RANKEN

TECHNICAL COLLEGE

Course Information

Course Number: EEL 1220
Course Name: Introduction to Automation and Control Circuits
Semester: Fall 2018-19
Class Day(s): Monday - Friday
Class Time: 12:05-3:55pm
Number of Sessions: 80
Building/Room: T104

Instructor Information

Name: Matthew Leigh
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Office Location: Taylor – 2nd Floor Faculty Office
Office Hours: 11:00-12:00pm

Program Level Student Outcomes

Electrical Automation Technology - Program graduates are trained to install, maintain, troubleshoot, program and repair electrical systems, including:

- Power distribution
- Variable frequency motor drives
- Industrial motors, motor controls and networking
- Switching circuits
- Human Machine Interfaces (HMIs) and PLCs

Control Systems Technology - Program graduates are prepared for a career in the instrumentation and process control industry. Coursework includes:

- AutoCAD® for piping and instrumentation diagrams
- Basic and Advanced Programmable Logic Controllers (PLCs)
- Industrial Communication Protocols
- Human Machine Interfaces (HMIs)
- Variable Frequency Drives
- Industrial applications of robotics technology

Course Materials and Texts

Stephen Herman, Industrial Motor Control 7th Edition,
Cengage Learning. 2013
ISBN-13: 978-1-133-69180-8

Eman Kamal, Hands-On PLC Programming with RSLogix 500 and LogixPro 1st Edition,
McGraw-Hill Education. 2016
ISBN-13: 978-1-259-64434-4

Course Description

This course explores, through lecture and hands-on construction, various types of electromechanical relay logic control circuits as applied in the industrial environment. The student will study ladder logic and component wiring design. The operations of these circuits operation are also emphasized through lab exercises. Fundamental motor control is studied from its basic application through advanced instruction sets. Students will be involved in hard wiring motor control components using ladder logic into functional control circuits. Students will also learn a hands-on approach to maintaining and troubleshooting of various types of control circuits. Students will focus on applying the National Electric Code (NEC) for sizing, grounding and over-current protection of single-phase and three-phase feeder circuits. Students will perform various calculations as required by the NEC. Students will program and troubleshoot PLC programs that use basic to intermediate level instruction sets. Students will also integrate motor control function and PLCs to simulate an automated motor control circuit. Students will design and construct automated control circuits from a written "description of operation". Transformer theory and commercial/industrial power distribution systems will also be covered. (Fourteen credit hours)

Course Level Student Outcomes

Students successfully completing EEL 1220: Intro to Automation and Control Circuits will be able to:

1. Create and analyze motor control logic and wiring diagrams.
2. Design, construct, and troubleshoot motor control circuits.
3. Properly size conductor and overload protection for single and three phase motor control circuits.
4. Program and wire a PLC integrated with a motor control circuit.
5. Calculate electrical values for single and three phase systems including transformers installations.
6. Construct the wiring on various types of transformers, including buck-boost, single, and three phase transformers, for different voltage and current systems

Policies

See the Ranken Technical College Student Handbook.

Attendance

Students are expected to attend all scheduled course sessions. Students are also expected to arrive on time and remain for the duration of each course session. Students are responsible for monitoring their attendance record on InsideRanken.

The goal of each student is to become an excellent employee. Companies frown on absences, so each student should make it their goal to have perfect or near perfect attendance. Furthermore, each student should make being prompt a priority. A good employee does not arrive on time but early. This class begins at 5 minutes past the hour, so each student should make a habit of being seated in class **on** the hour (12:00pm). Below is Ranken's attendance policy for this course. Absences are not to be used as "days off" or "vacation days" but for legitimate reasons (sickness, doctors apt., funeral) All students in all departments will be held to the following standards:

Seated/Face to Face Courses:

All students in all departments will be held to the following standards:

- The allowable number of absences is based on the total number of sessions the course is scheduled to meet. The allowable number of absences in this 80-session course will be six, as dictated in the student handbook.
- Cancelled course sessions and holidays do not affect the allowable number of absences. The allowable number is always based upon the total number of sessions the course is scheduled to meet.
- Arriving after the scheduled start time or leaving before the scheduled end time will result in a tardy designation for attendance. A tardy is defined as a period of up to 10 minutes during the scheduled class time when a student is not present.
    - Every two tardies will count as one absence.
      (two tardies = 1 absence, four tardies = 2 absences, six tardies = 3 absences, etc.)
    - Students missing more than 10 minutes of the course, will be counted absent.
- Students will be allowed to make up reasonable academic work missed due to an absence. Reasonable work

Academic Honesty

Academic honesty is essential to the education process at Ranken Technical College. Thus, academic dishonesty is a basis for disciplinary action or dismissal. Such acts include:

- Cheating on any type of exam
- Cheating on homework assignments
- Helping another student to cheat on any type of exam
- Helping another student to cheat on homework assignments
- Illegal or unauthorized possession of exams or restricted material
- Illegal or unauthorized changes to a graded assignment or exam
- Plagiarism (including in your work, another's work that is not properly cited)

Course Grading

The total grade is made up of the following:

- Homework 7.5% (All assignments weighted equally)
- Quizzes 7.5% (All quizzes weighted equally)
- Jobs 15% (All jobs weighted equally)
- Hands-On 35% (All Hands-On Tests weighted equally)
- Tests 15% (All tests, except midterm and final, weighted equally)
- Mid-term 10% (Shall have both written and hands on components)
- Final 10% (Shall have both written and hands on components)

- Shop jobs, homework and quizzes will be given at the discretion of the instructor.
- Late homework will not be accepted unless prior arrangements have been made.
- Homework shall be due at the beginning of class.
- Quizzes cannot be made up and will result in a zero for missing a quiz.
- See Shop Grading Rubrics for shop job grading.
- It is the student's responsibility to arrange for making up a missed Hands-On test the day of returning to school. Failure to do so can result in a zero being entered as a grade.
- Hands-On tests contain their own grading rubric based off the Shop Grading Rubric.

Overall Grade Scale

A	92.5-100%	Excellent
B+	89.5-92.49%	Very Good
B	83.5-89.49%	Good
C+	80.5-83.49%	Above Average
C	74.5-80.49%	Average
D	69.5-74.49%	Unsatisfactory; does not satisfy course requirement
F	BELOW 69.49%	Failing

Workload Table

Category	Reading	Homework	Lecture & Discussion	Quiz/ Exam	Projects	Hands-On	Total
Instructor Led Lecture & Discussion			100	16			116
Lab/Shop					184	20	204
Out-of-class participation by student	200	40					240

Inside Ranken

Students are expected to use Inside Ranken (http://insideranken.org) to gain access to general course information, digital course materials, current attendance record, current grades, and online assignments. Students are to notify their instructor immediately of any error in grades or attendance.

General College Information

Tutorial Assistance

Students experiencing academic difficulties are encouraged to use the tutorial services offered by the Student Success Center (SSC) located on the top floor on the Finney Building and through the Gray Bridge. You can contact the SSC at (314) 286-4891.

Students with Disabilities

Ranken Technical College makes every effort to accommodate individuals with disabilities. To obtain accommodations, students must identify themselves to the Student Success Center (SSC) and provide written documentation of their disabilities from qualified professionals or agencies. You can contact the SSC at (314) 286-4891.

Career Services

The Career Services department is available to help students with resume writing and job placement. You can contact Career Services at (314) 286-3665.

Snow Days and Campus Emergencies

If classes are canceled due to weather or an emergency, students will be notified via the notification system which will generate a text message to the assigned cell phone and/or email address. Notifications are also posted on the College website and Inside Ranken web portal.

Notifications are active for the time period you specify during the sign-up process. It is recommended that you sign up for a one-year period. If you are still actively taking classes at Ranken after this time period, your notifications can be revalidated for an additional period of time. This will also allow you to verify that your information is correct on a yearly basis.

Please Note: You may incur charges from your cellular provider for each text message.

We will make every effort to contact you when classes are cancelled.
UNLESS YOU ARE ADVISED OTHERWISE, YOU SHOULD ASSUME THAT CLASSES WILL BE HELD.

Specific Class Information

Class Materials

Required materials for class include: all listed course texts plus the following;

- Multi-meter and Amp-clamp
- Small standard screwdriver
- Phillips screwdriver (#2) and/or Multi Tool Screwdriver
- Wire Strippers
- Calculator
- Schematic Stencil
- Clear Safety Glasses
- Lock and Lock Tag

Classroom Conduct

- Class begins promptly at the scheduled time.
- Snacks or drinks that have lids will be permitted in the classroom.
- Tests and quizzes given on a scan sheet will be taken in pencil. Failure to do so will result in a zero being entered as a grade.
- Cell phones are not permitted during class/ lab time. Laptop/tablets are allowed for informational purpose pertaining to class. Cell phones may be used on breaks. If you need to use your during class time notify the instructor.
- Unprofessional behavior of any type will not be tolerated.
- Students are required to be in compliance with all policies regarding appearance as stated in the student handbook.

Course Schedule (subject to change)

Week 1

Day 1	Monday, August 27, 2018	
Unit:	Manual Motor Controls	
Lecture:	Semester Intro/Orientation	CLO#: 1
Day 2	Tuesday, August 28, 2018	
Unit:	Manual Motor Controls	
Lecture:	Schematic Symbols, Pushbuttons	CLO#: 1
Day 3	Wednesday, August 29, 2018	
Unit:	Manual Motor Controls	
Lecture:	Schematic Symbols, Selector Switch	CLO#: 1
Day 4	Thursday, August 30, 2018	
Unit:	Manual Motor Controls	
Lecture:	Estops and Selector Switches	CLO#: 1
Day 5	Friday, August 31, 2018	
Unit:	Manual Motor Controls	
Lecture:	TEST: NEMA Schematic Symbols	CLO#: 1
Assignments	Week 1	
Homework:	IMC Chpt 1, IMC Chpt 2, IMC Chpt 18	
Jobs:	MMC Job 01, MMC Job 02, MMC Job 03, MMC Job 04, MMC Job 05	

Week 2

No School	Monday, September 3, 2018	
Unit:		
Lecture:		CLO#:
Day 6	Tuesday, September 4, 2018	
Unit:	Manual Motor Controls	
Lecture:	Truth Tables and Boolean Logic	CLO#: 1
Day 7	Wednesday, September 5, 2018	
Unit:	Manual Motor Controls	
Lecture:	Relays and Contactors	CLO#: 1
Day 8	Thursday, September 6, 2018	
Unit:	Manual Motor Controls	
Lecture:	Latching Circuits	CLO#: 1
Day 9	Friday, September 7, 2018	
Unit:	Manual Motor Controls	
Lecture:	TEST: NEMA Symbols	CLO#: 1
Assignments	Week 2	
Homework:	IMC Chpt 5, IMC Chpt 6, IMC Chpt 50	
Jobs:	MMC Job 07, MMC Job 08, MMC Job 09	

Week 3

Day 10	Monday, September 10, 2018	
Unit:	Manual Motor Controls	
Lecture:	Stop/Start Circuit	CLO#: 1
Day 11	Tuesday, September 11, 2018	
Unit:	Manual Motor Controls	
Lecture:	Stop/Start Circuit using and ESTOP	CLO#: 1
Day 12	Wednesday, September 12, 2018	
Unit:	Manual Motor Controls	
Lecture:	Stop/Start Circuit using and ESTOP and Indicator Lights	CLO#: 1
Day 13	Thursday, September 13, 2018	
Unit:	Manual Motor Controls	
Lecture:	Stop/Start/ESTOP and Stopped and Running Lights Controls 1P motor	CLO#: 1
Day 14	Friday, September 14, 2018	
Unit:	Manual Motor Controls	
Lecture:	TEST: NEMA Symbols Boolean Logic	CLO#: 1
Assignments	Week 3	
Homework:	IMC Chpt 8, IMC Chpt 11, IMC Chpt 19	
Jobs:	MMC Job 10, MMC Job 11, MMC Job 12	

Week 4

Day 15	Monday, September 17, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start/Jog Circuit with two pushbuttons	CLO#:	1
Day 16	Tuesday, September 18, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start/Jog Circuit with selector switch	CLO#:	1
Day 17	Wednesday, September 19, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start/Jog Circuit with three pushbuttons	CLO#:	1
Day 18	Thursday, September 20, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start/Jog Circuit with three pushbuttons, three lights and 1P Motor	CLO#:	1
Day 19	Friday, September 21, 2018		
Unit:	Manual Motor Controls		
Lecture:	TEST: Basic Motor Controls and Single Phase Motors	CLO#:	1
Assignments	Week 4		
Homework:	IMC Chpt 9, IMC Chpt 14, IMC Chpt 30		
Jobs:	MMC Job 13, MMC Job 14, MMC Job 15, MMC Job 16		

Week 5

Day 20	Monday, September 24, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse of a 1P Motor	CLO#:	1
Day 21	Tuesday, September 25, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse of a 1P Motor	CLO#:	1
Day 22	Wednesday, September 26, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse plus Jog of a 1P Motor	CLO#:	1
Day 23	Thursday, September 27, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse plus Jog of a 1P Motor	CLO#:	1
Day 24	Friday, September 28, 2018		
Unit:	Manual Motor Controls		
Lecture:	TEST: Single and Three Phase Motors	CLO#:	1
Assignments	Week 5		
Homework:	IMC Chpt 10, IMC Chpt 16, IMC Chpt 17		
Jobs:	MMC Job 17, MMC Job 18, MMC Job 19		

Week 6

Day 25	Monday, October 1, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start of a 3P Motor, Motor Nameplate	CLO#:	3
Day 26	Tuesday, October 2, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Start w/Overload of a 3P Motor, Motor Nameplate	CLO#:	3
Day 27	Wednesday, October 3, 2018		
Unit:	Manual Motor Controls		
Lecture:	Stop/Stop/Jog with Overload of a 3P Motor, Motor Nameplate	CLO#:	3
Day 28	Thursday, October 4, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse with Overload of a 3P Motor, Motor Nameplate	CLO#:	3
Day 29	Friday, October 5, 2018		
Unit:	Manual Motor Controls		
Lecture:	TEST: Motor Nameplate and Three Phase Motors	CLO#:	2
Assignments	Week 6		
Homework:	IMC Chpt 4, IMC Chpt 7, IMC Chpt 29		
Jobs:	MMC Job 20, MMC Job 21		

Week 7

Day 30	Monday, October 8, 2018		
Unit:	Manual Motor Controls		
Lecture:	Forward/Reverse/Jog with Overload of a 3P Motor	CLO#:	3
Day 31	Tuesday, October 9, 2018		
Unit:	Manual Motor Controls		
Lecture:	On-Delay Timer	CLO#:	2
Day 32	Wednesday, October 10, 2018		
Unit:	Manual Motor Controls		
Lecture:	Off-Delay Timer	CLO#:	2
Day 33	Thursday, October 11, 2018		
Unit:	Manual Motor Controls		
Lecture:	Time Delay Circuits	CLO#:	2
Day 34	Friday, October 12, 2018		
Unit:	Manual Motor Controls		
Lecture:	TEST: Three Phase Motors and Motor Starters	CLO#:	2
Assignments	Week 7		
Homework:			
Jobs:	MMC Job 22, MMC Job 23, MMC Job 24		

Week 8

Day 35	Monday, October 15, 2018		
Unit:	Manual Motor Controls		
Lecture:	Final MMC Project	CLO#:	2
Day 36	Tuesday, October 16, 2018		
Unit:	Manual Motor Controls		
Lecture:	Final MMC Project	CLO#:	2
Day 37	Wednesday, October 17, 2018		
Unit:	Manual Motor Controls		
Lecture:	Final MMC Project	CLO#:	2
Day 38	Thursday, October 18, 2018		
Unit:	Manual Motor Controls		
Lecture:	MID-TERM: Manual Motor Controls	CLO#:	2
Day 39	Friday, October 19, 2018		
Unit:	Intro to PLC		
Lecture:	Intro to PLCs	CLO#:	4
Assignments	Week 8		
Homework:	HOP Chpt 1		
Jobs:	MMC Job 25, MMC Job 26		

Week 9

Day 40	Monday, October 22, 2018		
Unit:	Intro to PLC		
Lecture:	PLC Components and Scan Cycle	CLO#:	4
Day 41	Tuesday, October 23, 2018		
Unit:	Intro to PLC		
Lecture:	Input and Output Tables	CLO#:	4
Day 42	Wednesday, October 24, 2018		
Unit:	Intro to PLC		
Lecture:	Labels and Descriptions	CLO#:	4
Day 43	Thursday, October 25, 2018		
Unit:	Intro to PLC		
Lecture:	TEST: PLC Basics	CLO#:	4
Day 44	Friday, October 26, 2018		
Unit:	Intro to PLC		
Lecture:	Internal Tables	CLO#:	4
Assignments	Week 9		
Homework:			
Jobs:	I2P Job 01, I2P Job 02, I2P Job 03, I2P Job 04		

Week 10

Day 45	Monday, October 29, 2018	
Unit:	Intro to PLC	
Lecture:	Binary Number System	CLO#: 4
Day 46	Tuesday, October 30, 2018	
Unit:	Intro to PLC	
Lecture:	Basic Motor Control	CLO#: 4
Day 47	Wednesday, October 31, 2018	
Unit:	Intro to PLC	
Lecture:	Binary Number System	CLO#: 4
Day 48	Thursday, November 1, 2018	
Unit:	Intro to PLC	
Lecture:	Basic Motor Control	CLO#: 4
Day 49	Friday, November 2, 2018	
Unit:	Intro to PLC	
Lecture:	TEST: Numbers and Number Conversion	CLO#: 4
Assignments	Week 10	
Homework:	HOP Chpt 2	
Jobs:	I2P Job 05, I2P Job 06, I2P Job 07	

Week 11

Day 50	Monday, November 5, 2018	
Unit:	Intro to PLC	
Lecture:	Octal Number System	CLO#: 4
Day 51	Tuesday, November 6, 2018	
Unit:	Intro to PLC	
Lecture:	Three Phase Motor Control	CLO#: 4
Day 52	Wednesday, November 7, 2018	
Unit:	Intro to PLC	
Lecture:	Octal Number System	CLO#: 4
Day 53	Thursday, November 8, 2018	
Unit:	Intro to PLC	
Lecture:	Three Phase Motor Control	CLO#: 4
Day 54	Friday, November 9, 2018	
Unit:	Intro to PLC	
Lecture:	TEST: Number Conversion and PLC Basics	CLO#: 4
Assignments	Week 11	
Homework:		
Jobs:	I2P Job 08, I2P Job 09, I2P Job 10	

Week 12

No School	Monday, November 12, 2018	
Unit:		
Lecture:		CLO#:
Day 55	Tuesday, November 13, 2018	
Unit:	Intro to PLC	
Lecture:	Hexadecimal Number System	CLO#: 4
Day 56	Wednesday, November 14, 2018	
Unit:	Intro to PLC	
Lecture:	Forward-Reverse Phase Motor Control	CLO#: 4
Day 57	Thursday, November 15, 2018	
Unit:	Intro to PLC	
Lecture:	Hexadecimal Number System	CLO#: 4
Day 58	Friday, November 16, 2018	
Unit:	Intro to PLC	
Lecture:	TEST: Number Conversion and Logic Diagrams	CLO#: 4
Assignments	Week 12	
Homework:	HOP Chpt 3	
Jobs:	I2P Job 11, I2P Job 12, I2P Job 13	

Week 13

Day 59	Monday, November 19, 2018		
Unit:	Intro to PLC		
Lecture:	BCD Number System	CLO#:	4
Day 60	Tuesday, November 20, 2018		
Unit:	Intro to PLC		
Lecture:	Forward-Reverse Phase Motor Control	CLO#:	4
Day 61	Wednesday, November 21, 2018		
Unit:	Intro to PLC		
Lecture:	BCD Number System	CLO#:	4
No School	Thursday, November 22, 2018		
Unit:			
Lecture:		CLO#:	
No School	Friday, November 23, 2018		
Unit:			
Lecture:		CLO#:	
Assignments	Week 13		
Homework:			
Jobs:	I2P Job 14, I2P Job 15, I2P Job 16		

Week 14

Day 62	Monday, November 26, 2018		
Unit:	Intro to PLC		
Lecture:	Forward-Reverse Phase Motor Control	CLO#:	4
Day 63	Tuesday, November 27, 2018		
Unit:	Intro to PLC		
Lecture:	HOA Control	CLO#:	4
Day 64	Wednesday, November 28, 2018		
Unit:	Intro to PLC		
Lecture:	HOA Control	CLO#:	4
Day 65	Thursday, November 29, 2018		
Unit:	Intro to PLC		
Lecture:	HOA Control with MMC	CLO#:	4
Day 66	Friday, November 30, 2018		
Unit:	Intro to PLC		
Lecture:	TEST: BCD Number System and Logic Diagrams	CLO#:	4
Assignments	Week 14		
Homework:	HOP Chpt 4		
Jobs:	I2P Job 17, I2P Job 18		

Week 15

Day 67	Monday, December 3, 2018		
Unit:	Transformers		
Lecture:	Buck/Boost Basics	CLO#:	5
Day 68	Tuesday, December 4, 2018		
Unit:	Transformers		
Lecture:	Delta-Delta Connection	CLO#:	5
Day 69	Wednesday, December 5, 2018		
Unit:	Transformers		
Lecture:	Wye-Delta Connection	CLO#:	6
Day 70	Thursday, December 6, 2018		
Unit:	Transformers		
Lecture:	Wye-Wye Connection	CLO#:	6
Day 71	Friday, December 7, 2018		
Unit:	Transformers		
Lecture:	TEST: 3P Transformers	CLO#:	6
Assignments	Week 15		
Homework:			
Jobs:	I2P Job 19, I2P Job 20, I2P Job 21, I2P Job 22		

Week 16

Day 72	Monday, December 10, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	4
Day 73	Tuesday, December 11, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	5
Day 74	Wednesday, December 12, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	6
Day 75	Thursday, December 13, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	6
Day 76	Friday, December 14, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	6
Assignments	Week 16		
Homework:			
Jobs:	I2P Job 23, I2P Job 24, I2P Job 25		

Week 17

Day 77	Monday, December 17, 2018		
Unit:	Intro to Automation		
Lecture:	Final Practice	CLO#:	4
Day 78	Tuesday, December 18, 2018		
Unit:	Intro to Automation		
Lecture:	TEST: Comprehensive Written Final	CLO#:	6
Day 79	Wednesday, December 19, 2018		
Unit:	Intro to Automation		
Lecture:	HANDS ON: HOA Final	CLO#:	6
Day 80	Thursday, December 20, 2018		
Unit:	Intro to Automation		
Lecture:	HANDS ON: HOA Final	CLO#:	6
No School	Friday, December 21, 2018		
Unit:			
Lecture:		CLO#:	
Assignments	Week 17		
Homework:			
Jobs:	XFR Job 01, XFR Job 02, XFR Job 03, XFR Job 04		