Electro-Mechanical Engineering Technician

Ontario College Diploma
2 Years
Ottawa Campus

Academic Year: 2020/2021
Program Code: 0550X01FWO

Our Program

Get the technical skills required to repair and modify automated equipment.

The two-year Electromechanical Engineering Technician Ontario College Diploma program prepares you for many different career pathways. Industry professionals teach you the skills to repair and modify automated equipment in many different sectors.

In this program, you experience both classroom and lab-based hands-on learning. You develop team building skills and collaborate on class projects.

As a student in this program, you learn about:

- electronic circuits
- industrial pneumatics
- computer-aided design
- microcontrollers
- digital logic
- programmable logic controllers (PLCs)
- motor controls and machine tool operations
- industrial robots
- mechatronics

In your last semester, you complete an electromechanical project that solves an industrial automation problem. Your project incorporates the knowledge and skills that you learn in the program and demonstrates a fully-functional automated task.

Upon completion of the program, you are eligible to write the Level 1: Siemens Certified Mechatronics Systems Assistant certification, which will certify you as a Siemens Mechatronics Level 1 technician.

Graduates may find a career in a number of sectors. Job opportunities are varied, as almost every automated industrial process requires electro-mechanical maintenance in some capacity.

Upon graduation, you can apply to receive advanced academic standing in Algonquin College’s Bachelor of Automation and Robotics (Honours) program, or seek external pathways such as the Bachelor of Business Administration - Applied Business degree at Davenport University. You can also apply your diploma credits towards a degree with partnering universities.

SUCCESS FACTORS

This program is well suited for students who:

- Have knowledge of the career opportunities and study expectations of the program.
• Are self-motivated.
• Enjoy working with their hands.
• Like problem solving through troubleshooting.
• Have good oral and written communication skills and work well with others.
• Are inquisitive and want to explore how things are made using automation.
• Are interested in a comprehensive and challenging career.

Employment

A wide selection of diverse industry employment opportunities may be available. Graduates may be found repairing, adapting and performing preventative maintenance in the manufacturing and service industry.

Learning Outcomes

The graduate has reliably demonstrated the ability to:

• Fabricate and build electrical, electronic, and mechanical components and assemblies in accordance with operating standards, job requirements, and specifications.

• Interpret and produce electrical, electronic, and mechanical drawings and other related technical documents and graphics for a variety of stakeholders in compliance with industry standards.

• Select and use a variety of troubleshooting techniques and equipment to assess, maintain, and repair electromechanical circuits, equipment, processes, systems, and subsystems.

• Maintain and repair electrical, electronic, and mechanical components, equipment, and systems to ensure that they function according to specifications and to optimize production.

• Support the design and production of mechanical components by assisting in the specification of manufacturing materials and processes.

• Apply, analyze, build, install, commission, and troubleshoot a variety of mechanical, electrical, and electronic control systems, logic and digital circuits, passive AC and DC circuits, and active circuits.

• Install and troubleshoot basic computer hardware and programming to support the electromechanical engineering environment.

• Maintain and troubleshoot automated equipment including robotic systems.

• Establish and maintain inventory, records, and documentation systems to meet organizational and industry standards and requirements.

• Select and purchase electromechanical equipment, components, and systems that fulfill job requirements and functional specifications.

• Assist in applying quality control and quality assurance program procedures to meet organizational standards and requirements.

• Work in compliance with relevant industry standards, laws and regulations, codes, policies, and procedures.

• Develop strategies for ongoing personal and professional development to enhance work performance and to remain current in the field and responsive to emergent technologies and national and international standards.

• Contribute as an individual and a member of an electromechanical engineering team to the effective completion of tasks and projects.
• Support project management activities such as planning, implementation and evaluation of projects, and monitoring of resources, timelines, and expenditures as required.

• Identify and apply discipline-specific practices that contribute to the local and global community through social responsibility, economic commitment and environmental stewardship.

Program of Study

<table>
<thead>
<tr>
<th>Level: 01</th>
<th>Courses</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CAD8300</td>
<td>Computer Aided Design/Drafting (CAD/D)</td>
<td>56.0</td>
</tr>
<tr>
<td>ELN9104</td>
<td>DC and AC Electronics</td>
<td>84.0</td>
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<tr>
<td>ENL1813T</td>
<td>Communications I</td>
<td>42.0</td>
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<tr>
<td>GEN0351</td>
<td>Strategies for Learning</td>
<td>42.0</td>
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<tr>
<td>MAT8001M</td>
<td>Math for Engineering Technicians</td>
<td>56.0</td>
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<tr>
<td>MFG8518</td>
<td>Manufacturing and Metrology</td>
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<tr>
<th>Level: 02</th>
<th>Courses</th>
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<tbody>
<tr>
<td>ELN8613</td>
<td>Basic Electronic Assembly</td>
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<tr>
<td>ELN9192</td>
<td>Circuit Applications</td>
<td>98.0</td>
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<tr>
<td>ELN9206</td>
<td>Mechanisms</td>
<td>28.0</td>
</tr>
<tr>
<td>ELN9211</td>
<td>DC and AC Motor Controls</td>
<td>42.0</td>
</tr>
<tr>
<td>MAC8519</td>
<td>Machine Shop I</td>
<td>42.0</td>
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<tr>
<td>ROB8220</td>
<td>Industrial Pneumatics</td>
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<tr>
<td>ELN8305</td>
<td>Digital Logic Analysis</td>
<td>98.0</td>
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<tr>
<td>ELN9215</td>
<td>Microcontrollers</td>
<td>70.0</td>
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<tr>
<td>ENG0005</td>
<td>Introduction to Quality Assurance</td>
<td>28.0</td>
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<tr>
<td>ENG8317</td>
<td>Statics and Mechanics of Materials</td>
<td>56.0</td>
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<tr>
<td>ENL8720</td>
<td>Technical Communication for Technicians</td>
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<tr>
<td>ROB8306</td>
<td>Project Planning</td>
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Choose one from equivalencies: Courses

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<th>Hours</th>
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<td>CAM8515</td>
<td>Computer Aided Manufacturing I</td>
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<tr>
<td>ELN9204</td>
<td>Microcontroller Interfacing and Programming</td>
<td>70.0</td>
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<tr>
<td>ELN9212</td>
<td>Programmable Logic Controllers I</td>
<td>28.0</td>
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<tr>
<td>ELN9214</td>
<td>Programmable Logic Controllers II</td>
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<tr>
<td>GED0019</td>
<td>Becoming an Entrepreneur: Is It for Me?</td>
<td>42.0</td>
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<td>MGT8215</td>
<td>Final Project</td>
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<tr>
<td>ROB9205</td>
<td>Industrial Robots</td>
<td>42.0</td>
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Fees for the 2020/2021 Academic Year

Tuition and related ancillary fees for this program can be viewed by using the Tuition and Fees Estimator tool at https://www.algonquincollege.com/fee-estimator.

Further information on fees can be found by visiting the Registrar’s Office website at https://www.algonquincollege.com/ro.

Fees are subject to change.
Additional program related expenses include: Books, etextbooks and supplies including safety glasses, safety boots, DE1 board and parts toolbox cost approximately $1,000. (All students are responsible to supply their own CSA-approved leather steel toe work boots. Any other types of footwear are not acceptable).

Admission Requirements for the 2021/2022 Academic Year

College Eligibility

- Ontario Secondary School Diploma (OSSD) or equivalent. Applicants with an OSSD showing senior English and/or Mathematics courses at the Basic Level, or with Workplace or Open courses, will be tested to determine their eligibility for admission; OR
- Academic and Career Entrance (ACE) certificate; OR
- General Educational Development (GED) certificate; OR
- Mature Student status (19 years of age or older and without a high school diploma at the start of the program). Eligibility may be determined by academic achievement testing for which a fee of $50 (subject to change) will be charged.

Program Eligibility

- English, Grade 12 (ENG4C or equivalent).
- Mathematics, Grade 12 (MCT4C or equivalent).
- At least two science courses from Grade 11 and/or Grade 12.

Applicants with international transcripts must provide proof of the subject specific requirements noted above and may be required to provide proof of language proficiency. Domestic applicants with international transcripts must be evaluated through the International Credential Assessment Service of Canada (ICAS) or World Education Services (WES).

- IELTS-International English Language Testing Service (Academic) Overall band of 6.0 with a minimum of 5.5 in each band; OR TOEFL-Internet-based (iBT) Overall 80, with a minimum of 20 in each component: Reading 20; Listening 20; Speaking 20; Writing 20.

Should the number of qualified applicants exceed the number of available places, applicants will be selected on the basis of their proficiency in English and mathematics.

Admission Requirements for 2020/2021 Academic Year

College Eligibility

- Ontario Secondary School Diploma (OSSD) or equivalent. Applicants with an OSSD showing senior English and/or Mathematics courses at the Basic Level, or with Workplace or Open courses, will be tested to determine their eligibility for admission; OR
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- General Educational Development (GED) certificate; OR
- Mature Student status (19 years of age or older and without a high school diploma at the start of the program). Eligibility may be determined by academic achievement testing for which a fee of $50 (subject to change) will be charged.

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- English, Grade 12 (ENG4C or equivalent).
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International applicants must provide proof of the subject specific requirements noted above along with proof of either: (IELTS / TOEFL) IELTS-International English Language Testing
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Application Information

ELECTRO-MECHANICAL ENGINEERING TECHNICIAN
Program Code 0550X01FWO

Applications to full-time day programs must be submitted with official transcripts showing completion of the academic admission requirements through:

ontariocolleges.ca
60 Corporate Court
Guelph, Ontario N1G 5J3
1-888-892-2228

Students currently enrolled in an Ontario secondary school should notify their Guidance Office prior to their online application at http://www.ontariocolleges.ca/.

Applications for Fall Term and Winter Term admission received by February 1 will be given equal consideration. Applications received after February 1 will be processed on a first-come, first-served basis as long as places are available.

International applicants please visit this link for application process information: https://algonquincollege.force.com/myACint/.

For further information on the admissions process, contact:

Registrar`s Office
Algonquin College
1385 Woodroffe Ave
Ottawa, ON K2G 1V8
Telephone: 613-727-0002
Toll-free: 1-800-565-4723
TTY: 613-727-7766
Fax: 613-727-7632
Email: AskUs@algonquincollege.com

Additional Information

Programs at Algonquin College are Bring Your Own Device (BYOD). To see the BYOD requirements for your program, please visit: https://www7.algonquincollege.com/byod/.

The Electromechanical Engineering Technician program starts at three different times during the year; in September, January and May and runs for four consecutive semesters, without a break between semesters.

The first level of this program is common with Manufacturing Engineering Technician and Mechanical Engineering Technologist. This provides students with the option of transitioning to either of these programs prior to the start of the second level.

Students wishing to transition to Manufacturing Engineering Technician may do so with permission from the program coordinator prior to the start of the second level. Students wishing to transition to Mechanical Engineering Technology need to maintain a good academic standing during the first level and obtain a grade of at least C MAT8001M - Technical Mathematics for Engineering.

Students also need to speak to the coordinator of Mechanical Engineering Technology about an additional math course. Students starting level 01 in the Winter or Spring terms, do not have the
option of transferring to the Manufacturing Engineering Technician program.

For more information, please contact Program Coordinator, Irene Casey at 613-727-4723 ext. 6581 mailto:caseyi@algonquincollege.com or Gino Rinaldi at 613-727-4723 ext. 6323 mailto:rinaldg@algonquincollege.com.

Course Descriptions

**CAD8300 Computer Aided Design/Drafting (CAD/D)**

Students are introduced to (CAD/D) Computer-Aided Design/Drafting. Students use a commercial 3D CAD/D system (SolidWorks) to parametrically model mechanical parts and assemblies. Area and mass property information is determined and verified by students. Motion inter-dependencies and physical dynamics within the model are established to create realistic virtual models. Commercial-off-the-shelf third party components are sourced, imported and utilized as required. Students create drawing layouts which typically include the orthographic, section, auxiliary and detailed views necessary to thoroughly describe a part/assembly. Students learn how to annotate their drawings in strict accordance with the ANSI/ASME Y14.5 drafting standard.

Prerequisite(s): none
Corerequisite(s): none

**CAM8515 Computer Aided Manufacturing I**

The use of Computer Numerical Control (CNC) machinery has become a standard in the manufacturing industry. Through instruction and discussion of concept, applications and coding systems of CNC machines, students examine CNC manufacturing methods and develop the technical understanding required to operate such machinery. Students also write and edit part programs and operate IBM compatible computers using editing, printing and back-plotting software.

Prerequisite(s): CAD8300 and MFG8518
Corerequisite(s): none

**ELN8305 Digital Logic Analysis**

Students master the theory of digital logic, including BCD, hex and binary number systems. Topics of study include logic gates and Boolean algebra, an introduction to PLDs, sequential logic, combinational logic, flip-flops, counters and shift registers. Using lab experiments, students learn to design and apply modern digital circuitry.

Prerequisite(s): ELN9192
Corerequisite(s): none

**ELN8613 Basic Electronic Assembly**

Students are exposed to soldering techniques. Brief lecture sessions provide the theoretical background followed by practical skills demonstration. Students perform labs to develop various skills, such as Printed Circuit Board component soldering (and de-soldering) for both traditional Through-Hole and Surface Mount Technology. They build their own set of meter leads and a functional project, (such as a Logic Probe) for use in other electronic courses.

Prerequisite(s): none
Corerequisite(s): none

**ELN9104 DC and AC Electronics**

An understanding of entry-level electronics is essential to all engineering fields. Students explore basic electrical components and how they are used in electrical circuits. Discovering and using resistors, capacitors and inductors to build circuits from schematic diagrams, students perform tests and measurements to promote their understanding of fundamental electronics. Through following the flow of energy in complete circuits, students apply troubleshooting strategies to identify, localize and correct malfunctions. Students use digital multimeters, oscilloscopes and signal generators to create and measure circuit characteristics. Students evaluate circuits using...
Ohm's Law, Kirchoff's laws, superposition and other theorems. RL, RC and RLC circuits are examined. Good lab safety practices are stressed. Students provide written reports on their findings.

Prerequisite(s): none
Corerequisite(s): MAT8001M or MAT8100

**ELN9192 Circuit Applications**

Students enhance their understanding of the properties and uses of semi-conductor, solid state devices including diodes, transistors and integrated circuits. In lab experiments students construct circuits to explore the proper use of semi-conductor components. Components in circuits create amplifiers, operational amplifiers and power supplies. Students' analytical skills and troubleshooting skills are further developed through practical lab work.

Prerequisite(s): ELN9104
Corerequisite(s): none

**ELN9204 Microcontroller Interfacing and Programming**

Students interface the PIC microcontroller to an assortment of sensors, output devices and electronic components to demonstrate many of the ways these microcontrollers are used in industry. Topics include Temperature Sensors, EEPROM Programming, Analog to Digital Conversion, Clocking Data, Interfacing Displays, Real-Time Interfacing and Programming the PIC using C. Different methods of circuit analysis and troubleshooting skills are examined through experimentation with the PIC and its associated components.

Prerequisite(s): ELN8303 and ELN9213
Corerequisite(s): none

**ELN9206 Mechanisms**

Mechanics and mechanical systems are pervasive and can be found in many diverse applications ranging from automotive to aerospace. Students learn about the mechanical and fluid components used to transmit power in mechanical systems. How to select bearings, seals, shafts, couplings, brakes, clutches, and other components to assemble drive systems will be introduced. Students will be exposed to power losses, friction reduction and lubrication in mechanical systems. The use of fluid power and its integration into mechanical systems will be introduced.

Prerequisite(s): none
Corerequisite(s): none

**ELN9211 DC and AC Motor Controls**

Students gain a thorough knowledge of how DC and AC motors are controlled; understanding the use and control of motors is essential to maintaining any electro-mechanical process. Various motors and their control circuits are examined, providing students practical experience wiring and troubleshooting single and three phase circuits using logic control, forward/reverse starters, multiple motor control, relays and timers.

Prerequisite(s): ELN9104
Corerequisite(s): none

**ELN9212 Programmable Logic Controllers I**

Students learn to program and use the Programmable Logic Controller (PLC), an important industrial, commercial and building automation control system. Students reinforce their knowledge of programming by adapting it to the specific programming requirements of the PLC. Students learn how the PLC has replaced mechanical controls with a faster, more flexible, software alternative. Students are exposed to industrial, commercial and building automation applications of the PLC. Students gain practical experience programming the PLC, and doing basic interfacing of the PLC to electromechanical inputs and outputs such as light sensors and motors.
ELN9214 Programmable Logic Controllers II

Students further develop their ability to program and use the Programmable Logic Controller (PLC), important in industrial, commercial and building automation control systems. Students reinforce their knowledge of PLC programming, creating longer and more flexible software programs. Students expand their knowledge of different PLCs and different industrial, commercial and building automation applications of the PLC. Students gain advanced experience programming the PLC, and doing more complex interfacing of the PLC to electromechanical inputs and outputs, such as advanced sensors and robots.

Prerequisite(s): ELN8303 and ELN9212
Corerequisite(s): none

ELN9215 Microcontrollers

Control systems are an integral part of the modern world. With the current trend of ever increasing automation, fundamental knowledge and skill in the development and implementation of systemic control are a basic requirement. Students gain an understanding of the use of the microcontroller, one of the most commonly used electronic control components. Students learn C Language programming and then use C to program microcontrollers in basic electronic control circuits. Lab exercises reinforce programming skills and introduce basic interfacing techniques for the microcontroller. Analytical and troubleshooting skills are further developed through breadboard experiments with the microcontroller and associated interfacing component.

Prerequisite(s): ELN9192
Corerequisite(s): none

ENG0005 Introduction to Quality Assurance

Organizations require formal control processes and systems to ensure quality of products and services. Students gain an understanding of numerous quality control strategies, such as Lean Manufacturing and basic ISO standards and practices. In our data-driven society, statistics are everywhere, guiding personal and professional decisions. Students are introduced to the basics of statistics as well as how and when to use them. Topics covered include, mean, standard deviation, margin of error, normal distributions, Pareto charts and an overview of Statistical Process Control. Through the discussion of case studies, students gain an appreciation of the costs of quality.

Prerequisite(s): none
Corerequisite(s): none

ENG8317 Statics and Mechanics of Materials

Students are introduced to the concepts of force and stress and learn to apply these concepts to a variety of engineering problems. Statics topics include free body diagrams, force, moment, couples, static equilibrium, centroids and distributed loads. Mechanics of materials topics include normal stress, shear stress, strain and Hooke’s Law. The concept of Factor of Safety is used in the design of pinned connections, cables and axially loaded members.

Prerequisite(s): MAT8001M
Corerequisite(s): none

ENL1813T Communications I

Communication remains an essential skill sought by employers, regardless of discipline or field of study. Using a practical, vocation-oriented approach, students focus on meeting the requirements of effective communication. Through a combination of lectures, exercises, and independent learning, students practise writing, speaking, reading, listening, locating and documenting information and using technology to communicate professionally. Students develop and strengthen communication skills that contribute to success in both educational and workplace environments.
ENL8720 Technical Communication for Technicians
Clear, concise and detailed communication is essential for technical workplaces. Students plan and execute a variety of formal and informal visual, oral and written communication tasks. Exercises and activities foster confidence and competence in workplace communication.

Prerequisite(s): ENL1813T
Corerequisite(s): none

GED0019 Becoming an Entrepreneur: Is It for Me?
The ever changing global economy presents many challenges for job seekers, but it also provides opportunities for entrepreneurs. The process of turning an idea into an opportunity forms the nucleus of entrepreneurship, with the aim of enhancing the socio-economic experience of the public. Students are exposed to the various aspects of entrepreneurship and the effects they have on themselves and the global community. Through classroom discussions, presentations and online activities, students develop their understanding of the pros and cons of entrepreneurship. Students evaluate their career ambitions through introspective reflection to determine if they have the drive and desire to pursue a career as an entrepreneur.

Prerequisite(s): none
Corerequisite(s): none

GED0550 General Education Elective
Students have the opportunity to choose one from a group of general education electives. Options include courses which cover the following broad topic areas: Arts in Society, Civic Life, Social and Cultural Understanding, and Personal Understanding.

Prerequisite(s): none
Corerequisite(s): none

GEN0351 Strategies for Learning
Students learn techniques to help them become expert learners by examining their assumptions and attitudes towards learning. Students are introduced to concepts such as self-efficacy, goal setting and valid self-assessment. Students learn to identify how and when to ask for help. Students complete a learning plan to document and manage their own learning objectives.

Prerequisite(s): none
Corerequisite(s): none

MAC8519 Machine Shop I
Machine shop fundamentals are covered. Students focus on metal removal operations and the selection of machine tools for specific operations, including the use of drill presses, lathes, milling machines, grinders and various hand tools encompassing speed and feed calculations. To effectively function safely in a manufacturing environment, it is necessary to develop the knowledge and skills in maintaining machinery, performing manufacturing and developing components and products. While practising shop safety, students’ machine basic level projects providing practical experience in a manufacturing environment. Students operate standard machine tools and apply hands-precision measurement and layout tools.

Prerequisite(s): CAD8300 and ENG8313
Corerequisite(s): none

MAT8001M Math for Engineering Technicians
Students learn foundational mathematics required in many College technical programs. Students solve measurement problems involving a variety of units and ratio and proportion problems. They manipulate algebraic expressions and solve linear, quadratic, exponential and logarithmic equations. Students study the trigonometry of right triangles and vectors. Students acquire the knowledge to work with numerical systems and internal machine representations, binary/hex/ octal/decimal math, Boolean logic and truth tables. Students learn to use and manipulate complex numbers in rectangular, polar and exponential forms. Delivered in a modular format, this course is equivalent to the completion of all of the following math modules MAT8100 - a, b, c, e, f, h, i, k, and l.

Prerequisite(s): none
Corequisite(s): none

**MFG8518 Manufacturing and Metrology**

Manufacturing is complex and dynamic, and professionals must continuously demonstrate skill, adaptability, creativity and collaboration. By examining how components and products are created, students will discover numerous manufacturing processes using many different types of materials. What is also key to manufacturing is the ability to measure those manufactured goods. Through theory and lab exercises the student will learn the importance of quality and accuracy of manufactured components using many different types of measuring equipment. The importance of machine safety and personal safety are a key part in all types of manufacturing; the use of PPE, WHMIS regulations and safe operation of equipment will be emphasized.

Prerequisite(s): none
Corequisite(s): none

**MGT8215 Final Project**

Experience with practical projects provides students with learning opportunities to gain insight and experience, thereby making connections to industry. Students work, in consultation with faculty and closely with external stakeholders, to create deliverables and work towards solutions using project management methodologies. Students undertake projects generated by industry, the department faculty, or the students themselves that solve an industrial manufacturing and automation problem. The finished project must demonstrate a functional, design, manufacturing and electro-mechanical solution. Students in small groups research their project design problem, develop specifications for the design solution and produce a report to document their project work. Students are expected to meet with faculty advisors, document their work, deliver an oral presentation and demonstrate a functional automation project.

Prerequisite(s): ROB8306
Corequisite(s): none

**ROB8220 Industrial Pneumatics**

The current trend towards ever-increasing automation requires a workforce trained in all aspects of automated systems, including pneumatics and electro-pneumatics. Pneumatics is the use of air to do work. Students build pneumatic and electro-pneumatic circuits that mimic real life industrial situations. Simulation software complements the hands-on lab experience. Pneumatic and electro-pneumatic valves such as timers, directional and flow control valves controlled by solenoids and relays are used extensively throughout the course. Students make use of ladder logic diagrams to develop the logistical requirements of various industrial applications, including meeting safety standards. Students work in teams to apply their skills by designing an industrial application for a culminating project.

Prerequisite(s): none
Corequisite(s): none

**ROB8306 Project Planning**

Students develop basic project management skills, including team management, scheduling, budgeting and the organizational skills required to manage projects. In preparation for ROB9210, students research, review and create possible projects and define project goals. With their team members, students develop a project proposal which they execute in the following semester.
Where appropriate, students meet with industrial partners to inform their project proposal.

Prerequisite(s): none
Corerequisite(s): none

**ROB9205 Industrial Robots**

Students explore robotic applications and the various elements of robotic systems. A variety of robots and their various parts: drives, controllers, arms, sensors and end effectors are presented. Students complete a final project that simulates an industrial process.

Prerequisite(s): ELN8303 and ELN9213
Corerequisite(s): none