

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

**Campus Location:**

Stanton

**Effective Date:**

2022-52

**Prerequisite:**

(MAT 193 or higher), (PHY 205 or PHY 281 or higher)

**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, typically for MET students. Electrical topics include design of basic DC and AC electrical circuit theory, rate and test electrical control components such as circuit protection, switches, relays, transformers, motors, servos and electrical safety. Explore the use and programming of Programmable Logic Controllers.

**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. Define the operating principles, ratings, testing and electrical symbols of common electrical devices such as power supplies, circuit protection devices, switches, relays and resistors. (CCC 2, 5, 6; PGC 7)
3. Define the operating principles, ratings, testing and electrical symbols of inductive and magnetic devices such as motors, transformers, and generators. (CCC 2, 5, 6; PGC 7)
4. Design and size electrical components, devices, and conductors for DC, single, and 3-phase circuits and devices. (CCC 2, 5, 6; PGC 7)
5. Connect and troubleshoot simple electrical circuits. (CCC 2, 3, 5, 6; PGC 1, 7)
6. Develop and troubleshoot simple programmable logic controller (PLC) programs and circuits. (CCC 2, 5, 6; PGC 1, 3, 7)

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 Digital Multimeter to take readings.
  7. Define and calculate the following circuit parameters: voltage, line drop, resistance, and current.
2. Define the operating principles, ratings, testing and electrical symbols of common electrical devices such as power supplies, circuit protection devices, switches, relays, and resistors.
  1. Define typical ratings for each component.
  2. Test each component using a Digital Multimeter.
3. Define the operating principles, ratings, testing and electrical symbols 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, calculate and measure 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.
4. Design and size electrical components, devices, and conductors for DC, single, and 3-phase circuits and devices.
  1. Based on the load in the electrical circuit design and calculate the components in the electrical circuit, including conductor size and power supply.
5. Connect and troubleshoot simple electrical circuits.
  1. Assemble common electro-mechanical circuits, safely and in the correct sense.
6. Develop and troubleshoot simple programmable logic controller (PLC) programs and circuits.
  1. Connect and operate a simple PLC controlled devices.

**Evaluation Criteria/Policies:**

The grade will be determined using the Delaware Tech grading system:

90	-	100	=	A
80	-	89	=	B
70	-	79	=	C
0	-	69	=	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.

**Final Course Grade:**

Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Summative: Exam 1 (Written)	17.5%
Summative: Exam 2 (Written)	17.5%
Summative: Exam 3 (Written)	17.5%
Summative: Exam 4 (Practical)	20%
Formative: Assignment	17.5%
Formative: PLC – Practical	
Summative: PLC – Exam	10%

**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):**

**EENAASEEN**

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Apply a knowledge of mathematics, science, engineering, and technology to electronics engineering technology problems that require limited application of principles but extensive practical knowledge.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Identify, analyze, and solve narrowly defined electronics engineering technology problems.
5. Explain the importance of engaging in self-directed continuing professional development.
6. Demonstrate basic management, organizational, and leadership skills which commit to quality, timeliness, and continuous improvement.

**METAASMET**

1. Use effective problem-solving skills and make appropriate decisions relative to the technical field.
2. Design basic mechanical systems with the use of computer-aided drafting equipment.
3. Demonstrate basic computer literacy and knowledge of computer software applications in both the business and technical fields.
4. Use hand and power tools for standard manufacturing operations.
5. Conduct basic machining and welding operations; and perform basic programming of computer/numerically-controlled machines.
6. Calculate forces, properly size structures and mechanical components, and perform standard materials testing procedures.
7. Demonstrate an understanding of basic AC and DC electrical control circuits.
8. Select appropriate materials for basic mechanical applications.
9. Review and/or design basic hydraulic/pneumatic power systems.
10. Select basic machine components for mechanical systems.
11. Exhibit professional traits, including the ability to work with minimal supervision, willingness to learn new skills, and contributing to team project efforts.

**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.