KENNESAW STATE UNIVERSITY

SOUTHERN POLYTECHNIC COLLEGE OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF ENGINEERING TECHNOLOGY

SYLLABUS

ECET 4530: INDUSTRIAL MOTOR CONTROL
SPRING 2024

Course Information

Lecture meeting times: ***Monday & Wednesday 5^{00}pm – 6^{15}pm***
Location (Modality): **Q-109** (Face-to-Face)

Lab meeting time: ***Monday or Wednesday 6^{30}pm – 9^{15}pm*** *(as enrolled)*
Location (Modality): **Q-215** (Face-to-Face)

Instructor Information

Name: **Jeff Wagner**
Email: **jeffwagner@kennesaw.edu** **jwagne27@kennesaw.edu**
Office: **Q-224**
Phone #: **404-791-5427** ← The preferred method of communication is Text Message.

Office Hours: ***Mondays & Wednesdays*** Day: ***9^{00}am – 10^{00}am 11^{00}am – noon***
Evening: ***4^{00}pm – 5^{00}pm***

Course Description

This course presents the concept of motor control from an industrial perspective, with a concentration on the three-phase induction motor. Topics include motor and load characteristics, common control system components, relay logic, motor starters and controllers, overload protection, directional control, safety concerns, Variable Frequency Drives (VFDs), Programmable Logic Controllers (PLCs), and Ladder-Logic programming. The laboratory component of the course is used to reinforce the topics covered during the lectures and to provide students with hands-on experience constructing, analyzing, and utilizing both traditional relay-logic-based and PLC-based systems.

Prerequisites: **ECET 3000 (MET)** or **ECET 3500 (EET)** Credit Hours: **4**

Learning Outcomes

Students who successfully complete this course will be able to:

- Identify and demonstrate a fundamental understanding of the operational concepts of common, discrete motor-control devices including pushbuttons, timers, contactors, and overload relays.
- Design and construct a variety of discrete element motor controllers, including both across-the-line starters, series-resistance starters, and starters that provide directional control.
- Analyze the operation of a basic motor controller using a schematic diagram.
- Configure and utilize a VFD to control an Induction motor.
- Demonstrate a fundamental understanding of ladder-logic programming.
- Configure both the hardware and the software required implement and program a PLC-based, networked, motor control system.
- Program (using Ladder Logic) and operate a PLC-based, motor control system.

Required Course Materials

Required Text: **None** (References will be provided in D2L)

Course Requirements

During the Spring 2024 semester, this course is being offered as a traditional on-campus course that consists primarily of face-to-face instructional components.

LECTURE SESSIONS

The **lecture** portion of this course will be presented in a traditional (face-to-face) format that will take place in the assigned classroom (Q-109) during the regularly-scheduled lecture time blocks (Mondays & Wednesdays 5^{00} pm – 6^{15} pm).

Students are **required** to attend all of the lecture sessions.

Although there are no plans to either stream the live lecture sessions via Microsoft Teams and/or to record and post lecture videos for viewing online asynchronously, pre-recorded content may be provided to the students as additional resources throughout the semester.

LAB SESSIONS (Lab Experiments, Lab Assignments, and the Final Project)

Lab experiments will be conducted in a face-to-face format in the assigned lab room (Q-215).

During the first half+ of the semester, lab experiments will take place during the regularly-scheduled laboratory time blocks (Mondays or Wednesdays 6^{30} pm – 9^{15} pm). These experiments are meant to both reinforce and further the lecture material. They will typically be completed in small groups and will often include discussions both during the experiments and after completion.

Students are **required to attend** all of the scheduled (face-to-face) lab experiments on the day of the week as specified for their enrolled lab session.

During the second half of the semester, students will be provided swipe-card access to the lab room in order to allow the students to complete the remaining experiments during any of the normal operational hours for the Engineering Technology Center. Experiments completed in this manner will be conducted in a tutorial format and are intended to be completed on an individual basis.

Lab Assignments are “take-home” assignments that will be assigned via D2L and completed by the students on an individual basis. Lab assignments do not require on-campus attendance in order to complete the assignments.

A **Final Project** will also be assigned towards the end of the semester. The lab sessions during the last several weeks of the semester will be scheduled as open-lab sessions in order to provide students with some time to work on the project.

Note that the majority of the work required to complete the final project must be performed in the Q-215 lab. Thus, students should expect to come to campus multiple times outside of the scheduled lab sessions, both during the last several weeks of class and/or during the week of final exams, in order to complete this project.

Course/Policy Changes

Although policies and a tentative schedule have been prepared for this course, changes to those policies and/or the schedule may need to occur due to unexpected circumstances. If so, students will be notified of any such changes as soon as possible.

Evaluation and Grading Policies

The **overall course grade** will be based on the following weighted components:

Semester Exams	**55%** of overall course grade	← Exam I – 25%, Exam II – 30 %.
Lab Grades	**15%** of overall course grade	← Combination of Experiments & Assignments
Final Project	**30%** of overall course grade	

Note – Since the Final Project is considered a critical aspect of this course and successful completion of the Final Project is required to ensure that several of this learning outcomes for this course are met, **students must achieve a grade of at least 70% on the Final Project in order to receive a letter grade of a C or better for the course**.

OVERALL GRADE SCALE

90% - 100%	**A**
80% - 89%	**B**
70% - 79%	**C**
60% - 69%	**D**
0% - 59%	**F**

I will only round up overall course grades if the decimal portion is ≥ 0.5
For example – an overall grade of 89.6 will be assigned an A, but an 89.2 will be assigned a B.

Other Course Policies

Other policies may be provided in D2L.

Institutional Policies

Federal, BOR, & KSU Course Syllabus Policies

KSU Student Resources

This link contains information on help and resources available to students:
KSU Student Resources

Detailed Schedule of Events

A "tentative" schedule has been provided on the last page of this handout. This schedule has been provided in order to present an overview of the various topics that will be covered throughout the semester. Although every effort will be made to adhere to this schedule, it should only be considered as a prediction of the events to come.

Tentative Course Schedule

SPRING SEMESTER 2024

Date	Lecture Topics	Project	Labs
01/08	Introduction		No Lab
01/10	Induction Motor Operation		
01/15	☹ ☹ ☹ ☹ ☹ ☹ Holiday – No Classes ☹ ☹ ☹ ☹ ☹ ☹		No Lab
01/17	Induction Motor Operation / Motor Control Systems		
01/22	Basic Motor Control System Components		Intro 1
01/24	Stop-Start Motor Controller / Additional Control System Components		
01/29	Ladder Diagrams		2
01/31	Relay Logic		
02/05	Motor Ratings / Overload Protection		3
02/07	Motor Starting / Soft-Starters		
02/12	Directional Control		4
02/14	Variable-Frequency Drives (VFDs)		
02/19	Review		5 (take home)
02/21	☺ ☺ ☺ ☺ ☺ ☺ Exam I ☺ ☺ ☺ ☺ ☺ ☺		
02/26	Intro to Programmable Logic Controllers (PLCs) / PLC-based Control Systems		6
02/28	Introduction to Ladder Logic		
03/04	Ladder Logic – Instructions		7
03/06	Ladder Logic – Instructions		
03/11	☹ ☹ ☹ ☹ ☹ ☹ Spring Break ☹ ☹ ☹ ☹ ☹ ☹		Spring Break
03/13	☹ ☹ ☹ ☹ ☹ ☹ Spring Break ☹ ☹ ☹ ☹ ☹ ☹		
03/18	Final Project Presentation / Ladder Logic – I/O Programming		Open Lab
03/20	Ladder Logic – I/O Programming	Project in D2L	
03/25	Ladder Logic – Mini System Programming Example	Project Assigned	Open Lab for Project
03/27	Ladder Logic – Mini System Programming Example		
04/01	PLC Programming Concepts		Open Lab for Project
04/03	PLC Programming Concepts		
04/08	Project Driven Lecture Topics	Milestone 1 Deadline	Open Lab for Project
04/10	Project Driven Lecture Topics		
04/15	Review		Open Lab for Project
04/17	☺ ☺ ☺ ☺ ☺ ☺ Exam II ☺ ☺ ☺ ☺ ☺ ☺		
04/22	Project Driven Lecture Topics	Milestone 2 Deadline	Open Lab for Project
04/24	Project Driven Lecture Topics		
04/29	Closure (Last Day of Classes)		Open Lab
05/01	Final Project – Demonstration & Submission Deadline – 7pm	Project Deadline	