer, Motor and Compressor,** James G. Stallcup, Jones and Bartlett.

On-line free resources

- http://deangelisa.faculty.mjc.edu
- GENERAL ELECTRIC - GE
- EATON
- ROCKWELL AUTOMATION – ALLEN BRADLEY
- EandM – SIEMENS USA
- SCHNEIDER ELECTRIC USA

Attendance prior and after Census Day

Attendance will be taken daily. Regular attendance is essential to ensure success in this course and that laboratory procedures are clearly understood.
Students must email giving notice to the instructor if they are planning to miss a class before the end of second week (prior to census day) to avoid being dropped from the course. After the second week, it is the student responsibility to drop this course. If after the second week, and before the completion of the 75% of the course, a student stops attending but forgets to drop the class, the instructor could, unintentionally, overlook the situation and fail to drop the student from the roster. In such case, the final grade will be likely an "F". However, a student showing a pattern of several consecutive missed assignments can be interpreted as a permanent absence in which case the instructor may drop the student without giving previous notice.

Lab Requirements (Back to Index)

A safe laboratory environment is essential. Safety procedures are most often given during the lecture period. If, in the opinion of the instructor, you are unaware of the proper safety procedures for a particular laboratory exercise because of excessive absences, you may not be allowed to participate in that exercise.
The labs will be developed at dangerous levels of voltage and current. Therefore, it will be neither a playground nor a freewill space. SAFETY REQUIREMENTS WILL BE FOLLOWED AT ALL TIMES. The instructor will work both as instructor and supervisor. In such character, the instructor will explain how to perform tasks, will supervise the development of the teams, and will not intervening in the class dynamic unless it is evident that the group is having difficulties. Good results are expected within a reasonable time frame according to different situations.

Most of the labs are designed as a team endeavor; groups of two or three persons will work together. Differences of character might arise and, as it happens in a real work environment, these differences will have to be put aside in order to achieve the successful completion of the work at hand. A professional attitude in front of differences is a calm and cold analysis of the problem, looking for a solution and not for the self-satisfaction of "being the winner" of the discussion. The quality of the team effort will be a factor for a positive evaluation on the lab.
As it was said, workplace rules apply, such as:

1. Be on time
2. Come ready
    a. Read the lab material ahead of time,
    b. Bring your notes (class notes and questions)
3. Plan your work and set your area
4. Don't quarrel with your team mate, discuss differences calmly
5. Stop 15 to 20 min before the end of the class and clean your area

You'll be provided with instruments, tools and safety glasses. ONCE IN THE LAB AREA (B102) WEARING SAFETY GLASSES IS MANDATORY – NO EXCEPTIONS.

Exams and Grading Criteria (Back to Index)

Class Participation

Being on-time, staying on-task, and keeping self-engaged in the subject, although leave a lot of margin for subjectivities from the point of view of the student and the instructor, is going to be considered and awarded. "Class Participation" includes punctuality, readiness, engagement with the subject, cooperation, team spirit. Class Participation represents ***5% of the final grade.***

Homework

Homework will be delivered through CANVAS; it will mostly consist of questions based on the technical articles from the class package; however, some written assignments (paper based) will be required. These written assignments will be delivered as handouts. There will be plenty time to turn in homework, therefore, HW must be completed by the due day specified during the class agenda. After the due day, homework assignments will be rendered "not done" – 0 points. HW represents ***25% of the final grade***

Labs

Labs are expected to be completed within the timeframe specified when the class agenda is set, but periods of catch up will be available to complete lab assignments. Basically, labs will be evaluated based on their functionality. But, use of work practices, work ethic, and teamwork are factors that will affect the overall evaluation of the lab. There are some less subjective matters on the evaluation of the development of labs such as:

1. Methodicalness – proved through the development of notes, schematics, or charts to keep record of circuits details, variants, or measurements.

2. Clear wiring.
3. Prompt functionality.
4. Accurate diagnostic of faults.

To help the understanding of the expectations for labs, a rubric will be delivered in each exercise.
Labs represent ***25% of the final grade***.

Exams

Several small exams will be taken throughout the semester and a comprehensive final exam at the end of the semester.

Review and Summative Exams will be delivered at the beginning of classes or as the conclusion of subjects. They will be short exams paper-based or electronic (in CANVAS). They will represent ***20% of the final grade***.
The Final Exam is VERY IMPORTANT. It is the culmination of this course, and it will cover the totality of the course. The final exam will be held in the sixteenth week. The final exam represents ***25% of the final grade*** **and it must be correct in a 50% or more**. Not taking the final exam, or having an F as grade, automatically disqualifies a student who will then not pass the course. Only in very special cases a student that misses the Final will receive an incomplete grade (IF or ID) in order to give him/her the opportunity to take the exam another day. Fail to do so will grant an automatic F or D.

In summary

Participation	5%
Homework	25%
Labs	25%
Review and Summative Exams	20%
Final Exam (at least 50% must be correct)	25%

Grades (Back to Index)

Although some exception might apply, a “C” is required to complete successfully this course. That is the equivalent of the 70% of the total points (gathered between participation, homework, labs, and exams) with the strict condition of having not less than the 50% of the final exam correct

The grading scale is as follows:

A = 90 to 100%
B = 80 to 89%
C = 70 to 79%
D = 50 to 69%
F = up to 49%

Electrical Trainees – ETs

Students enrolled in the DAS as electrical trainees (Electrical Trainee – ET – working for a licensed contractor or under the supervision of a journeyman) will log 87 hours of technical education of the 150 required in a year, but must pass with a C or better in order to be accredited with the hours.

Keys for success (Back to Index)

- Before each class, review the material of the latest class.
- Print all the RQ files in CANVAS and answer all the questions in them before taking the online quiz.
- Summarize the main points. Good summaries will help you to prepare the exams. Mark the text or keep notes with subjects that are not clear in order to ask for clarification the following class.
- All written assignments will be given with enough time to show your instructor a draft of your work. Corrections and tips will be given so you will be able to correct mistakes or improve answers. Use this advantage!
- Keep books, notes, and personal gear together.
- Keep track of what HW you turned in, the state of your labs, and the grades you are obtaining. These elements will give you a good idea of your progress and will show the areas that you need to work out.
- It is not bad idea to organize some group sessions to review concepts and get ready for the exams.
- Formal education, such as this class, is a short term commitment with long term consequences. Some family matters – little league, Halloween, a fishing trip, etc… - may need to take the back seat for a while. It is up to the instructor to do the upmost to deliver good content, but up to the student to achieve success.

Generic 16-week schedule (Back to Index)

This is a tentative schedule for a 16-week format. Review and summative tests will be embedded into the schedule according to necessities and added to the class agenda on weekly basis. Written assignments will be given, and online reading and quizzes may be added at a later time. Catch up periods will also be scheduled according to the development of the semester. Students will need to adjust the schedule to follow the agenda of the course.

WEEK		SUBJECT	Reading (PDF files in CANVAS)	HW Due
1	Lecture	Introduction. Syllabus. Review of Basic Electrical Theory. Review of NEMA Symbols and Schematics	• Mechanical, Electrical, and Magnetism Principles	
	Lab	Review of Basic Concepts and Skills I – Lab #01		
2	Lecture	Electrical Machines and Control. Protection Devices	• Basic on Control Circuits • Limit Switches • Sensors	
	Lab	Review of Basic Concepts and Skills II – Lab #02		
3	Lecture	The Basics of Motor Control: Two and Three-Wires Control Systems		
	Lab	Two and Three-Wires Control Systems – Lab #03		
4	Lecture	The Basics of Motor Control: Safety Measures in Motor Control systems	• Relays and Timers • Manual and Magnetic Contactors and Starters	
	Lab	Sequencing and Reversing Circuits – Lab #04		
5	Lecture	The Basics of Motor Control: Jogging and Braking Systems.		
	Lab	Braking and Jogging Basic Circuits. – Lab #05		
6	Lecture	Troubleshooting Motor Control Circuits 1st Class		
	Lab	Troubleshooting Exercise #1 – Lab #06		
7	Lecture	Timers: Types and Uses		
	Lab	Basic Circuits and Sequencing Using Timers – Lab #07		
8	Lecture	Basic Signaling. Limitations of Wired Remote Control Systems.	• Technical Considerations for Control Circuits	
	Lab	Full Voltage Starting Circuit with Jogging Function, Multiple Stations, Signaling, and Safeties. – Lab #08		

9	Lecture	Configuration of Motor Control centers	• Asynchronous Motors Basic Concepts	
	Lab	Wiring a Motor to a MCC Bucket – Lab #09		
10	Lecture	Wound Rotor Induction Motor	• Wound Rotor Induction Motors • Reduced Voltage Starting Methods	
	Lab	Push-button Speed selection with Wound Rotor Induction Motor – Lab #10		
11	Lecture	Motor Starting Methods		
	Lab	Reduced Voltage and Automatic WYE/DELTA Starting Systems – Lab #11		
12	Lecture	Troubleshooting Motor Control Circuits 2nd Class		
	Lab	Troubleshooting Exercise #2 – Lab #12		
13	Lecture	Other Motor Control Devices: Soft Starters and VFDs. Part I	• AC Motors and AC Drives	
	Lab	Soft starters and VFDs Part I – Lab #13		
14	Lecture	Other Motor Control Devices: Soft Starters and VFDs. Part II		
	Lab	VFDs Part II – Lab #14		
15	Lecture	Review of the course.		
16		FINAL EXAM		

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