Area of Interest: Engineering and Architecture

**Mechanical Engineering Technology (Co-op and Non Co-op Version)**

Ontario College Advanced Diploma

Academic Year: 2020/2021

3 Years

Program Code: 0010X01FWO

Ottawa Campus

**Our Program**

*Learn engineering design, and offer solutions as a mechanical engineering technologist.*

The three-year Mechanical Engineering Technology Ontario College Advanced Diploma program teaches you to apply scientific and engineering principles to solve mechanical engineering problems in a variety of industries.

Through a series of classroom-based courses and extensive practical labs, you acquire skills specific to mechanical engineering technologists, including:

- modifying and improving engineering designs using conventional and computer-based methods
- performing engineering tests
- supporting product development
- using engineering software and systems to conduct engineering design and analysis
- designing specialized jigs and fixtures
- analyzing problems involving machine design, fluid dynamics, thermodynamics and heat transfer
- understanding and applying design standards (i.e. ASHRAE and ASM International)
- using design software such as SolidWorks, AutoCAD and MasterCAM

During your third year in the program, you complete a capstone project under the guidance of your faculty members. You work with external stakeholders in the industry during the project to analyze, plan and execute your project.

Students also have the option to gain real-world experience through a paid co-operative education (co-op) work term (see Additional Information for more details). Please note that places in the co-op version of the program are subject to availability. Students who elect to apply to the non-co-op version of the program may not have the opportunity to transfer to the co-op version at a later date.

Graduates may find work in the research, design and testing of mechanical systems, or with:

- manufacturing processes
- electro-mechanical control systems
- automation
- green-energy and building systems

**SUCCESS FACTORS**
This program is well-suited for students who:

- Have investigated the career opportunities and study expectations by speaking with recent graduates, students, employers and faculty of the program.
- Enjoy learning activities and assume responsibility for the time and effort required.
- Enjoy science and are eager to apply applications of mathematics, physics and chemistry.
- Are committed to a well-rounded education leading to multiple career opportunities in a variety of industries.

Employment

Graduates may find employment as engineering technologists in the manufacturing, aerospace, transportation, and system industries. Graduates may be involved in product design and product testing; electronics and computer manufacturing; automation and control systems/processes and other diverse jobs that involve the transmission of power and energy in mechanical systems.

Learning Outcomes

The graduate has reliably demonstrated the ability to:

- Monitor compliance with current legislation, standards, regulations and guidelines.
- Plan, co-ordinate, implement and evaluate quality control and quality assurance procedures to meet organizational standards and requirements.
- Monitor and encourage compliance with current health and safety legislation, as well as organizational practices and procedures.
- Develop and apply sustainability best practices in workplaces.
- Use current and emerging technologies to implement mechanical engineering projects.
- Analyze and solve complex mechanical problems by applying mathematics and fundamentals of mechanical engineering.
- Prepare, analyze, evaluate and modify mechanical engineering drawings and other related technical documents.
- Design and analyze mechanical components, processes and systems by applying fundamentals of mechanical engineering.
- Design, manufacture and maintain mechanical components according to required specifications.
- Establish and verify the specifications of materials, processes and operations for the design and production of mechanical components.
- Plan, implement and evaluate projects by applying project management principles.
- Develop strategies for ongoing personal and professional development to enhance work performance.
- Apply business principles to design and engineering practices.
- 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 Courses</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CAD8300 Computer Aided Design/Drafting (CAD/D)</td>
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<tr>
<td>ELN9104 DC and AC Electronics</td>
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<tr>
<td>ENG8307 Statics</td>
<td>56.0</td>
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<tr>
<td>ENL1813T Communications I</td>
<td>42.0</td>
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<td>GEN0351 Strategies for Learning</td>
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<tr>
<td>MAT8100 Essential Mathematics</td>
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<tr>
<td>MFG8518 Manufacturing and Metrology</td>
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<tr>
<td>CAD8305 CAD Applications and GDT</td>
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<td>ENG8308 Strength of Materials I</td>
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<td>GED0019 Becoming an Entrepreneur: Is It for Me?</td>
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<td>MAC8519 Machine Shop I</td>
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<td>ROB8220 Industrial Pneumatics</td>
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<td>WEL9107 Introduction to Fuel Gas and Electrical Welding</td>
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<td>CAM8515 Computer Aided Manufacturing I</td>
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<td>ELN8299 Industrial Electricity</td>
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<tr>
<td>ENG8306 Materials Science</td>
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<td>ENG8309 Strength of Materials II</td>
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<td>ENG8320 Fluid Mechanics</td>
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<td>CAM8313 Introduction to C Language</td>
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<td>DRA8362 Computer Aided Engineering</td>
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<td>DSN0037 Tool Design</td>
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<td>ELN8298 Industrial Electronics</td>
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<td>ENG8305 Metallurgy and Polymers</td>
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<td>ENG8321 Thermodynamics</td>
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<td>ENL2019T Technical Communication for Engineering Technologies</td>
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<td>ENG8315 Machine Design and Analysis I</td>
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<td>ENG8322 Thermofluids</td>
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<td>ENL4001 Technology Report Preparation</td>
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<tr>
<th>Level: 06 Courses</th>
<th>Hours</th>
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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 and supplies cost approximately $1,350 per year. Supplies can be purchased at the campus store. See https://www.algonquincollege.com/coursematerials/ for more information about books.

Students are required to procure safety boots and glasses for use in some labs at a cost of approximately $200. (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 (Grade 11 MCR3U) 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
- 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 (Grade 11 MCR3U) or equivalent.
- At least two science courses from Grade 11 and/or Grade 12.
- International applicants must provide proof of the subject specific requirements noted above along with proof of either: (IELTS / TOEFL) 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.
- Applicants with international transcripts must provide proof of the subject specific requirements noted above and may be required to provide proof of language proficiency.

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.

Application Information

MECHANICAL ENGINEERING TECHNOLOGY (CO-OP AND NON CO-OP VERSION)
Program Code 0010X01FWO

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
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/.

Apply directly to the co-op or non co-op version of this program through OntarioColleges.ca or our International Application Portal.

Cooperative education (Co-op) allows students to integrate their classroom learning with a real-world experience though paid work terms. Two academic terms prior to the cooperative education work term, students are required to actively participate in and successfully complete the self-directed co-op online readiness activities and in-person workshops.

Students must actively conduct a guided, self-directed job search and are responsible for securing approved program-related paid co-op employment. Students compete for co-op positions alongside students from Algonquin and other Canadian and international colleges and universities. Algonquin College’s Co-op Department provides assistance in developing co-op job opportunities and facilitates the overall process, but does not guarantee that a student will obtain employment in a co-op work term. Co-op students may be required to relocate to take part in the co-op employment opportunities available in their industry and must cover all associated expenses; e.g., travel, work permits, visa applications, accommodation and all other incurred expenses.

Co-op work terms are typically 14 weeks in duration and are completed during a term when students are not taking courses.

International students enrolled in a co-op program are required by Immigration, Refugees and Citizenship Canada (IRCC) to have a valid Co-op/Internship Work Permit prior to commencing their work term. Without this document, International students are not legally eligible to engage in work in Canada that is a mandatory part of an academic program.

For more information, please visit https://www.algonquincollege.com/coop.

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

Students wishing to continue in Mechanical Engineering Technology are required to maintain good academic standing during the first level and obtain a grade of no less than a C in MAT8100 - Essential Mathematics.

A passing grade in ENG8307 is 60%. ENG8307 requires a grade of 60% in order to progress to the next level of the program.

For more information, contact Brian Gray, Program Coordinator, at 613-727-4723 ext. 5786 or mailto:grayb@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

CAD8305 CAD Applications and GDT
Students use a commercial CAD/D system (SolidWorks) to parametrically model mechanical parts, assemblies and systems. Rudimentary statistics and probabilities are introduced to analyze error and tolerance in a design. Established design fits and their associated engineering tolerances are used to define functional mates between assembled parts. Tolerance accumulation and stack-up analysis are performed on assemblies. Students learn how to annotate working drawings in compliance with the ANSI/ASME Y14.5 and Y14.41 Geometric Dimensioning and Tolerancing (GD&T) standards. The creation of specialized types of CAD models is also taught; these applications include programmed parts, sheet metal developments, welded structures and rudimentary FEA.

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

CAM8302M Microcomputer Interfacing

Through theoretical and several lab sessions, microcomputers (e.g. Raspberry Pi) and microcontrollers architecture and particularly interfacing operation are introduced. Practical knowledge is gained on interfacing electric and electronic circuits with a microcontroller/microcomputer, both from/with digital and analog inputs and outputs, such as from switches, sensors, or to LEDs (indicators) and to control mechanical actuators (DC and servo motors). Students are introduced to mechatronic systems operation and control (ex. for manufacturing), PLCs, ladder logic and LabView. Simple computer programs are developed to perform simple open-loop I/O control of external devices.

Prerequisite(s): CAM8313 and ELN8298  
Corerequisite(s): none

CAM8313 Introduction to C Language

Computer hardware, operating systems and C programming are introduced. Students are also introduced to the essentials of a microcomputer system. Topics include: algorithms, pre-processor directives, variables, data I/O, relational operators, arrays, matrices and file I/O. Students use these concepts to create structured C programs to solve engineering problems. Hardware, including a microcontroller board, and simple input (switches) and output (LED indicators) components are also explored.

Prerequisite(s): MAT8101  
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

DRA8362 Computer Aided Engineering

Students use commercial finite element analysis (FEA) software (SolidWorks Simulation) to analyze mechanical parts and assemblies. Topics include rudimentary theory, mesh design, convergence testing, optimization and verification of FEA problems. Students also use FEA methods to solve problems involving stress analysis, beam deflection, buckling of columns, contact frictions, free vibration and rudimentary computational fluid dynamics (CFD). Each FE or CFD analysis is compared with a theoretical solution and/or an empirical prediction.

Prerequisite(s): CAD8300 and ENG8309 and ENG8320  
Corerequisite(s): none
DSN0037 Tool Design
Students are exposed to a significant amount of drafting. Topics include design of cutting tools, gauges and gauge design, principles of locating and clamping, work-holder standards and special purpose, design analysis procedures, manufacturing process as related to tool design, tooling materials and their applications, design of sheet metal, shearing, bending and forming and drawing dies.
Prerequisite(s): CAD8305
Corerequisite(s): none

ELN8298 Industrial Electronics
Theory and laboratory work are used to build upon previously acquired knowledge on the use of power supply, signal generation and signal output and power measurement equipment, such as oscilloscopes and voltmeters and ammeters. As well, the design and assembly of electronic circuits for different engineering applications are performed through the application of fundamental electronic devices, such as resistors, capacitors, diodes, transistors, operational amplifiers and other integrated circuits. Some of the applications involve building rectifiers, logic circuits and amplifiers circuits, filters, summing amplifiers, integrators, comparators and differentiators. Students are introduced to mechatronic systems operation and control (ex. for manufacturing), PLCs, ladder logic.
Prerequisite(s): ELN8299
Corerequisite(s): none

ELN8299 Industrial Electricity
Theory and applications of industrial electrical components are expanded. Topics covered expand on previous knowledge of relays, transformers, DC/AC generators and single phase circuits to develop a deeper understanding on DC/AC motors, single-phase motors and three phase AC circuits, and their application to mechatronic systems operation.
Prerequisite(s): ELN9104
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

ENG4001 Project I
Experience with practical projects provides students with learning opportunities to gain insight and experience, thereby making the connection to industry. Through collaborative participation in applied research projects, students in groups undertake problems of significant technical complexity and work towards solutions using project management methodologies. Student groups initiate projects working closely with stakeholders in real-world workplace environments. There is an option to take the project course ENG4002 as an equivalence to this course. Note: the project courses (ENG4001 and ENG4003) and the supporting communication courses (ENL4001 and ENL4003) have to be done in two consecutive terms.
Prerequisite(s): none
ENG4002 Engineering Project for Entrepreneurs

Experiencing the process of creating and validating a new product or service idea provides students with the opportunity to decide whether the path of an entrepreneur is suited to them. Through the processes of ideation and customer idea validation, students continue to refine an idea until it is ready to pitch to investors. Students with successful pitches earn funds to build their prototype the following term in ENG4003.

Prerequisite(s): none
Corequisite(s): ENL4001

ENG4003 Project II

The ability to identify and satisfy all stakeholder expectations is essential in successful product development. Following up on topics selected in the Project 1 course (ENG4001 or ENG4003) student groups continue to execute projects of significant technical complexity in an applied research context. Student groups work in consultation with faculty and external stakeholders to create deliverables by monitoring and controlling the project resources. The solutions developed are defended in formal oral and written presentations. Students that started with ENG4002 must continue with the project course ENG4004. Note: the project courses (ENG4001 and ENG4003) and the supporting communication courses (ENL4001 and ENL4003) have to be done in two consecutive terms.

Prerequisite(s): ENG4001
Corequisite(s): ENL4003

ENG8305 Metallurgy and Polymers

Topics covered include steels, aluminum, alloys and their industrial applications, powder metallurgy, surface treatments, ceramics, and corrosion control and prevention, failure mechanisms, fatigue and creep, fundamentals of polymer and composite structures, thermoset, thermoplastic, and elastomeric polymerization reactions, and physical, mechanical, and thermal properties of polymers and composites. A laboratory component is included.

Prerequisite(s): ENG8306
Corequisite(s): none

ENG8306 Materials Science

Understanding the properties of materials is an important component in working with such materials. Topics covered include crystal structures, atomic bonding, dislocation theory, equilibrium diagrams, heat treatments, hardening ability, IT diagrams and ferrous alloys.

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

ENG8307 Statics

Statics is the study of bodies at rest, or of forces in equilibrium. Students explore concepts of free body diagram, force, moment, couple, force components, force resultants, concentrated and distributed loads. The basics of static equilibrium of machines and structures, friction, centroids and moments of inertia are covered.

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

ENG8308 Strength of Materials I

Students are introduced to applied stress analysis including normal and shear stress, deformation and various material properties. Hooke’s Law is presented to show the relationship between stress
and strain. Other topics include stresses in bolted connections, torsional shear stress and angle of twist in shafts, normal and shear stress in beams and the concept of factor of safety.

Prerequisite(s): MAT8100 or MAT8100P  
Corerequisite(s): ENG8101

**ENG8309 Strength of Materials II**

Students are introduced to combined loadings, pressure vessels, the state of stress and the use of Mohr’s circle to determine principle stresses. Beam deflection is calculated using a variety of techniques. Critical load for column buckling is determined for columns with various types of supports. Labs are designed to complement new theory, as well as reinforce concepts. Students experimentally determine material properties, such as Young’s Modulus, Shear Modulus and yield strength.

Prerequisite(s): ENG8307 and ENG8308 and MAT8101  
Corerequisite(s): MAT8102

**ENG8310 Dynamics**

Students explore the dynamics of particles and rigid bodies. Topics include position, velocity, acceleration analysis, Newton's second law, power, energy and momentum. Students use analytical and graphical methods to solve velocities and accelerations of machine parts.

Prerequisite(s): ENG8307 and MAT8101 or ENG8101 and MAT8101  
Corerequisite(s): none

**ENG8311 Dynamics of Machinery I**

The Grashof criteria and Gruebler’s equation are used to identify and evaluate linkages. Students design common linkages using graphical methods. Position, velocity and acceleration are calculated using both graphical and analytical techniques. Students demonstrate competence by completing a final project and verify their design through the use of simulation or models.

Prerequisite(s): ENG8310  
Corerequisite(s): none

**ENG8312 Dynamics of Machinery II**

A variety of machine components are introduced with their kinematics and kinetics approaches. Included are: forces acting on links; cam design and its terminology; cam S V A J diagrams; cam kinematics and dynamics of rigid cam systems; gear trains; fundamental law of gearing; gear types and terminology; simple and compound gear trains; mass moment; center of gravity, mass moment of inertia; radius of gyration; D' Alembert principle; dynamic force analysis of linkages. Students learn how to visualize and analyze motions in machines, and how to design mechanisms to achieve desired motion specifications. A combination of graphical and analytical techniques is used. Students write computer scripts and use CAD design software, such as Solidworks to create their designs.

Prerequisite(s): ENG8311  
Corerequisite(s): none

**ENG8314 Mechanical Vibrations**

Students examine the theory of mechanical vibrations and its application and effects on mechanical systems. Topics covered include modelling of mechanical systems to study their vibrations, determination of equivalent spring mass system, damping elements, resonant frequency free vibration, vibration due rotational imbalance and vibration measurement.

Prerequisite(s): ENG8312 and MAT8103  
Corerequisite(s): none
ENG8315 Machine Design and Analysis I

An understanding of failure mechanisms is essential to design parts that are safe. Following a review of applied and principal stresses for static loading, students learn static failure theories for ductile and brittle materials. Students also learn fatigue failure theories and demonstrate competence by analyzing parts with stress concentrations, fabricated of ductile and brittle materials, using Modified-Goodman.

Prerequisite(s): DRA8362 and ENG8309
Corerequisite(s): none

ENG8316 Machine Design and Analysis II

A competent mechanical designer designs and analyzes a variety of machine elements by drawing upon appropriate fatigue and other failure theories. Applying these theories, the student specifies, designs and analyzes a variety of parts, such as, shafts, keys, springs, screws and fasteners, solid-disk flywheels and determines interference fits.

Prerequisite(s): ENG8315
Corerequisite(s): none

ENG8320 Fluid Mechanics

Students explore fluid properties; manometry laws; fluid statics; buoyancy and stability of submerged objects and continuity equations. Bernoulli’s principle and modifications for pumps and turbines; viscosity; Reynold’s number; Darcy's equation; Moody’s diagram; hydraulic systems, and pressure and flow measuring techniques are also covered.

Prerequisite(s): ENG8307 and MAT8101 or ENG8101 and MAT8101
Corerequisite(s): none

ENG8321 Thermodynamics

Energy transformation and utilization of various working substances in some thermal and refrigeration systems are studied along with their efficiency and performance definitions. Fundamental concepts based on zeroth, first and second laws of thermodynamics are also introduced. Students study Closed and Open systems along with different types of processes (e.g. isothermal, isentropic). Properties and processes for ideal gases and solid-liquid-vapor phases of pure substances are studied with their applications to power and refrigeration cycle. Students define entropy and its change for some processes. Students solve problems using T-s or P-h diagrams graphically, or using thermodynamic property tables.

Prerequisite(s): ENG8320 and MAT8102
Corerequisite(s): none

ENG8322 Thermofluids

The theory and practice of power and refrigeration cycles are covered. Upon completion the student is able to apply 1st and 2nd laws of thermodynamics to a variety of thermal-mechanical systems, design and troubleshoot heating and ventilation systems used in residential and commercial buildings, evaluate the performance of air conditioning and refrigeration systems, understand how a steam plant works, and determine its efficiency and perform engineering calculations in both metric and English units.

Prerequisite(s): ENG8321
Corerequisite(s): none

ENG8323 Heat Transfer

Conduction, convection and radiation heat transfer concepts are covered. The application of Fourier's equation for conduction through plane walls, cylindrical and spherical shapes; Newton's law of cooling, convection heat transfer rates using experimental correlations, non-dimensional numbers, overall heat transfer coefficients; and basic relations in radiation heat transfer are also
ENG8344M Control Systems

Various industrial control systems and their components are introduced. Open and closed loop control systems are explained, through an understanding and development of block diagrams, transfer functions, Laplace transforms, sensors and actuators applications, analog signal processing and conversion (analog to digital and vice-versa), motion control principles; component selection, integration and circuit design; discrete control, continuous control and use of digital and analog controllers, including microcontrollers and microcomputers. During lab work, data acquisition and processing are performed, with data retrieved from digital and analog inputs, such as from sensors, using Analog to Digital Converters (ADC). As well, outputs from industrial controllers are used for motion control (DC motors and servos), using Pulse-Width Modulation (PWM). Students apply their learning to mechatronic systems operation and control (ex. for manufacturing), using PLCs, ladder logic and LabView.

Prerequisite(s): CAM8302M and MAT8103
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.

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

ENL2019T Technical Communication for Engineering Technologies

The ability to communicate effectively in a technically-oriented interdisciplinary workplace is a foundational skill in an innovation-driven economy. Students are exposed to exercises and assignments designed to foster independent and collaborative critical thinking, research, writing, visual communication and presentation skills related to technical topics.

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

ENL4001 Technology Report Preparation

Students define and describe a problem of significant technical complexity and present a suitable technological solution. Drawing upon skills previously acquired, students plan, conduct research for and begin the creation of a written report that is based upon the guidelines established by the Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

Prerequisite(s): ENL1819T or ENL2019T
Corerequisite(s):ENG4001

ENL4003 Technology Report

Students complete the report defined in ENL4001. The completed report forms the basis of an oral presentation to faculty, peers and interested industry personnel in the final weeks of the term. ENL4001 and ENL4003 must be taken in the same academic year unless an exception is approved.

Prerequisite(s): ENL4001
Corerequisite(s):ENG4003
GED0010 General Education Elective
Students choose one course, from a group of general education electives, which meets one of the following five theme requirements: Arts in Society, Civic Life, Social and Cultural Understanding, Personal Understanding, and Science and Technology.
Prerequisite(s): none
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

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

MAT8100 Essential Mathematics
Students review the manipulation of algebraic expressions as a foundation for advanced mathematical concepts. Students solve 2x2 and 3x3 systems of linear equations, and factor algebraic expressions using common factors and techniques for factoring trinomials. They simplify, add, subtract, multiply and divide rational expressions and solve equations involving algebraic fractions. Students study the properties of right triangles and trigonometric functions of obtuse angles. Students graph polynomial and sinusoidal functions using tables of values and stretches, shifts and shrinks. They also add and subtract vectors and convert between 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 modules in MAT8100 - a, b, c, d, e, f, g and i.
Prerequisite(s): none
Corerequisite(s): none
MAT8101 Differential Calculus

Differential Calculus is the mathematical study of rates of change. Students study derivative, its definition and interpretation and its applications. Stud limits and use first principles to find simple derivatives. The product, quotient and chain rules are used to find derivatives of algebraic functions. Students use differentiation rules to find derivatives of transcendental functions. A variety of applications of derivatives, such as curve sketching, finding the tangent to a curve and finding an approximate solution to an equation using Newton's method, are also studied.

Prerequisite(s): MAT8100 or MAT8100P or MAT8050 and MAT8051 or MAT8050P and MAT8051
Corequisite(s): none

MAT8102 Integral Calculus

Integral calculus is the study of the definitions, properties and applications of two related concepts, the indefinite integral and the definite integral. Students find the area under a curve and the area between two curves. Students calculate both indefinite and definite integrals, and use the Trapezoidal Rule and Simpson's Rule to perform numerical integrations. Students integrate polynomial, exponential, logarithmic and trigonometric functions by substitution. Integration by parts and partial fractions are employed to perform complex integrations.

Prerequisite(s): MAT8101
Corequisite(s): none

MAT8103 Ordinary Differential Equations

Physical situations such as beam deflection, harmonic motion, circuit theory or Newton's Laws require solving first or second order ordinary differential equations. Students study first order differential equations and solve these equations using separation of variables, integrating factors for linear equations and Laplace Transforms. Both homogeneous and non-homogenous second and higher order differential equations with constant coefficients are solved using the method of undetermined coefficients and using Laplace Transforms. Students also use both methods to solve practical applications of second order ordinary differential equations related to students' program of study. A review of sequences and series is completed in order to prepare students for power series expansions. Students apply Maclaurin series to expand functions as a power series and use the results to approximate values of transcendental functions. Students also study periodic functions and determine their Fourier series expansions.

Prerequisite(s): MAT8102
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

ROBB220 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
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standards. Students work in teams to apply their skills by designing an industrial application for a culminating project.

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

**ROB8305M Pneumatics/Hydraulics/Automation**

Focus is on the design and logic of power circuits operated by hydraulic or pneumatic devices and equipment. Developing on previous theoretical knowledge on Fluid Mechanics, the course content includes the following: pneumatic/hydraulic directional control valves, logic gates, series and parallel circuits, compressors and pumps, motors and pneumatic/hydraulic cylinders, sequencing, intensifiers and amplifiers, and directional, volume and pressure (flow) control valves. Application of pneumatic/hydraulic circuits and components on mechatronics systems operation and control (ex. for manufacturing) is explored, including the use of Programmable Logic Controllers (PLCs), ladder logic, and the use of computer software to simulate power circuits.

Prerequisite(s): CAM8302M
Corerequisite(s): none

**WEL9107 Introduction to Fuel Gas and Electrical Welding**

Welding is a skill essential to a variety of professions. Students develop competent welding skills at a basic level using oxyacetylene equipment, Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding, (GMAW) and Gas Tungsten Arc Welding (GTAW). Students are provided with instructions on the safety, proper setup and operation of equipment. Students learn basic principles of flame types and temperatures, metal preparation, gas selection and electrode classification.

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

**WKT0010A MET - Coop Placement I**

Cooperative Education is an experiential learning program that ties classroom learning to its applications in the world of work, normally off-campus, by formally integrating work experience into the student’s program of studies. Students gain valuable learning opportunities through paid, full-time, on-the-job work experiences. All Co-op students must complete and submit assignments while on work-term, including a Final work term report by the established due date for each scheduled work term.

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

**WKT0010B MET - Coop Placement II**

Cooperative Education is an experiential learning program that ties classroom learning to its applications in the world of work, normally off-campus, by formally integrating work experience into the student’s program of studies. Students gain valuable learning opportunities through paid, full-time, on-the-job work experiences. All Co-op students must complete and submit assignments while on work-term, including a Final work term report by the established due date for each scheduled work term.

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