



## Course Number and Title: ELC 248 Electro-Mechanical Systems

**Campus Location:**

Stanton

**Effective Date:**

2018-51

**Prerequisite:**

MAT 190, PHY 205

**Co-Requisites:**

none

**Course Credits and Hours:**

4.00 credits

3.00 lecture hours/week

3.00 lab hours/week

**Course Description:**

This course covers power and controls systems found in modern machines. Electrical topics include basic DC and AC electrical theory, circuits, electrical control components such as switches, relays, transformers, contactors, motors, servos and electrical safety. Mechanical components include couplings, gear drives, belting, chain drives and how electrical components are incorporated into a function system.

**Required Text(s):**

Obtain current textbook information by viewing the [campus bookstore - https://www.dtcc.edu/bookstores](https://www.dtcc.edu/bookstores) online or visit a campus bookstore. Check your course schedule for the course number and section.

**Additional Materials:**

None

**Schedule Type:**

Classroom Course

**Disclaimer:**

None

**Core Course Performance Objectives (CCPOs):**

1. Apply basic electrical theory, principles, and laws. (CCC 2, 5, 6; PGC 1, 2)
2. Define the operating principles of common electrical devices such as switches, resistors, power supplies, and relays. (CCC 1, 2, 5, 6; PGC 1)
3. Identify common electrical symbols. (CCC 2, 5, 6; PGC 1)
4. Explain the fundamentals of inductive and magnetic devices such as motors, transformers, and generators. (CCC 2, 5, 6; PGC 1, 2)
5. List the theory of operation and applications of single and 3-phase circuits and devices. (CCC 1, 2, 5, 6; PGC 1, 2)
6. Read and develop simple relay ladder diagrams. (CCC 2, 5, 6; PGC 1, 2)
7. Connect and troubleshoot simple electrical circuits and relay ladder systems. (CCC 2, 3, 5, 6; PGC 1, 2, 3)
8. Read and develop simple programmable logic controller (PLC) programs. (CCC 2, 5, 6; PGC 1, 2)
9. Connect and troubleshoot simple programmable logic controller (PLC) systems. (CCC 2,3, 5, 6; PGC 1, 2, 3)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

## Measurable Performance Objectives (MPOs):

Upon completion of this course, the student will:

1. Apply basic electrical theory, principles, and laws.
  1. Apply Ohm's law to series and parallel DC circuits.
  2. Calculate energy and power requirements for simple DC circuits.
  3. Describe the theory, construction, and operation of common batteries.
  4. Differentiate between primary and secondary batteries.
  5. Practice electrical safety, and list tagout/lockout procedures.
  6. Set up a circuit in the lab and use a volt Ohm meter to take readings.
  7. Define and calculate the following circuit parameters: *voltage, line drop, resistance, and current*.
2. Define the operating principles of common electrical devices such as switches, resistors, power supplies, and relays.
  1. State the applications and use the following electrical devices in a circuit: switches, power supplies, relays, resistors, capacitors, solenoids, lamps, and conductors.
3. Identify common electrical symbols.
  1. Identify common electrical symbols used on schematics and wiring diagrams.
4. Explain the fundamentals of inductive and magnetic devices such as motors, transformers, and generators.
  1. Define common magnetic theories.
  2. Define *magnetic field, flux, flux density, coil or solenoid, electro-magnet, and right hand rule*.
  3. State the rule of magnetic attraction and repulsion.
  4. State the applications of magnets and electro-magnets in industry.
  5. Define *induced electrical magnetic field (EMF)*.
  6. List the factors that affect induced EMF.
  7. Explain the operation of common inductive devices such as transformers and coils.
  8. Define the characteristics of common transformer types, such as single phase, three phase, autotransformer, current transformers and tap changing.
  9. Define the characteristics of alternating current.
  10. Calculate power requirements for simple AC circuits.
  11. Define and calculate the following AC circuit parameters: *voltage, frequency, resistance, current, cycle, capacitive reactance, inductive reactance, and impedance*.
  12. List the benefits and applications of 3-phase power and devices.
  13. Identify common 3-phase circuit connections, voltage, and current relationships in wye and delta connected devices.
  14. Define *power factor*.
  15. Explain the operation of common 3-phase motors and motor starters.
  16. Connect an experimental 3-phase circuit.
5. List the theory of operation and applications of single and 3-phase circuits and devices.
  1. Explain the theory of operation and the main parts of an AC generator.
  2. List the factors that affect the output voltage, power, and frequency of AC generators.
  3. Explain the theory and operation of a simple single-phase AC motor.
  4. Identify common motor control devices.
  5. List the applications, characteristics and operating principles of common AC motors such as split phase, capacitor start, capacitor start, capacitor run, shaded pole, and resistance start split phase.
6. Read and develop simple relay ladder diagrams.
  1. Read and interpret common wiring diagrams and schematics.
  2. Write a simple ladder logic diagram.
7. Connect and troubleshoot simple electrical circuits and relay ladder systems.
  1. Identify and specify common electro-mechanical control devices.
  2. Assemble and operate a simple ladder relay control circuit.
8. Read and develop simple programmable logic controllers (PLC) programs.
  1. List the applications of PLC in industry.
  2. Describe the theory of operations and main functional parts of a PLC system.
  3. Describe common control systems.
  4. List common PLC input devices.
  5. List common PLC output devices.
9. Connect and troubleshoot simple programmable logic controllers (PLC) systems.
  1. Connect and operate a simple PLC controlled devices.
  2. Write a simple PLC program using Rockwell Software (RS) Logic software.
  3. Write, troubleshoot, and execute a PLC program on the laboratory simulators.

**Evaluation Criteria/Policies:**

Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	-	100	=	A
83	-	91	=	B
75	-	82	=	C
0	-	74	=	F

Students should refer to the [Student Handbook - https://www.dtcc.edu/handbook](https://www.dtcc.edu/handbook) for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

**Core Curriculum Competencies (CCCs are the competencies every graduate will develop):**

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

**Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):**

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Design or improve electrical/electronics systems using critical thinking, theoretical knowledge, and practical understanding.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Demonstrate basic management, organizational, and leadership skills.
5. Explain the importance of engaging in self-directed continuing professional development.

**Disabilities Support Statement:**

The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the [disabilities services - https://www.dtcc.edu/disabilitysupport](https://www.dtcc.edu/disabilitysupport) web page or visit the campus Advising Center.