Area of Interest: Advanced Technology

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

Ontario College Advanced Diploma Program Code: 0010X03FWO

3 Years

Ottawa Campus

## Our Program

**Learn engineering design - 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 jogs 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 design 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 work term are subject to availability and academic eligibility. Please note admission to the co-op program does not guarantee a co-op placement.

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

| Level: 01 | Courses | Hours |
|---|---|---|
| CAD8300 | Computer Aided Design/Drafting (CAD/D) | 56.0 |
| ELN9104 | DC and AC Electronics | 84.0 |
| ENG8307 | Statics | 56.0 |
| ENL1813T | Communications I | 42.0 |
| GEN0351 | Strategies for Learning | 42.0 |
| MAT8100 | Essential Mathematics | 42.0 |
| MFG8528 | Metrology | 42.0 |
| **Level: 02** | **Courses** | **Hours** |
| CAD8305 | CAD Applications and GDT | 42.0 |
| ENG8308 | Strength of Materials I | 56.0 |
| GED0019 | Becoming an Entrepreneur: Is It for Me? | 42.0 |
| GEP1001 | Cooperative Education and Job Readiness | 18.0 |
| MAT8101 | Differential Calculus | 42.0 |
| MFG8519 | Machine Shop I | 70.0 |
| ROB8220 | Industrial Pneumatics | 56.0 |
| WEL9107 | Introduction to Fuel Gas and Electrical Welding | 42.0 |
| **Level: 03** | **Courses** | **Hours** |
| CAM8515 | Computer Aided Manufacturing I | 28.0 |
| ELN8299 | Industrial Electricity | 42.0 |
| ENG8309 | Strength of Materials II | 70.0 |
| ENG8310 | Dynamics | 56.0 |
| ENG8320 | Fluid Mechanics | 56.0 |
| ENG8335 | Materials Science | 28.0 |
| MAT8102 | Integral Calculus | 42.0 |
| **Co-op: 01** | **Courses** | **Hours** |
| WKT0010A | Met - Coop Placement I | |
| **Level: 04** | **Courses** | **Hours** |
| CAM8313 | Introduction to C Language | 42.0 |
| DRA8362 | Computer Aided Engineering | 42.0 |
| DSN0037 | Tool Design | 28.0 |
| ELN8298 | Industrial Electronics | 42.0 |

| | | |
|---|---|---|
| ENG8311 | Dynamics of Machinery I | 42.0 |
| ENG8321 | Thermodynamics | 56.0 |
| ENG8336 | Metallurgy and Heat Treatment Lab | 28.0 |
| ENG8337 | Metallurgy and Polymers | 42.0 |
| ENL2019T | Technical Communication for Engineering Technologies | 42.0 |
| **Co-op: 02** | **Courses** | **Hours** |
| WKT0010B | Met - Coop Placement II | |
| **Level: 05** | **Courses** | **Hours** |
| CAM8302M | Microcomputer Interfacing | 42.0 |
| ENG4001 | Project 1 | 28.0 |
| ENG8312 | Dynamics of Machinery II | 42.0 |
| ENG8315 | Machine Design and Analysis I | 56.0 |
| ENG8322 | Thermofluids | 42.0 |
| ENL4001 | Technology Report Preparation | 14.0 |
| MAT8103 | Ordinary Differential Equations | 42.0 |
| **Choose one from equivalencies:** | **Courses** | **Hours** |
| GED0010 | General Education Elective | 42.0 |
| **Level: 06** | **Courses** | **Hours** |
| ENG4003 | Project 2 | 28.0 |
| ENG8314 | Mechanical VIbrations | 42.0 |
| ENG8316 | Machine Design and Analysis II | 56.0 |
| ENG8323 | Heat Transfer | 42.0 |
| ENG8344M | Control Systems | 42.0 |
| ENL4003 | Technology Report | 14.0 |
| ROB8305M | Pneumatics/Hydraulics/Automation | 56.0 |

## Fees for the 2023/2024 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 and can be purchased from the campus store. For more information visit https://www.algonquincollege.com/coursematerials .

- 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 2024/2025 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; OR Duolingo English Test (DET) Overall 110, minimum of 110 in Literacy and no score below 95.

Not sure if you meet all of the requirements? Academic Upgrading may be able to help with that: https://www.algonquincollege.com/access/ .

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.

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## Application Information

**MECHANICAL ENGINEERING TECHNOLOGY (CO-OP AND NON CO-OP VERSION)**
**Program Code 0010X03FWO**

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
Contact: https://www.algonquincollege.com/ro

## Additional Information

**CO-OP INFORMATION:**
All applicants apply directly to the co-op version of this program through OntarioColleges.ca or our International Application Portal. Applicants not wishing to pursue the co-op version will have the opportunity to opt-out after being admitted to the program but prior to the first co-op work term.

Co-operative education (Co-op) allows students to integrate their classroom learning with a real-world experience through 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 course, readiness activities and 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 College and other Canadian and international colleges and universities. Algonquin College`s Co-op Department provides assistance in developing co-op job opportunities and guides 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. For more information on your program`s co-op level(s), visit the courses tab on your program`s webpage.

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 part of an academic program. The Co-op/Internship Work Permit does not authorize international students to work outside the requirements of their academic program.

For more information on co-op programs, the co-op work/study schedule, as well as general and program-specific co-op eligibility criteria, please visit https://www.algonquincollege.com/coop .

The program shares courses with Manufacturing Engineeering Technician and Electro-Mechanical Engineering Technician programs, allowing students the option of continuing their studies in either of these programs

## Contact Information

### Program Coordinator(s)

- Brian Gray, mailto:grayb@algonquincollege.com , 613-727-4723, ext. 5786
- Andrew Greenhalgh, mailto:greenha@algonquincollege.com , 613-727-4723, ext. 2074

## Course Descriptions

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

Drawings and blueprints are the language of design for engineered parts and structures, therefore creating, interpreting, and understanding drawings is critical to working in the engineering field. 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): 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 concepts, 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, generate G-codes in software such as Mastercam and Fusion 360, verify the correct tool operations, and check the simulated CNC operations ready to execute on a CNC machine.

Prerequisite(s): CAD8300 and MFG8528
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, Kirchhoff'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):none

**ENG4001 Project 1**

Experience with practical projects provides students with learning opportunities to gain insight and experience, thereby making connections to industry. Through collaborative participation in applied research projects or self-directed in-class projects, student 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. Note: Project 1 and Project 2 courses must be successfully completed in two consecutive terms.

Prerequisite(s): CAM8313 and DRA8362 and DSN8300 and ELN8298 and ENG8305 and ENG8311 and ENG8321 and ENL2019T
Corerequisite(s):ENL4001

**ENG4003 Project 2**

The ability to identify and satisfy stakeholder expectations is essential for successful project development and completion. Following up on topics selected in Project 1, student groups continue to execute projects of significant technical complexity in an applied research context. Student groups work in consultation with faculty and/or external stakeholders to create deliverables by monitoring and controlling the project resources. The solutions developed are defended in formal oral and written presentations. Note: Project 1 and Project 2 courses must be successfully completed in two consecutive terms.

Prerequisite(s): ENG4001

Corerequisite(s):ENL4003

**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): none
Corerequisite(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): ENG8307 and MAT8100
Corerequisite(s):none

**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):none

**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 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**

Vibration is present in almost any engineering application, from dropping a cell phone to a rotating tire on a car, so understand and managing vibration is critical in engineering design. 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, and analysis of bolted connections under dynamic load.

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
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 covered.

Prerequisite(s): ENG8321 and MAT8103
Corerequisite(s):none

**ENG8335 Materials Science**

As rapid advances in materials continue, from polymers used in composite components on aircraft, to high strength aluminum used in EV's to make vehicles lighter, a thorough understanding of how to determine a materials suitability for an application is crucial. Students interpret mechanical properties of materials and their microscopic structural behaviours. Crystal structures, atomic bonding, dislocation theory, heat treatments, phase and TTT diagrams for some alloys are explained. Ferrous and non-ferrous alloys naming convention and their applications are discussed, and the students are familiarized with select national and international standard institutes. Students learn concepts such as failure and strengthening mechanisms. Ceramics, polymers and composite materials and their properties and applications are discussed.

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

**ENG8336 Metallurgy and Heat Treatment Lab**

Heat treating can change metal product properties. Some alloy properties can be improved by heat treatment processes. Students experiment with heat treatment processes in a lab. Ferrous and non-ferrous materials properties are tested and reported and students compare the results with published data. Students are familiarized with techniques used in industry to obtain better mechanical properties for metals. Students use destructive and non-destructive tests to observe and report materials properties.

Prerequisite(s): ENG8335
Corerequisite(s):none

**ENG8337 Metallurgy and Polymers**

Advances in materials science continue at a rapid pace. Whether powder metallurgy of aircraft components or the latest flexible touchscreen phone, an understanding of metallurgy and polymers is critical in engineering applications. 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 physic

Prerequisite(s): ENG8335
Corerequisite(s):none

**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**

Self-Regulated Learning is important not only for academic success but also in the development of lifelong learning skills, and can be defined as an active constructive process whereby learners monitor, regulate, and control their cognition, motivation, and behaviour. Through a variety of assignments and in class activities, students learn how to transform their mental abilities into academic skills by investigating notetaking, time management, goal setting and feedback. Case studies allow students to consider how to employ SRL in their own learning. Students explore effective learning techniques and move toward implementing these techniques to improve their study habits.

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

**GEP1001 Cooperative Education and Job Readiness**

Students are guided through a series of activities that prepare them to conduct a professional job search and succeed in the workplace. Through a detailed orientation students learn the cooperative education program policies and procedures related to searching and securing a work term opportunity. Students identify their strengths and transferable skills and participate in workshop-style sessions that focus on cover letter and resume development, interview techniques and job search strategies. Students learn how to navigate a web-based resource centre, which is used to post employment and cooperative education job opportunities. Students reflect on workplace success, ethics and responsibilities.

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

**MFG8519 Machine Shop I**

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. 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 practicing 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. The importance of machine safety and personal safety are a key part of manufacturing; the use of PPE, WHMIS regulations and safe operation of equipment will be emphasized.

Prerequisite(s): CAD8300 and MFG8528
Corerequisite(s):none

**MFG8528 Metrology**

Metrology is an important part of science, technology and engineering fields. In general, It involves measurements that the industrial sectors rely on for safety and quality control. Students are introduced to the science of measurement. 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. Fundamental topics include systems of measurement, units, linear measurement, and angular measurement. Labs are used to provide students with the opportunity

to gain a practical and theoretical understanding of a variety of measuring instruments. Students are familiarized with the basic concepts of data analysis, using graphing, linear regression, and statistics to demonstrate lab results and form conclusions.

Prerequisite(s): none
Corerequisite(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
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 mechatronic 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